

MAT 101	LINEAR ALGEBRA AND CALCULUS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: This course introduces students to some basic mathematical ideas and tools which are at the core of any engineering course. A brief course in Linear Algebra familiarises students with some basic techniques in matrix theory which are essential for analysing linear systems. The calculus of functions of one or more variables taught in this course are useful in modelling and analysing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

Prerequisite: A basic course in one-variable calculus and matrix theory.

Course Outcomes: After the completion of the course the student will be able to

CO 1	solve systems of linear equations, diagonalize matrices and characterise quadratic forms
CO 2	compute the partial and total derivatives and maxima and minima of multivariable functions
CO 3	compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas
CO 4	perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent
CO 5	determine the Taylor and Fourier series expansion of functions and learn their applications.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	1			1	2		2
CO 2	3	3	3	3	2	1			1	2		2
CO 3	3	3	3	3	2	1			1	2		2
CO 4	3	2	3	2	1	1			1	2		2
CO 5	3	3	3	3	2	1			1	2		2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

Assignments: Assignment should include specific problems highlighting the applications of the methods introduced in this course in science and engineering.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1): Solve systems of linear equations, diagonalize matrices and characterise quadratic forms

1. A is a real matrix of order 3×3 and $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$. What can you say about the solution of $AX =$

0 if rank of A is 1? 2? 3?

2. Given $A = \begin{bmatrix} 3 & 0 & 2 \\ 0 & 2 & 0 \\ -2 & 0 & 0 \end{bmatrix}$, find an orthogonal matrix P that diagonalizes A.

3. Find out what type of conic section the following quadratic form represents

$$17x^2 - 30x_1x_2 + 17x_2^2 = 128$$

4. The matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ has an eigen value 5 with corresponding Eigen vector $X =$

$$\begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}. \text{ Find } A^5 X$$

Course Outcome 2 (CO2): compute the partial and total derivatives and maxima and minima of multivariable functions

1. Find the slope of the surface $z = x^2y + 5y^3$ in the x-direction at the point (1,-2)

2. Given the function $w = xy + z$, use chain rule to find the instantaneous rate of change of w at each point along the curve $x = \cos t, y = \sin t, z = t$
3. Determine the dimension of rectangular box open at the top, having a volume 32 cubic ft and requiring the least amount of material for its construction.

Course Outcome 3 (CO3): compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas.

1. Evaluate $\iint_D (x + 2y) dA$ where D is the region bounded by the parabolas $y = 2x^2$ and $y = 1 + x^2$
2. Explain how you would find the volume under the surface $z = f(x, y)$ and over a specific region D in the xy -plane using (i) double integral (ii) triple integral?
3. Find the mass and centre of gravity of a triangular lamina with vertices $(0,0)$, $(2,1)$, $(0,3)$ if the density function is $f(x, y) = x + y$
4. Use spherical coordinates to evaluate $\iiint_B (x^2 + y^2 + z^2)^3 dV$ where B is the unit ball defined by $B = \{(x, y, z): x^2 + y^2 + z^2 \leq 1\}$

Course Outcome 4 (CO4): perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent.

1. What is the difference between a sequence and a series and when do you say that they are convergent? Divergent?
2. Determine whether the series $\sum_{n=1}^{\infty} \frac{5}{2n^2 + 4n + 3}$ converges or diverges.
3. Is the series $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n}$ convergent? Absolutely convergent? Conditionally convergent?

Course Outcome 5 (CO5): determine the Taylor and Fourier series expansion of functions and learn their applications.

1. Assuming the possibility of expansion find the Maclaurin series expansion of $f(x) = (1 + x)^k$ for $|x| < 1$ where k is any real number. What happens if k is a positive integer?
2. Use Maclaurin series of $\ln(1 + x)$, $-1 < x \leq 1$ to find an approximate value of $\ln 2$.
3. Find the Fourier series of the function $f(x) = x^2$, $-2 \leq x < 2$, $f(x + 4) = f(x)$. Hence using Parseval's identity prove that $1 + \frac{1}{2^4} + \frac{1}{3^4} + \dots = \frac{\pi^4}{90}$
4. Expand the function $f(x) = x$ ($0 < x < 1/2$) into a (i) Fourier sine series (ii) Fourier cosine series.

Model Question paper

QP CODE:

PAGES:3

Reg No: _____

Name : _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: MAT 101

Max. Marks: 100

Duration: 3 Hours

LINEAR ALGEBRA AND CALCULUS

(2019-Scheme)

(Common to all branches)

PART A

(Answer all questions, each question carries 3 marks)

1. Determine the rank of the matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ -2 & -4 & 2 \\ 3 & 6 & -3 \end{bmatrix}$.
2. Write down the eigen values of $\begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$. What are the eigen values of $P^{-1}AP$ where $P = \begin{bmatrix} -4 & 2 \\ 3 & -1 \end{bmatrix}$?
3. Find $f_x(1,3)$ and $f_y(1,3)$ for the function $f(x, y) = 2x^3y^2 + 2y + 4x$.
4. Show that the function $u(x, t) = \sin(x - ct)$ is a solution of the equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$.
5. Use double integral to find the area of the region enclosed between the parabolas $y = \frac{1}{2}x^2$ and the line $y = 2x$.
6. Use polar coordinates to evaluate the area of the region bounded by $x^2 + y^2 = 4$, the line $y = x$ and the y axis in the first quadrant.
7. Test the convergence of the series $\sum_{k=1}^{\infty} \frac{k}{k+1}$.
8. Test the convergence of the alternating series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{1}{k}$ using Leibnitz test.
9. Find the Taylor series expansion of $\sin \pi x$ about $x = \frac{1}{2}$.
10. Find the values to which the Fourier series of

$f(x) = x$ for $-\pi < x < \pi$, with $f(x + 2\pi) = f(x)$ converges

(10x3=30)

PART B

(Answer **one full** question from each module, each question carries **14** marks)

Module - I

11. (a) Solve the following system of equations

$$y + z - 2w = 0$$

$$2x - 3y - 3z + 6w = 2$$

$$4x + y + z - 2w = 4$$

- (b) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$

12. (a) Diagonalize the matrix $\begin{bmatrix} -1 & 2 & -2 \\ 2 & 4 & 1 \\ 2 & 1 & 4 \end{bmatrix}$

- (b) What kind of conic section the quadratic form $3x_1^2 + 22x_1x_2 + 3x_2^2 = 0$ represents? Transform it to principal axes.

Module - II

13. (a) Find the local linear approximation to $f(x, y) = \sqrt{x^2 + y^2}$ at the point $(3, 4)$. Use it to approximate $f(3.04, 3.98)$

- (b) Let $w = \sqrt{x^2 + y^2 + z^2}$, $x = \cos\theta$, $y = \sin\theta$, $z = \tan\theta$. Use chain rule to find $\frac{dw}{d\theta}$ when $\theta = \frac{\pi}{4}$.

14. (a) Let $z = f(x, y)$ where $x = r\cos\theta$, $y = r\sin\theta$, prove that

$$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2} \left(\frac{\partial z}{\partial \theta}\right)^2.$$

- (b) Locate all relative maxima, relative minima and saddle points

$$f(x, y) = xy + \frac{a^3}{x} + \frac{b^3}{y} \quad (a \neq 0, b \neq 0).$$

Module - III

15. (a) Evaluate $\iint_D (2x^2y + 9y^3) dx dy$ where D is the region bounded by $y = \frac{2}{3}x$ and $y = 2\sqrt{x}$

- (b) Evaluate $\int_0^4 \int_{\sqrt{y}}^2 e^{x^3} dx dy$ changing the order of integration.

16. (a) Find the volume of the solid bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$.

- (b) Evaluate $\iiint \sqrt{1 - x^2 - y^2 - z^2} dx dy dz$, taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$, by transforming to spherical polar coordinates

Module - IV

17. (a) Test the convergence of the series

$$(i) \quad \sum_{k=1}^{\infty} \frac{k^k}{k!} \quad (ii) \quad \sum_{k=2}^{\infty} \left(\frac{4k-5}{2k+1} \right)^k$$

- (b) Determine the convergence or divergence of the series $\sum_{k=1}^{\infty} (-1)^k \frac{(2k-1)!}{3^k}$

18. (a) Check whether the series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{(2k)!}{(3k-2)!}$ is absolutely convergent, conditionally convergent or divergent.

(b) Test the convergence of the series $1 + \frac{1.2}{1.3} + \frac{1.2.3}{1.3.5} + \frac{1.2.3.4}{1.3.5.7} + \dots$

Module - V

19. (a) Obtain the Fourier series of $f(x) = e^{-x}$, in the interval $0 < x < 2\pi$. with $f(x + 2\pi) = f(x)$. Hence deduce the value of $\sum_{n=2}^{\infty} \frac{(-1)^n}{1+n^2}$.

(b) Find the half range sine series of $f(x) = \begin{cases} \frac{2kL}{x} & \text{if } 0 < x < \frac{L}{2} \\ \frac{2k(L-x)}{L} & \text{if } \frac{L}{2} < x < L \end{cases}$

20. (a) Expand $(1+x)^{-2}$ as a Taylor series about $x=0$ and state the region of convergence of the series.

(b) Find the Fourier series for $f(x) = x^2$ in the interval $-\pi < x < \pi$

with $f(x + 2\pi) = f(x)$. Hence show that $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \dots = \frac{\pi^4}{90}$. (14X5=70)

Syllabus

Module 1 (Linear algebra)

(Text 2: Relevant topics from sections 7.3, 7.4, 7.5, 8.1, 8.3, 8.4)

Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix, fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof), Eigen values and eigen vectors. Diagonalization of matrices, orthogonal transformation, quadratic forms and their canonical forms.

Module 2 (multivariable calculus-Differentiation)

(Text 1: Relevant topics from sections 13.3, 13.4, 13.5, 13.8)

Concept of limit and continuity of functions of two variables, partial derivatives, Differentials, Local Linear approximations, chain rule, total derivative, Relative maxima and minima, Absolute maxima and minima on closed and bounded set.

Module 3 (multivariable calculus-Integration)

(Text 1: Relevant topics from sections 14.1, 14.2, 14.3, 14.5, 14.6, 14.8)

Double integrals (Cartesian), reversing the order of integration, Change of coordinates (Cartesian to polar), finding areas and volume using double integrals, mass and centre of gravity of inhomogeneous laminas using double integral. Triple integrals, volume calculated as triple integral, triple integral in cylindrical and spherical coordinates (computations involving spheres, cylinders).

Module 4 (sequences and series)

(Text 1: Relevant topics from sections 9.1, 9.3, 9.4, 9.5, 9.6)

Convergence of sequences and series, convergence of geometric series and p-series(without proof), test of convergence (comparison, ratio and root tests without proof); Alternating series and Leibnitz test, absolute and conditional convergence.

Module 5 (Series representation of functions)

(Text 1: Relevant topics from sections 9.8, 9.9. Text 2: Relevant topics from sections 11.1, 11.2, 11.6)

Taylor series (without proof, assuming the possibility of power series expansion in appropriate domains), Binomial series and series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence); Fourier series, Euler formulas, Convergence of Fourier series (without proof), half range sine and cosine series, Parseval's theorem (without proof).

Text Books

1. H. Anton, I. Biven, S. Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2016.

Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7th Edition, 2012
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Linear Algebra (10 hours)	
1.1	Systems of linear equations, Solution by Gauss elimination	1
1.2	Row echelon form, finding rank from row echelon form, fundamental theorem for linear systems	3
1.3	Eigen values and eigen vectors	2
1.4	Diagonalization of matrices, orthogonal transformation, quadratic forms	4

	and their canonical forms.	
2	Multivariable calculus-Differentiation (8 hours)	
2.1	Concept of limit and continuity of functions of two variables, partial derivatives	2
2.2	Differentials, Local Linear approximations	2
2.3	Chain rule, total derivative	2
2.4	Maxima and minima	2
3	Multivariable calculus-Integration (10 hours)	
3.1	Double integrals (Cartesian)-evaluation	2
3.2	Change of order of integration in double integrals, change of coordinates (Cartesian to polar),	2
3.3	Finding areas and volumes, mass and centre of gravity of plane laminae	3
3.4	Triple integrals	3
4	Sequences and series (8 hours)	
4.1	Convergence of sequences and series, geometric and p-series	2
4.2	Test of convergence(comparison, ratio and root)	4
4.3	Alternating series and Leibnitz test, absolute and conditional convergence	2
5	Series representation of functions (9 hours)	
5.1	Taylor series, Binomial series and series representation of exponential, trigonometric, logarithmic functions;	3
5.2	Fourier series, Euler formulas, Convergence of Fourier series(Dirichlet's conditions)	3
5.3	Half range sine and cosine series, Parseval's theorem.	3

PHT 100	ENGINEERING PHYSICS A (FOR CIRCUIT BRANCHES)	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics Program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Classify the properties of magnetic materials and apply vector calculus to static magnetic fields and use Maxwell's equations to diverse engineering problems
CO 5	Analyze the principles behind various superconducting applications, explain the working of solid state lighting devices and fibre optic communication system

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3	1						1	2			1
CO 5	3	1						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20

Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.
(b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.
(b) A liquid of refractive index μ is introduced between the lens and glass plate.

What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function ?
2. What are excitons ?
3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.
(b) Calculate the first three energy values of an electron in a one dimensional box of width $1 \text{ \AA}$ in electron volt.

Course Outcome 4 (CO4):

1. Compare displacement current and conduction current.
2. Mention any four properties of ferro magnetic materials.
3. (a) Starting from Maxwell's equations, derive the free space electromagnetic wave equation and show that velocity of electromagnetic wave is $1/(\mu_0 \epsilon_0)^{1/2}$
(b) An electromagnetic wave is described by $E = 100 \exp 8\pi i [10^{14} t - (10^6 z / 3)] \text{ V/m}$. Find the direction of propagation of the wave, speed of the wave and magnetic flux density in the wave.

Course Outcome 5 (CO5):

1. Explain the working of a solar cell.
2. Distinguish between Type I and Type II super conductors.
3. (a) Define numerical aperture and derive an expression for it.
(b) Explain the working of intensity modulated fibre optic sensor.

Model Question paper

QP CODE:

PAGES:3

Reg No: _____

Name : _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: PHT 100

Course Name: Engineering Physics A

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators
2. Distinguish between longitudinal and transverse waves
3. Write a short note on antireflection coating.
4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.
5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.
6. Explain surface to volume ratio of nanomaterials.
7. State Faraday's laws of electromagnetic induction.
8. Compare displacement current and conduction current
9. List four important applications of superconductors.
10. Give the working principle of LED. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution. Discuss the cases of over damped, critically damped and under damped cases. (10)
- (b) The frequency of a tuning fork is 500 Hz and its Q factor is 7×10^4 . Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value. (4)
12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)
- (b) The equation of transverse vibration of a stretched string is given by $y = 0.00327 \sin (72.1x - 2.72t)$ m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv) Velocity of the wave. (4)

Module 2

13. (a) Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid. (10)
- (b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength $4800 \text{ \AA}$. Given $\beta = 0.0555 \text{ cm}$. (4)
14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)
- (b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15. (a) Derive time dependent and independent Schrodinger equations. (10)
- (b) An electron is confined to one dimensional potential box of length $2 \text{ \AA}$. Calculate the energies corresponding to the first and second quantum states in eV. (4)
16. (a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)
- (b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17. (a) State Poynting's Theorem. Calculate the value of Poynting vector at the surface of the sun if the power radiated by the sun is $3.8 \times 10^{26} \text{ W}$ and its radius is $7 \times 10^8 \text{ m}$. (5)

(b) Distinguish between paramagnetic, diamagnetic and ferromagnetic materials. (9)

18.(a) Starting from Maxwell's Equations, derive electromagnetic wave equations in free space. (10)

(b) If the magnitude of $\mathbf{H}$ in a plane wave is 1 A/m, find the magnitude of $\mathbf{E}$ in free space. (4)

Module 5

19.(a) Show that superconductors are perfect diamagnets. Distinguish between Type I and Type II superconductors with suitable examples. (10)

(b) Write a short note on high temperature superconductors. (4)

20.(a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33. (4) (14x5=70)

Syllabus

ENGINEERING PHYSICS A (FOR CIRCUIT BRANCHES)

Module 1

Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2

Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3

Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4

Magnetism & Electro Magnetic Theory

Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux, Magnetic permeability and susceptibility, Classification of magnetic materials-para, dia and ferromagnetic materials

Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem, Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)

Module 5

Superconductivity & Photonics

Superconducting phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II, BCS Theory (Qualitative), High temperature superconductors-Applications of super conductivity

Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics, Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors.

Text Books

1. M.N.Abadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition 2019
2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition 2017

Reference Books

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials", McGraw Hill India Ltd, 2007
7. Halliday, Resnick, Walker, "Fundamentals of Physics", John Wiley & Sons.Inc, 2001
8. David J Griffiths, "Introduction to Electrodynamics", Addison-Wesley publishing, 3rd Edition, 1999
9. Premlet B., "Advanced Engineering Physics", Phasor Books,10th edition,2017
10. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Oscillations and Waves (9 hours)	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves. Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	Wave Optics (9 hours)	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hr
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	Quantum Mechanics & Nanotechnology (9hours)	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	Magnetism & Electro Magnetic Theory (9 hours)	
4.1	Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux	2 hrs

	density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux	
4.2	Explanation for Magnetic permeability and susceptibility Classification of magnetic materials- para, dia and ferromagnetic materials	1 hr
4.3	Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem	2 hrs
4.4	Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)	4 hrs
5	Superconductivity & Photonics (9hours)	
5.1	Super conducting Phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II	2 hrs
5.2	BCS Theory (Qualitative), High temperature superconductors, Applications of super conductivity	2 hrs
5.3	Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics	2 hrs
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

EST 110	ENGINEERING GRAPHICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	0	2	3	2019

Preamble: To enable the student to effectively perform technical communication through graphical representation as per global standards.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Draw the projection of points and lines located in different quadrants
CO 2	Prepare multiview orthographic projections of objects by visualizing them in different positions
CO 3	Draw sectional views and develop surfaces of a given object
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three dimensions.
CO 5	Convert 3D views to orthographic views
CO 6	Obtain multiview projections and solid models of objects using CAD tools

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3											
CO 3	3	1										
CO 4	3									1		
CO 5	3									2		
CO 6	3				3					3		

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (100 Marks)
	Test 1 (15 Marks)	Test 2 (15 Marks)	
Remember			
Understand	5		20
Apply	10	10	80
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

CIA for section A carries 25 marks (15 marks for 1 test and Class work 10 marks)

CIA for section B carries 15 marks (10 marks for 1 test and Class work 5 marks)

End Semester Examination Pattern:

ESE will be of 3 hour duration on A4 size answer booklet and will be for 100 marks. The question paper shall contain two questions from each module of Section A only. Student has to answer any one question from each module. Each question carries 20 marks.

Course Level Assessment Questions

(Questions may be framed based on the outline given under each course outcome)

Course Outcome 1 (CO1):

1. Locate points in different quadrants as per given conditions.
2. Problems on lines inclined to both planes .
3. Find True length, Inclinations and Traces of lines.

Course Outcome 2 (CO2)

1. Draw orthographic views of solids and combination solids
2. Draw views of solids inclined to any one reference plane.
3. Draw views of solids inclined to both reference planes.

Course Outcome 3 (CO3):

1. Draw views of solids sectioned by a cutting plane
2. Find location and inclination of cutting plane given true shape of the section
3. Draw development of lateral surface of solids and also its sectioned views

Course Outcome 4 (CO4):

1. Draw Isometric views/projections of solids
2. Draw Isometric views/projections of combination of solids
3. Draw Perspective views of Solids

Course Outcome 5 (CO5):

1. Draw Orthographic views of solids from given three dimensional view

Course Outcome 6 (CO6):

1. Draw the given figure including dimensions using 2D software
2. Create 3D model using modelling software from the given orthographic views or 3D figure or from real 3D objects

Model Question paper

QP CODE:

PAGES:3

Reg No:_____

Name : _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: EST 110

ENGINEERING GRAPHICS

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

Instructions: Retain necessary Construction lines

Show necessary dimensions

Answer any ONE question from each module

Each question carries 20 marks

MODULE I

1. The end point A of a line is 20mm above HP and 10mm in front of VP. The other end of the line is 50mm above HP and 15mm behind VP. The distance between the end projectors is 70mm. Draw the projections of the line. Find the true length and true inclinations of the line with the principal planes. Also locate the traces of the line.
2. One end of a line is 20mm from both the principal planes of projection. The other end of the line is 50mm above HP and 40mm in front of VP. The true length of the line is 70mm. Draw the projections of the line. Find its apparent inclinations, elevation length and plan length. Also locate its traces.

MODULE II

3. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined 30° to VP. Draw the projections of the solid.

4. A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at 30° to HP and 45° to VP. Draw the projections of the solid.

MODULE III

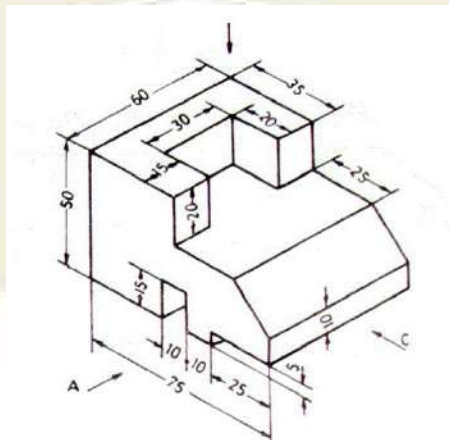
5. A triangular prism of base side 40mm and height 70mm is resting with its base on the ground and having an edge of the base perpendicular to VP. Section the solid such that the true shape of the section is a trapezium of parallel sides 30mm and 10mm. Draw the projections showing the true shape. Find the inclination of the cutting plane with the ground plane.
6. Draw the development of a pentagonal pyramid of base side 30mm and height 50mm. A string is wound from a corner of the base round the pyramid and back to the same point through the shortest distance. Show the position of the string in the elevation and plan.

MODULE IV

7. The frustum of a cone has base diameter 50mm and top diameter 40mm has a height of 60mm. It is placed centrally on top of a rectangular slab of size 80x60mm and of thickness 20mm. Draw the isometric view of the combination.
8. A hexagonal prism has base side 35mm and height 60mm. A sphere of diameter 40mm is placed centrally on top of it. Draw the isometric projection of the combination.

MODULE V

9. Draw the perspective view of a pentagonal prism, 20mm side and 45mm long lying on one of its rectangular faces on the ground and having its axis perpendicular to picture plane. One of its pentagonal faces touches the picture plane and the station point is 50mm in front of PP, 25mm above the ground plane and lies in a central plane, which is 70mm to the left of the center of the prism.
10. Draw three orthographic views with dimensions of the object shown in figure below.



(20X5=100)

SCHEME OF VALUATION

1. Locating the points and drawing the projections of the line – 4 marks
Finding true length by any one method – 6 marks
Finding true inclination with VP – 2 marks
Finding true inclination with HP – 2 marks
Locating horizontal trace – 2 marks
Locating vertical trace – 2 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

2. Locating the points and drawing true length of the line – 4 marks
Finding projections by any method – 6 marks
Finding length of elevation and plan – 2 marks
Finding apparent inclinations – 2 marks
Locating horizontal trace – 2 marks
Locating vertical trace – 2 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

3. Drawing initial position plan and elevation – 4 marks
First inclination views – 4 marks
Second inclination views -8 marks
Marking invisible edges – 2 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

*(Any one method or combination of methods for solving can be used.**If initial position is wrong then maximum 50% marks may be allotted for the answer)*

4. Drawing initial position plan and elevation – 4 marks
First inclination views – 4 marks
Second inclination views -8 marks
Marking invisible edges – 2 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

*(Any one method or combination of methods for solving can be used**If initial position is wrong then maximum 50% marks may be allotted for the answer)*

5. Drawing initial position plan and elevation – 4 marks
Locating section plane as per given condition – 5 marks
Drawing true shape -5 marks
Finding inclination of cutting plane – 2 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

6. Drawing initial position plan and elevation – 4 marks
Development of the pyramid – 6 marks

Locating string in development -2 marks
Locating string in elevation – 3 marks
Locating string in plan – 3 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

7. Drawing initial positions – 4 marks
Isometric View of Slab -6 marks
Isometric View of Frustum – 10 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

*(Initial position is optional, hence redistribute if needed.
Reduce 4 marks if Isometric scale is taken)*

8. Drawing initial positions – 4 marks
Isometric scale – 4 marks
Isometric projection of prism -5 marks
Isometric projection of sphere – 5 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

(Initial position is optional, hence redistribute if needed.

9. Drawing the planes and locating the station point – 4 marks
Locating elevation points – 2 marks
Locating plan points – 2 marks
Drawing the perspective view – 10 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

10. Drawing the elevation – 8marks
Drawing the plan – 4 marks
Drawing the side view – 4 marks
Marking invisible edges – 2 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

SYLLABUS

General Instructions:

- First angle projection to be followed
- Section A practice problems to be performed on A4 size sheets
- Section B classes to be conducted on CAD lab

SECTION A

Module 1

Introduction : Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.

Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes.

Module 2

Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.

Module 3

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given.

Development of Surfaces: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.

Module 4

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone , Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.

Module 5

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane.

Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.

SECTION B

(To be conducted in CAD Lab)

Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two dimensional drawing with dimensions using suitable software. (Minimum 2 exercises mandatory)

Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory)

Text Books

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.

Reference Books

1. Anilkumar, K.N., Engineering Graphics, Adhyuth narayan Publishers
2. Agrawal, B. And Agrawal, C.M., Engineering Drawing, Tata McGraw Hill Publishers.
3. Benjamin, J., Engineering Graphics, Pentex Publishers- 3rd Edition, 2017
4. Duff, J.M. and Ross, W.A., Engineering Design and Visualisation, Cengage Learning.
5. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K., Engineering Graphics with AutoCAD, PHI.
6. Luzaddff, W.J. and Duff, J.M., Fundamentals of Engineering Drawing, PHI.
7. Varghese, P.I., Engineering Graphics, V I P Publishers
8. Venugopal, K., Engineering Drawing and Graphics, New Age International Publishers.

Course Contents and Lecture Schedule

No	SECTION A	No. of Hours
1	MODULE I	
1.1	Introduction to graphics, types of lines, Dimensioning	1
1.2	Concept of principle planes of projection, different quadrants, locating points on different quadrants	2
1.3	Projection of lines, inclined to one plane. Lines inclined to both planes, trapezoid method of solving problems on lines.	2
1.4	Problems on lines using trapezoid method	2
1.5	Line rotation method of solving, problems on line rotation method	2
2	MODULE II	
2.1	Introduction of different solids, Simple position plan and elevation of solids	2
2.2	Problems on views of solids inclined to one plane	2
2.3	Problems on views of solids inclined to both planes	2
2.4	Practice problems on solids inclined to both planes	2

3	MODULE III	
3.1	Introduction to section planes. AIP and AVP. Principle of locating cutting points and finding true shape	2
3.2	Problems on sections of different solids	2
3.3	Problems when the true shape is given	2
3.4	Principle of development of solids, sectioned solids	2
4	MODULE IV	
4.1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2
4.2	Isometric problems on Frustum of solids, Sphere and Hemisphere	2
4.3	Problems on combination of different solids	2
5	MODULE V	
5.1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2
5.2	Perspective problems on prisms	2
5.3	Practice on conversion of pictorial views into orthographic views	2
	SECTION B (To be conducted in CAD lab)	
1	Introduction to CAD and software. Familiarising features of 2D software. Practice on making 2D drawings	2
2	Practice session on 2D drafting	2
3	Introduction to solid modelling and software	2
4	Practice session on 3D modelling	2

EST 120	BASICS OF CIVIL & MECHANICAL ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

To introduce the students to the basic principles of mechanical engineering

Prerequisite: NIL

Course Outcomes: After completion of the course, the student will be able to

CO 1	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
CO 2	Explain different types of buildings, building components, building materials and building construction
CO 3	Describe the importance, objectives and principles of surveying.
CO 4	Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps
CO 5	Discuss the Materials, energy systems, water management and environment for green buildings.
CO 6	Analyse thermodynamic cycles and calculate its efficiency
CO 7	Illustrate the working and features of IC Engines
CO 8	Explain the basic principles of Refrigeration and Air Conditioning
CO 9	Describe the working of hydraulic machines
CO 10	Explain the working of power transmission elements
CO 11	Describe the basic manufacturing, metal joining and machining processes

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	3	2	2	-	-	-	-
CO2	3	2	-	1	3	-	-	3	-	-	-	-
CO3	3	2	-	-	3	-	-	-	2	-	-	-

CO4	3	2	-	-	3	-	-	-	2	-	-	-
CO5	3	2	-	-	3	2	3	-	2	-	-	-
CO6	3	2										
CO7	3	1										
CO8	3	1										
CO9	3	2										
CO10	3	1										
CO11	3											

Assessment Pattern

	Basic Civil Engineering			Basic Mechanical Engineering		
Bloom's Category	Continuous Assessment		End Semester Examination (marks)	Continuous Assessment		End Semester Examination (marks)
	Test 1 marks	Test 2 marks		Test 1 marks	Test 2 marks	
Remember	5	5	10	7.5	7.5	15
Understand	20	20	40	12.5	12.5	25
Apply				5	5	10
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern:

There will be two parts; Part I – Basic Civil Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts -

Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions:

Course Outcome CO1: *To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.*

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.

Course outcome 2 (CO2) (One question from each module and not more than two)

Explain different types of buildings, building components, building materials and building construction

1. Discuss the difference between plinth area and carpet area.

Course outcome 3 (CO3) (One question from each module and not more than two)

Describe the importance, objectives and principles of surveying.

1. Explain the importance of surveying in Civil Engineering

Course outcome 4 (CO4) (One question from each module and not more than two)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps

1. Explain the civil engineering aspects of elevators, escalators and ramps in buildings

Course outcome 5 (CO5) (One question from each module and not more than two)

Discuss the Materials, energy systems, water management and environment for green buildings.

1. Discuss the relevance of Green building in society

Section II *Answer any 1 full question from each module. Each full question carries 10 marks*

Course Outcome 1 (CO1) (Two full question from each module and each question can have maximum 2 sub-divisions)

To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering

CO Questions

1. **a** List out the types of building as per occupancy. Explain any two, each in about five sentences.

b. Discuss the components of a building with a neat figure.

2. **a.** What are the major disciplines of civil engineering and explain their role in the infrastructural framework.

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country.

Course Outcome 2 (CO2) & Course Outcome 3 (CO3) (Two full question from each module and each question can have maximum 2 sub-divisions)

Explain different types of buildings, building components, building materials and building construction & Describe the importance, objectives and principles of surveying.

CO Questions

1. a. What are the different kinds of cement available and what is their use.
b. List the properties of good building bricks. Explain any five.
2. a. List and explain any five modern construction materials used for construction.
b. Explain the objectives and principles of surveying

Course outcome 4 (CO4) & Course outcome 5 (CO5) (Two full question from each module and each question can have maximum 2 sub-divisions)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps & Discuss the Materials, energy systems, water management and environment for green buildings.

CO Questions

1. a. Draw the elevation and plan of one brick thick wall with English bond
b. Explain the energy systems and water management in Green buildings
2. a. Draw neat sketch of the following foundations: (i) Isolated stepped footing;
(ii) Cantilever footing; and (iii) Continuous footing.

b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building

Course Outcome 6 (CO6):

1. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35°C, 0.1 MPa. The maximum temperature of the cycle is 1100°C. Find
 - i) Heat supplied per kg of air,
 - ii) Work done per kg of air,
 - iii) Cycle efficiencyTake $C_p = 1.005 \text{ kJ/kgK}$ and $C_v = 0.718 \text{ kJ/kgK}$
2. A Carnot cycle works with adiabatic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of isothermal expansion is 0.3 m^3 . If the maximum temperature and pressure is limited to 550K and 21 bar, determine the minimum temperature in the cycle and efficiency of the cycle.
3. In an ideal diesel cycle, the temperature at the beginning and end of compression is 65°C and 620°C respectively. The temperature at the beginning and end of the expansion is 1850°C and 850°C. Determine the ideal efficiency of the cycle.

4. Explain the concepts of CRDI and MPFI in IC Engines.

Course Outcome 7 (CO7)

1. With the help of a neat sketch explain the working of a 4 stroke SI engine
2. Compare the working of 2 stroke and 4 stroke IC engines
3. Explain the classification of IC Engines.

Course Outcome 8(CO8):

1. Explain the working of vapour compression refrigeration system.
2. With the help of suitable sketch explain the working of a split air conditioner.
3. Define: COP, specific humidity, relative humidity and dew point temperature.

Course Outcome 9 (CO9):

1. Explain the working of a single stage centrifugal pump with sketches.
2. With the help of a neat sketch, explain the working of a reciprocating pump.
3. A turbine is to operate under a head of 25 m at 200 rpm. The discharge is $9 \text{ m}^3/\text{s}$. If the overall efficiency of the turbine is 90%. Determine the power developed by the turbine.

Course Outcome 10 (CO10):

1. Explain the working of belt drive and gear drive with the help of neat sketches
2. Explain a single plate clutch.
3. Sketch different types of gear trains and explain.

Course Outcome 11 (CO11):

1. Describe the operations which can be performed using drilling machine.
2. Explain the functions of runners and risers used in casting.
3. With a neat sketch, explain the working and parts of a lathe.

Model Question Paper

QP CODE: EST120

page:3

Reg No: _____

Name: _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: EST 120

Course Name: BASICS OF CIVIL AND MECHANICAL ENGINEERING

Max. Marks: 100

Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

PART I: BASIC CIVIL ENGINEERING

PART A

(Answer all questions. Each question carries 4 marks)

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.
2. Discuss the difference between plinth area and carpet area.
3. Explain different types of steel with their properties.
4. What are the different kinds of cement available and what is their use?
5. Define bearing capacity of soil.

(5 x 4 = 20)

Part B

Answer one full question from each module.

MODULE I

- 6a. List out the types of building as per occupancy. Explain any two, each in about five sentences. (5)
- b. Discuss the components of a building with a neat figure. (5)

OR

- 7a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework. (5)
- b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country. (5)

MODULE II

- 8a. What are the different kinds of cement available and what is their use. (5)
- b. List the properties of good building bricks. Explain any five. (5)

OR

- 9a. List and explain any five modern construction materials used for construction. (5)
- b. Explain the objectives and principles of surveying (5)

MODULE III

- 10a. Draw the elevation and plan of one brick thick wall with English bond (5)
- b. Explain the energy systems and water management in Green buildings (5)

OR

- 11a. Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing. (5)
- b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building (5)

[10 x 3 = 30]

PART II: BASIC MECHANICAL ENGINEERING

PART A

Answer all questions. Each question carries 4 marks

1. Sketch the P-v and T-s diagram of a Carnot cycle and List the processes.
2. Illustrate the working of an epicyclic gear train.
3. Explain cooling and dehumidification processes.
4. Differentiate between soldering and brazing.
5. Explain the principle of Additive manufacturing.

4 x 5 = 20 marks

Part B

Answer one full question from each module.

MODULE I

6. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35°C, 0.1MPa. The maximum temperature of the cycle is 1100°C. Find
 - i) Heat supplied per kg of air,
 - ii) Work done per kg of air,
 - iii) Cycle efficiency

Take $C_p = 1.005 \text{ kJ/kgK}$ and $C_v = 0.718 \text{ kJ/kgK}$

10 marks

OR

7. a) Explain the working of a 4 stroke SI engine with neat sketches.
b) Explain the fuel system of a petrol engine.

7 marks

3 marks

MODULE II

8. a) Explain the working of a vapour compression system with help of a block diagram.
b) Define: Specific humidity, relative humidity and dew point temperature.

7 marks

3 marks

OR

9. With the help of a neat sketch, explain the working of a centrifugal pump.

10 marks

MODULE III

10. Explain the two high, three high, four high and cluster rolling mills with neat sketches.

10 marks

OR

11. a) Describe the arc welding process with a neat sketch.
b) Differentiate between up-milling and down-milling operations.

6 marks

4 marks

SYLLABUS

Module 1

General Introduction to Civil Engineering: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.

Introduction to buildings: Types of buildings, selection of site for buildings, components of a residential building and their functions.

Building rules and regulations: Relevance of NBC, KBR & CRZ norms (brief discussion only).

Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

Module 2

Surveying: Importance, objectives and principles.

Construction materials, Conventional construction materials: types, properties and uses of building materials: bricks, stones, cement, sand and timber

Cement concrete: Constituent materials, properties and types.

Steel: Steel sections and steel reinforcements, types and uses.

Modern construction materials:- Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).

Module 3

Building Construction: Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Load bearing and framed structures (concept only).

Brick masonry: - Header and stretcher bond, English bond & Flemish bond random rubble masonry.

Roofs and floors: - Functions, types; flooring materials (brief discussion only).

Basic infrastructure services: MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings.

Green buildings:- Materials, energy systems, water management and environment for green buildings. (brief discussion only).

Module 4

Analysis of thermodynamic cycles: Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency. IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines(Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.

Module 5

Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.

Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)

Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

Module 6

Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.

Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications

Basic Machining operations: Turning, Drilling, Milling and Grinding.

Description about working with block diagram of: Lathe, Drilling machine, Milling machine, CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.

Text Books:

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. McKay, W.B. and McKay, J. K., Building Construction, Volumes 1 to 4, Pearson India Education Services

References Books:

1. Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
2. Chudley, R and Greeno R, Building construction handbook, Addison Wesley, Longman group, England
3. Chudley, R, Construction Technology, Vol. I to IV, Longman group, England Course Plan
4. Kandya A A, Elements of Civil Engineering, Charotar Publishing house
5. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
6. Rangwala S.C and Dalal K B Building Construction Charotar Publishing house
7. Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
8. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018
11. Benjamin, J., Basic Mechanical Engineering, Pentex Books, 9th Edition, 2018
12. Balachandran, P. Basic Mechanical Engineering, Owl Books

Course Contents and Lecture Schedule:

No	Topic	Course outcomes addressed	No. of Lectures
1	Module I		Total: 7
1.1	<i>General Introduction to Civil Engineering:</i> Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment.	CO1	1
1.2	Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.	CO1	2
1.3	<i>Introduction to buildings:</i> Types of buildings, selection of site for buildings, components of a residential building and their functions.	CO2	2
1.4	<i>Building rules and regulations:</i> Relevance of NBC, KBR & CRZ norms (brief discussion only)	CO2	1
1.5	<i>Building area:</i> Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.	CO2	1
2	Module 2		Total: 7
2.1	<i>Surveying:</i> Importance, objectives and principles.	CO3	1
2.2	Bricks: - Classification, properties of good bricks, and tests on bricks	CO2	1
2.3	Stones: - <i>Qualities</i> of good stones, types of stones and their uses. Cement: - Good qualities of cement, types of cement and their uses.	CO2	1
2.4	Sand: - Classification, qualities of good sand and sieve analysis (basics only). Timber: - Characteristics, properties and uses.	CO2	1
2.5	Cement concrete: - Constituent materials, properties and types, Steel: - Steel sections and steel reinforcements, types and uses.	CO2	1

2.6	Modern construction materials: - Architectural glass, ceramics, plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials, modern uses of gypsum, pre-fabricated building components (brief discussion only)	CO2	2
3	Module 3		Total: 7
3.1	Foundations: - Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Brick masonry: - Header and stretcher bond, English bond & Flemish bond– elevation and plan (one & one and a half brick wall only). Random rubble masonry.	CO2	2
3.2	Roofs: Functions, types; roofing materials (brief discussion only) Floors: Functions, types; flooring materials (brief discussion only)	CO2	2
3.3	<i>Basic infrastructure services:</i> MEP, HVAC, Elevators, escalators and ramps (Civil Engineering aspects only) fire safety for buildings	CO4	2
3.4	<i>Green buildings:-</i> Materials, energy systems, water management and environment for green buildings. (brief discussion only)	CO5	1
4	MODULE 4		
4.1	Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle- Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency	4	
4.2	IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines, efficiencies of IC Engines(Description only)	2	
4.3	Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines	2	
5	MODULE 5		
5.1	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems)	1	
5.2	Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.	1	

5.3	Description about working with sketches : Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)	4
5.4	Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches	3
6	MODULE 6	
6.1	Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.	2
6.2	Metal Joining Processes :List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications	1
6.3	Basic Machining operations: Turning, Drilling, Milling and Grinding Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine	3
6.4	Principle of CAD/CAM, Rapid and Additive manufacturing	1

HUN 101	LIFE SKILLS	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		MNC	2	0	2	---	2019

Preamble: Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underly personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to

CO 1	Define and Identify different life skills required in personal and professional life
CO 2	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.
CO 3	Explain the basic mechanics of effective communication and demonstrate these through presentations.
CO 4	Take part in group discussions
CO 5	Use appropriate thinking and problem solving techniques to solve new problems
CO 6	Understand the basics of teamwork and leadership

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2		1	2	2	1	3
CO 2									3			2
CO 3						1			1	3		
CO 4										3		1
CO 5		3	2	1								
CO 6						1			3			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

Continuous Internal Evaluation

Total Marks: 50

Attendance	: 10 marks
Regular assessment	: 15 marks
Series test (one test only, should include first three modules)	: 25 marks

Regular assessment

➤ **Group Discussion (Marks: 9)**

Create groups of about 6 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation are as follows:

- Communication Skills : 3 marks
- Subject Clarity : 2 marks
- Group Dynamics : 2 marks
- Behaviours & Mannerisms : 2 marks

➤ **Presentation Skills (Marks: 6)**

Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation are as follows:

- Communication Skills : 2 marks
- Platform Skills : 2 marks
- Subject Clarity/Knowledge : 2 marks

End Semester Examination

Total Marks: 50

Time: 2 hrs.

Part A: Short answer question (25 marks)

There will be one question from each MODULE (five questions in total, five marks each). Each question should be written in about maximum of 400 words. Parameters to be used for evaluation are as follows:

- (i) Content Clarity/Subject Knowledge
- (ii) Presentation style
- (iii) Organization of content

Part B: Case Study (25 marks)

The students will be given a case study with questions at the end. The students have to analyze the case and answer the question at the end. Parameters to be used for evaluation are as follows:

- (i) Analyze the case situation
- (ii) Key players/characters of the case
- (iii) Identification of the problem (both major & minor if exists)
- (iv) Bring out alternatives
- (v) Analyze each alternative against the problem
- (vi) Choose the best alternative
- (vii) Implement as solution
- (viii) Conclusion

(ix) Answer the question at the end of the case

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List 'life skills' as identified by WHO
2. What do you mean by effective communication?
3. What are the essential life skills required by a professional?

Course Outcome 2 (CO2)

1. Identify an effective means to deal with workplace stress.
2. How can a student apply journaling to stress management?
3. What is the PATH method? Describe a situation where this method can be used effectively.

Course Outcome 3(CO3):

1. Identify the communication network structure that can be observed in the given situations. Describe them.
 - (a) A group discussion on development.
 - (b) An address from the Principal regarding punctuality.
 - (c) A reporter interviewing a movie star.
 - (d) Discussing the answers of a test with a group of friends.
2. Elucidate the importance of non-verbal communication in making a presentation
3. Differentiate between kinesics, proxemics, and chronemics with examples.

Course Outcome 4 (CO4):

1. How can a participant conclude a group discussion effectively?
2. 'Listening skills are essential for effectively participating in a group discussion.' Do you agree? Substantiate your answer.

Course Outcome 5 (CO5):

1. Illustrate the creative thinking process with the help of a suitable example
2. Translate the following problem from verbal to graphic form and find the solution : *In a quiz, Ananth has 50 points more than Bimal, Chinmay has 60 points less than Ananth, and Dharini is 20 points ahead of Chinmay. What is the difference in points between Bimal and Dharini?*

3. List at least five ways in which the problem "How to increase profit?" can be redefined

Course Outcome 6 (CO6):

1. A group of engineers decided to brainstorm a design issue on a new product. Since no one wanted to disagree with the senior members, new ideas were not flowing freely. What group dynamics technique would you suggest to avoid this 'groupthink'? Explain the procedure.
2. "A group focuses on individual contribution, while a team must focus on synergy." Explain.
3. Identify the type of group formed / constituted in each of the given situations
 - a) A Police Inspector with subordinates reporting to him
 - b) An enquiry committee constituted to investigate a specific incident
 - c) The Accounts Department of a company
 - d) A group of book lovers who meet to talk about reading

Syllabus

Module 1

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ

Module 2

Self-awareness: definition, need for self-awareness; Coping With Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback.

Stress Management: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion-oriented, acceptance-oriented, resilience, Gratitude Training,

Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques.

Morals, Values and Ethics: Integrity, Civic Virtue, Respect for Others, Living Peacefully. Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Co operation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.

Module 3

21st century skills: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Steps in problem solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.

Module 4

Group and Team Dynamics: Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.

Module 5

Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.

Lab Activities

Verbal

Effective communication and Presentation skills.

Different kinds of communication; Flow of communication; Communication networks, Types of barriers; Miscommunication

Introduction to presentations and group discussions.

Learning styles: visual, aural, verbal, kinaesthetic, logical, social, solitary; Previewing, KWL table, active listening, REAP method

Note-taking skills: outlining, non-linear note-taking methods, Cornell notes, three column note taking.

Memory techniques: mnemonics, association, flashcards, keywords, outlines, spider diagrams and mind maps, spaced repetition.

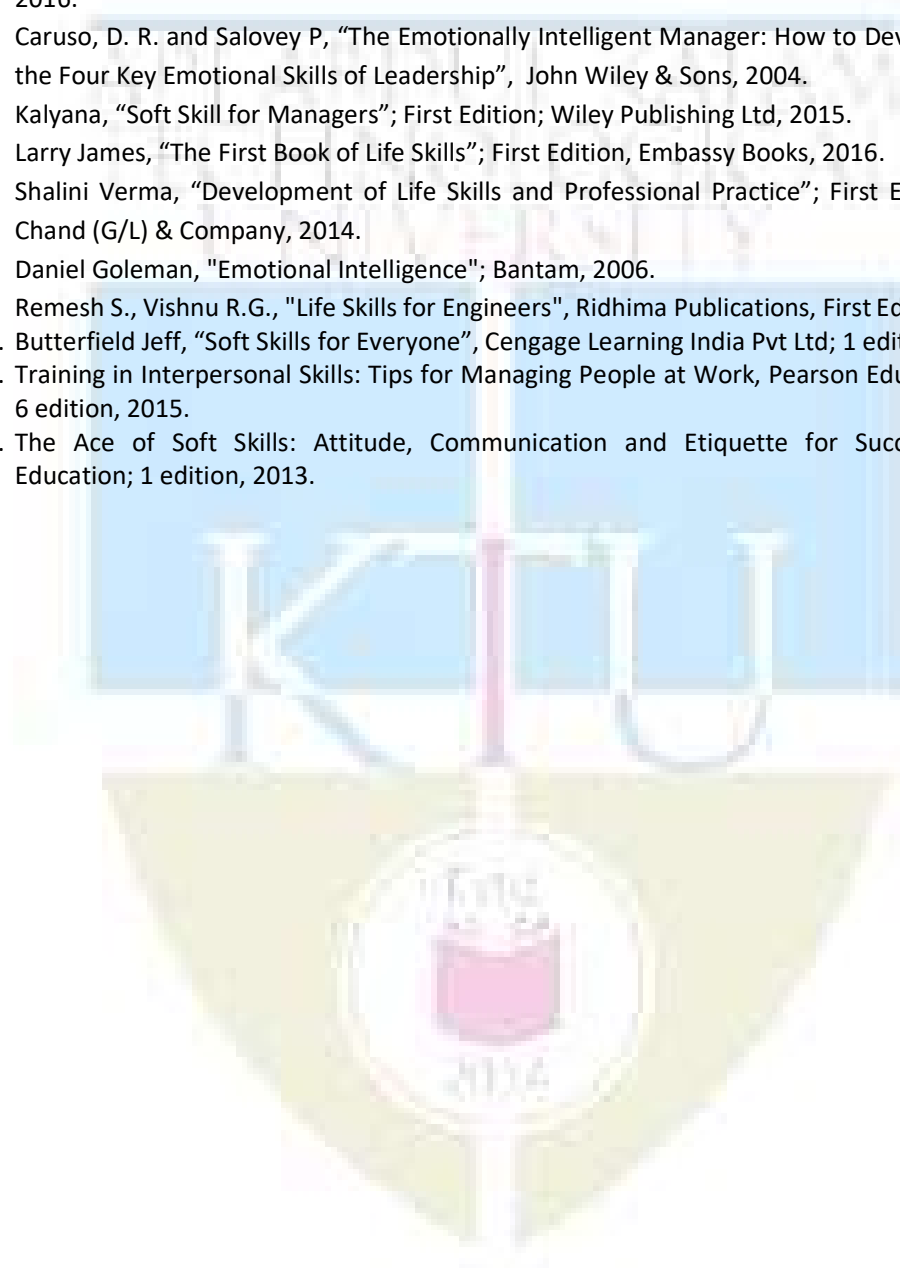
Time management: auditing, identifying time wasters, managing distractions, calendars and checklists; Prioritizing - Goal setting, SMART goals; Productivity tools and apps, Pomodoro technique.

Non Verbal:

Non-verbal Communication and Body Language: Forms of non-verbal communication; Interpreting body-language cues; Kinesics; Proxemics; Chronemics; Effective use of body language, Communication in a multi cultural environment.

Reference Books

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra, "Personality Development & Soft Skills", Oxford Publishers, Third impression, 2017.
3. ICT Academy of Kerala, "Life Skills for Engineers", McGraw Hill Education (India) Private Ltd., 2016.
4. Caruso, D. R. and Salovey P, "The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership", John Wiley & Sons, 2004.
5. Kalyana, "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd, 2015.
6. Larry James, "The First Book of Life Skills"; First Edition, Embassy Books, 2016.
7. Shalini Verma, "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company, 2014.
8. Daniel Goleman, "Emotional Intelligence"; Bantam, 2006.
9. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016.
10. Butterfield Jeff, "Soft Skills for Everyone", Cengage Learning India Pvt Ltd; 1 edition, 2011.
11. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India; 6 edition, 2015.
12. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.



PHL 120	ENGINEERING PHYSICS LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	0	0	2	1	2019

Preamble: The aim of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to develop practical applications of engineering materials and use the principle in the right way to implement the modern technology.

Prerequisite: Higher secondary level Physics

Course Outcomes: After the completion of the course the student will be able to

CO 1	Develop analytical/experimental skills and impart prerequisite hands on experience for engineering laboratories
CO 2	Understand the need for precise measurement practices for data recording
CO 3	Understand the principle, concept, working and applications of relevant technologies and comparison of results with theoretical calculations
CO 4	Analyze the techniques and skills associated with modern scientific tools such as lasers and fiber optics
CO 5	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				3			1	2			1
CO 2	3				3			1	2			1
CO 3	3				3			1	2			1
CO 4	3				3			1	2			1
CO 5	3				3			1	2			1

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment/Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour**SYLLABUS****LIST OF EXPERIMENTS**

(Minimum 8 experiments should be completed)

1. CRO-Measurement of frequency and amplitude of wave forms
2. Measurement of strain using strain gauge and wheatstone bridge
3. LCR Circuit – Forced and damped harmonic oscillations
4. Melde's string apparatus- Measurement of frequency in the transverse and longitudinal mode
5. Wave length measurement of a monochromatic source of light using Newton's Rings method.
6. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
7. To measure the wavelength using a millimeter scale as a grating.
8. Measurement of wavelength of a source of light using grating.
9. Determination of dispersive power and resolving power of a plane transmission grating
10. Determination of the particle size of lycopodium powder
11. Determination of the wavelength of He-Ne laser or any standard laser using diffraction grating
12. Calculate the numerical aperture and study the losses that occur in optical fiber cable.
13. I-V characteristics of solar cell.
14. LED Characteristics.
15. Ultrasonic Diffractometer- Wavelength and velocity measurement of ultrasonic waves in a liquid
16. Deflection magnetometer-Moment of a magnet- Tan A position.

Reference books

1. S.L.Gupta and Dr.V.Kumar, "Practical physics with viva voice", Pragati Prakashan Publishers, Revised Edition, 2009
2. M.N.Abadhanulu, A.A.Dani and Pokely P.M, "Experiments in Engineering Physics", S.Chand & Co, 2008
3. S. K. Gupta, "Engineering physics practicals", Krishna Prakashan Pvt. Ltd., 2014
4. P. R. Sasikumar "Practical Physics", PHI Ltd., 2011.

CO 7	2											
CO 8	2											

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hour

Assessment Procedure: Total marks allotted for the course is 100 marks. CIE shall be conducted for 70 marks and ESE for 30 marks. CIE should be done for the work done by the student and also viva voce based on the work done on each practical session. ESE shall be evaluated by written examination of one hour duration conducted internally by the institute.

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment/Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

PART 1

CIVIL WORKSHOP

- Exercise 1. Calculate the area of a built-up space and a small parcel of land- Use standard measuring tape and digital distance measuring devices
- Exercise 2. (a) Use screw gauge and vernier calliper to measure the diameter of a steel rod and thickness of a flat bar
- (b) Transfer the level from one point to another using a water level
- (c) Set out a one room building with a given plan and measuring tape
- Exercise 3. Find the level difference between any two points using dumpy level
- Exercise 4. (a) Construct a $1\frac{1}{2}$ thick brick wall of 50 cm height and 60 cm length using English bond. Use spirit level to assess the tilt of walls.
- (b) Estimate the number of different types of building blocks to construct this wall.

Exercise 5. (a) Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves, fixtures and sanitary fittings.

(b) Install a small rainwater harvesting installation in the campus

Reference Books:

1. Khanna P.N, "Indian Practical Civil Engineering Handbook", Engineers Publishers.
2. Bhavikatti. S, "Surveying and Levelling (Volume 1)", I.K. International Publishing House
3. Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications
4. S. C. Rangwala, "Engineering Materials," Charotar Publishing House.

PART II

MECHANICAL WORKSHOP

LIST OF EXERCISES

(Minimum EIGHT units mandatory and FIVE models from Units 2 to 8 mandatory)

UNIT 1:- General : Introduction to workshop practice, Safety precautions, Shop floor ethics, Basic First Aid knowledge.

Study of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc.

UNIT 2:- Carpentry : Understanding of carpentry tools

Minimum any one model

1. T-Lap joint
2. Cross lap joint
3. Dovetail joint
4. Mortise joints

UNIT 3:- Foundry : Understanding of foundry tools

Minimum any one model

1. Bench Molding
2. Floor Molding
3. Core making
4. Pattern making

UNIT 4:- Sheet Metal : Understanding of sheet metal working tools

Minimum any one model

1. Cylindrical shape
2. Conical shape
3. Prismatic shaped job from sheet metal

UNIT 5:- Fitting : Understanding of tools used for fitting

Minimum any one model

1. Square Joint
2. V- Joint
3. Male and female fitting

UNIT 6:- Plumbing : Understanding of plumbing tools, pipe joints

Any one exercise on joining of pipes making use of minimum three types of pipe joints

UNIT 7:- Smithy: Understanding of tools used for smithy.

Demonstrating the forge-ability of different materials (MS, Al, alloy steel and cast steels) in cold and hot states.

Observing the qualitative difference in the hardness of these materials

Minimum any one exercise on smithy

1. Square prism
2. Hexagonal headed bolt
3. Hexagonal prism
4. Octagonal prism

UNIT 8: -Welding: Understanding of welding equipments

Minimum any one welding practice

Making Joints using electric arc welding. bead formation in horizontal, vertical and over head positions

UNIT 9: - Assembly: Demonstration only

Disassembling and assembling of

1. Cylinder and piston assembly
2. Tail stock assembly
3. Bicycle
4. Pump or any other machine

UNIT 10: - Machines: Demonstration and applications of the following machines

Shaping and slotting machine; Milling machine; Grinding Machine; Lathe; Drilling Machine.

UNIT 11: - Modern manufacturing methods: Power tools, CNC machine tools, 3D printing, Glass cutting.

Course Contents and Lecture Schedule:

No	Topic	No of Sessions
1	INTRODUCTION	
1.1	Workshop practice, shop floor precautions, ethics and First Aid knowledge. Studies of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc	1
2	CARPENTRY	
2.1	Understanding of carpentry tools and making minimum one model	2

3	FOUNDRY	
3.1	Understanding of foundry tools and making minimum one model	2
4	SHEET METAL	
4.1	Understanding of sheet metal working tools and making minimum one model	2
5	FITTING	
5.1	Understanding of fitting tools and making minimum one model	2
6	PLUMBING	
6.1	Understanding of pipe joints and plumbing tools and making minimum one model	2
7	SMITHY	
7.1	Understanding of smithy tools and making minimum one model	2
8	WELDING	
8.1	Understanding of welding equipments and making minimum one model	2
9	ASSEMBLY	
9.1	Demonstration of assembly and dissembling of multiple parts components	1
10	MACHINES	
10.1	Demonstration of various machines	1
11	MODERN MANUFACTURING METHODS	
11.1	Demonstrations of: power tools, CNC Machine tools, 3D printing, Glass cutting	1

MAT 102	VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: This course introduces the concepts and applications of differentiation and integration of vector valued functions, differential equations, Laplace and Fourier Transforms. The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include the Calculus of vector valued functions, ordinary differential equations and basic transforms such as Laplace and Fourier Transforms which are invaluable for any engineer's mathematical tool box. The topics treated in this course have applications in all branches of engineering.

Prerequisite: Calculus of single and multi variable functions.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the derivatives and line integrals of vector functions and learn their applications
CO 2	Evaluate surface and volume integrals and learn their inter-relations and applications.
CO 3	Solve homogeneous and non-homogeneous linear differential equation with constant coefficients
CO 4	Compute Laplace transform and apply them to solve ODEs arising in engineering
CO 5	Determine the Fourier transforms of functions and apply them to solve problems arising in engineering

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	1			1	2		2
CO 2	3	3	3	3	2	1			1	2		2
CO 3	3	3	3	3	2	1			1	2		2
CO 4	3	3	3	3	2	1			1	2		2
CO 5	3	3	3	3	2	1			1	2		2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			

Create			

Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

Assignments: Assignment should include specific problems highlighting the applications of the methods introduced in this course in science and engineering.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1): Compute the derivatives and line integrals of vector functions and learn their applications

1. How would you calculate the speed, velocity and acceleration at any instant of a particle moving in space whose position vector at time t is $\mathbf{r}(t)$?
2. Find the work done by the force field $F = (e^x - y^3)\mathbf{i} + (\cos y + x^3)\mathbf{j}$ on a particle that travels once around the unit circle centred at origin having radius 1.
3. When do you say that a vector field is conservative? What are the implications if a vector field is conservative?

Course Outcome 2 (CO2): Evaluate surface and volume integrals and learn their inter-relations and applications

1. Write any one application each of line integral, double integral and surface integral.
2. Use the divergence theorem to find the outward flux of the vector field $F(x, y, z) = z\mathbf{k}$ across the

$$x^2 + y^2 + z^2 = a^2$$

3. State Greens theorem. Use Green's theorem to express the area of a plane region bounded by a curve as a line integral.

Course Outcome 3 (CO3): Solve homogeneous and non-homogeneous linear differential equation with constant coefficients

1. If $y_1(x)$ and $y_2(x)$ are solutions of $y'' + py' + qy = 0$, where p, q are constants, show that

$y_1(x) + y_2(x)$ is also a solution.

2. Solve the differential equation $y'' + y = 0.001x^2$ using method of undetermined coefficient.

3. Solve the differential equation of $y''' - 3y'' + 3y' - y = e^x - x - 1$.

Course Outcome 4 (CO4): Compute Laplace transform and apply them to solve ODEs arising in engineering

1. What is the inverse Laplace Transform of $(s) = \frac{3s-137}{s^2+2s+4}$?

2. Find Laplace Transform of Unit step function.

3. Solve the differential equation of $y'' + 9y = \delta\left(t - \frac{\pi}{2}\right)$? Given $y(0) = 2$, $y'(0) = 0$

Course Outcome 5 (CO5): Determine the Fourier transforms of functions and apply them to solve problems arising in engineering

1. Find the Fourier integral representation of function defined by

$f(x) = e^{-x}$ for $x > 0$ and $f(x) = 0$ for $x < 0$.

2. What are the conditions for the existence of Fourier Transform of a function $f(x)$?

3. Find the Fourier transform of $f(x) = 1$ for $|x| < 1$ and $f(x) = 0$ otherwise.

Model Question paper

QP CODE:

PAGES:3

Reg No: _____

Name : _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: MAT 102

Max. Marks: 100

Duration: 3 Hours

VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS

(2019-Scheme)

(Common to all branches)

PART A

(Answer all questions. Each question carries 3 marks)

1. Is the vector $\mathbf{r}$ where $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ conservative. Justify your answer.
2. State Greens theorem including all the required hypotheses
3. What is the outward flux of $\mathbf{F}(x, y, z) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ across any unit cube.
4. What is the relationship between Green's theorem and Stokes theorem?
5. Solve $y'' + 4y' + 2.5y = 0$
6. Does the function $y = C_1 \cos x + C_2 \sin x$ form a solution of $y'' + y = 0$? Is it the general solution? Justify your answer.
7. Find the Laplace transform of $e^{-t} \sinh 4t$
8. Find the Laplace inverse transform of $\frac{1}{s(s^2 + \omega^2)}$.
9. Given the Fourier transform $\frac{1}{\sqrt{2}} e^{-\frac{\omega^2}{4}}$ of $f(x) = e^{-x^2}$, find the Fourier transform of xe^{-x^2}
10. State the convolution theorem for Fourier transform

PART B

(Answer one full question from each module. Each full question carries 14 marks)

MODULE 1

- 11a) Prove that the force field $\mathbf{F} = e^y \mathbf{i} + xe^y \mathbf{j}$ is conservative in the entire xy-plane
 - b) Use Greens theorem to find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
- 12 a) Find the divergence of the vector field $\mathbf{F} = \frac{c}{(x^2 + y^2 + z^2)^{3/2}} (x\mathbf{i} + y\mathbf{j} + z\mathbf{k})$
 - b) Find the work done by the force field $\mathbf{F}(x, y, z) = xy\mathbf{i} + yz\mathbf{j} + xz\mathbf{k}$ along C where C is the curve $\mathbf{r}(t) = t\mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}$

MODULE II

- 13 a) Use divergence theorem to find the outward flux of the vector field $\mathbf{F} = 2x\mathbf{i} + 3y\mathbf{j} + z^3\mathbf{k}$ across the unit cube bounded by $x = 0, y = 0, z = 0, x = 1, y = 1, z = 1$
 - b) Find the circulation of $\mathbf{F} = (x - z)\mathbf{i} + (y - x)\mathbf{j} + (z - xy)\mathbf{k}$ using Stokes theorem around the triangle with vertices $A(1,0,0), B(0,2,0)$ and $C(0,0,1)$
- 14 a) Use divergence theorem to find the volume of the cylindrical solid bounded by $x^2 + 4x + y^2 = 7, z = -1, z = 4$, given the vector field $\mathbf{F} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ across surface of the cylinder
 - b) Use Stokes theorem to evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F} = x^2\mathbf{i} + 3x\mathbf{j} - y^3\mathbf{k}$ where C is

the circle $x^2 + y^2 = 1$ in the xy - plane with counterclockwise orientation looking down the positive z -axis

MODULE III

- 15 a) Solve $y'' + 4y' + 4y = x^2 + e^{-x} \cos x$
b) Solve $y''' - 3y'' + 3y' - y = e^x - x - 1$
16 a) Solve $y''' + 3y'' + 3y' + y = 30e^{-x}$ given $y(0) = 3, y'(0) = -3, y''(0) = -47$
b) Using method of variation of parameters, solve $y'' + y = \sec x$

MODULE IV

- 17 a) Find the inverse Laplace transform of $F(s) = \frac{2(e^{-s} - e^{-3s})}{s^2 - 4}$
b) Solve the differential equation $y'' + 16y = 4\delta(t - 3\pi); y(0) = 2, y'(0) = 0$ using Laplace transform
18 a) Solve $y'' + 3y' + 2y = f(t)$ where $f(t) = 1$ for $0 < t < 1$ and $f(t) = 1$ for $t > 1$ using Laplace transform
b) Apply convolution theorem to find the Laplace inverse transform of $\frac{1}{s^2(s^2 + \omega^2)}$

MODULE V

- 19 a) Find the Fourier cosine integral representation for $f(x) = e^{-kx}$ for $x > 0$ and $k > 0$ and hence evaluate $\int_0^\infty \frac{\cos wx}{k^2 + w^2}$ the function
b) Does the Fourier sine transform $f(x) = x^{-1} \sin x$ for $0 < x < \infty$ exist? Justify your answer
20 a) Find the Fourier transform of $f(x) = |x|$ for $|x| < 1$ and $f(x) = 0$ otherwise
b) Find the Fourier cosine transform of $f(x) = e^{-ax}$ for $a > 0$

Syllabus

Module 1 (Calculus of vector functions)

(Text 1: Relevant topics from sections 12.1, 12.2, 12.6, 13.6, 15.1, 15.2, 15.3)

Vector valued function of single variable, derivative of vector function and geometrical interpretation, motion along a curve-velocity, speed and acceleration. Concept of scalar and vector fields, Gradient and its properties, directional derivative, divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields, independence of path and potential function (results without proof).

Module 2 (Vector integral theorems)

(Text 1: Relevant topics from sections 15.4, 15.5, 15.6, 15.7, 15.8)

Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Surface integrals over surfaces of the form $z = g(x, y)$, $y = g(x, z)$ or $x = g(y, z)$, Flux integrals over surfaces of the form $z = g(x, y)$, $y = g(x, z)$ or $x = g(y, z)$, divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done.

Module- 3 (Ordinary differential equations)

(Text 2: Relevant topics from sections 2.1, 2.2, 2.5, 2.6, 2.7, 2.10, 3.1, 3.2, 3.3)

Homogenous linear differential equation of second order, superposition principle, general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order only). Existence and uniqueness (without proof). Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients (for the right hand side of the form $x^n, e^{kx}, \sin ax, \cos ax, e^{kx} \sin ax, e^{kx} \cos ax$ and their linear combinations), methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficient using method of undetermined coefficient.

Module- 4 (Laplace transforms)

(Text 2: Relevant topics from sections 6.1, 6.2, 6.3, 6.4, 6.5)

Laplace Transform and its inverse, Existence theorem (without proof), linearity, Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Dirac delta function and its Laplace transform, Solution of ordinary differential equation involving unit step function and Dirac delta functions. Convolution theorem (without proof) and its application to finding inverse Laplace transform of products of functions.

Module-5 (Fourier Transforms)

(Text 2: Relevant topics from sections 11.7,11.8, 11.9)

Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties. The Fourier transform of derivatives. Convolution theorem (without proof)

Text Books

1. H. Anton, I. Biven S.Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 10th edition, 2015.

Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Peter O Neil, Advanced Engineering Mathematics, 7th Edition, Thomson, 2007.
4. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6th edition, 2003.
5. VeerarajanT."Engineering Mathematics for first year", Tata McGraw - Hill, 2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th edition, 2010.
7. Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 2015.
8. Ronald N. Bracewell, "The Fourier Transform and its Applications", McGraw – Hill International Editions, 2000.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Calculus of vector functions (9 hours)	
1.1	Vector valued function of a scalar variable - derivative of vector valued function of scalar variable t-geometrical meaning	2
1.2	Motion along a curve-speed, velocity, acceleration	1
1.3	Gradient and its properties, directional derivative, divergent and curl	3
1.4	Line integrals with respect to arc length, line integrals of vector fields. Work done as line integral	2
1.5	Conservative vector field, independence of path, potential function	1

2	Vector integral theorems(9 hours)	
2.1	Green's theorem and it's applications	2
2.2	Surface integrals , flux integral and their evaluation	3
2.3	Divergence theorem and applications	2
2.4	Stokes theorem and applications	2
3	Ordinary Differential Equations (9 hours)	
3.1	Homogenous linear equation of second order, Superposition principle, general solution	1
3.2	Homogenous linear ODEs of second order with constant coefficients	2
3.3	Second order Euler-Cauchy equation	1
3.4	Non homogenous linear differential equations of second order with constant coefficient-solution by undetermined coefficients, variation of parameters.	3
3.5	Higher order equations with constant coefficients	2
4	Laplace Transform (10 hours)	
4.1	Laplace Transform , inverse Transform, Linearity, First shifting theorem, transform of basic functions	2
4.2	Transform of derivatives and integrals	1
4.3	Solution of Differential equations, Initial value problems by Laplace transform method.	2
4.4	Unit step function --- Second shifting theorem	2
4.5	Dirac Delta function and solution of ODE involving Dirac delta function	2
4.6	Convolution and related problems.	1
5	Fourier Transform (8 hours)	
5.1	Fourier integral representation	1
5.2	Fourier Cosine and Sine integrals and transforms	2
5.3	Complex Fourier integral representation, Fourier transform and its inverse transforms, basic properties	3
5.4	Fourier transform of derivatives, Convolution theorem	2

ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

KTU



CYT 100	ENGINEERING CHEMISTRY	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like spectroscopy, electrochemistry, instrumental methods etc. Also familiarize the students with topics like mechanism of corrosion, corrosion prevention methods, SEM, stereochemistry, polymers, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of chemistry.

Prerequisite: Concepts of chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Apply the basic concepts of electrochemistry and corrosion to explore its possible applications in various engineering fields.
CO 2	Understand various spectroscopic techniques like UV-Visible, IR, NMR and its applications.
CO 3	Apply the knowledge of analytical method for characterizing a chemical mixture or a compound. Understand the basic concept of SEM for surface characterisation of nanomaterials.
CO 4	Learn about the basics of stereochemistry and its application. Apply the knowledge of conducting polymers and advanced polymers in engineering.
CO 5	Study various types of water treatment methods to develop skills for treating wastewater.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1									
CO 2	1	1		1	2							
CO 3	1	1		1	2							
CO 4	2	1										
CO 5	1			1			3					

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			
Create			

End Semester Examination Pattern: There will be two parts- **Part A** and **Part B**. **Part A** contains **10** questions (**2** questions from each module), having **3** marks for each question. Students should answer **all** questions. **Part B** contains **2** questions from each module, of which student should answer any one. Each question can have maximum **2** subdivisions and carries **14** marks.

Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. What is calomel electrode? Give the reduction reaction (3 Marks)
2. List three important advantages of potentiometric titration (3 Marks)
3. (a) Explain how electroless plating copper and nickel are carried out (10 Marks)
(b) Calculate the emf of the following cell at 30°C, $Zn / Zn^{2+} (0.1M) // Ag^+ (0.01M) // Ag$.
Given $E^0 Zn^{2+}/Zn = -0.76 V$, $E^0 Ag^+/Ag = 0.8 V$. (4 Marks)

Course Outcome 2 (CO 2)

1. State Beer Lambert's law (3 Marks)
2. List the important applications of IR spectroscopy (3 Marks)
3. (a) What is Chemical shift? What are factors affecting Chemical shift? How ^1H NMR spectrum of CH_3COCH_2Cl interpreted using the concept of chemical shift. (10 Marks)
(b) Calculate the force constant of HF molecule, if it shows IR absorption at 4138 cm^{-1} . Given that atomic masses of hydrogen and fluorine are 1u and 19u respectively. (4 Marks)

Course Outcome 3 (CO 3):

1. Distinguish between TGA and DTA (3 Marks)
2. Give two differences between GSC and GLC (3 Marks)

3. (a) Explain the principle, instrumentation and procedure of HPLC (10 Marks)

(b) Interpret TGA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ (4 Marks)

Course Outcome 4 (CO 4):

1. Explain the geometrical isomerism in double bonds (3 Marks)

2. What are the rules of assigning R-S notation? (3 Marks)

3. (a) What are conducting polymers? How it is classified? Give the preparation of polyaniline (10 Marks)

(b) Draw the stereoisomers possible for $\text{CH}_3\text{-(CHOH)}_2\text{-COOH}$ (4 Marks)

Course Outcome 5 (CO 5):

1. What is degree of hardness? (3 Marks)

2. Define BOD and COD (3 Marks)

3. (a) Explain the EDTA estimation of hardness (10 Marks)

(b) Standard hard water contains 20 g of CaCO_3 per liter, 50 mL of this required 30 mL of EDTA solution, 50 mL of sample water required 20 mL of EDTA solution. 50 mL sample water after boiling required 14 mL EDTA solution. Calculate the temporary hardness of the given sample of water, in terms of ppm. (4 Marks)

MODEL QUESTION PAPER

Total Pages:

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION

Course Code: CYT100,

Course Name: ENGINEERING CHEMISTRY

Max. Marks: 100

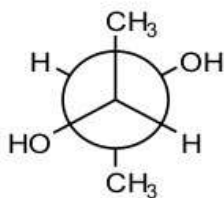
Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks

		Marks
1	What is potentiometric titration? How the end point is determined graphically?	(3)
2	What is Galvanic series? How is it different from electrochemical series?	(3)
3	Which of the following molecules can give IR absorption? Give reason?	(3)
	(a) O_2 (b) H_2O (c) N_2 (d) HCl	
4	Which of the following molecules show UV-Visible absorption? Give reason.	(3)
	(a) Ethane (b) Butadiene (c) Benzene	

- 5 What are the visualization techniques used in TLC? (3)
- 6 Write the three important applications of nanomaterials. (3)
- 7 Draw the Fischer projection formula and find R-S notation of (3)



- 8 Write the structure of a) Polypyrrole b) Kevlar. (3)
- 9 What is break point chlorination? (3)
- 10 What is reverse osmosis? (3)

PART B

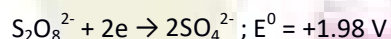
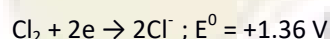
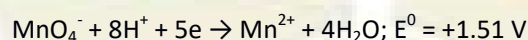
Answer any one full question from each module, each question carries 14 marks

Module 1

- 11 a) Give the construction of Li-ion cell. Give the reactions that take place at the electrodes during charging and discharging. What happens to anodic material when the cell is 100% charged. (10)
- b) Calculate the standard electrode potential of Cu, if its electrode potential at 25 °C is 0.296 V and the concentration of Cu^{2+} is 0.015 M. (4)

OR

- 12 a) Explain the mechanism of electrochemical corrosion of iron in oxygen rich and oxygen deficient acidic and basic environments. (10)
- b) Given below are reduction potentials of some species (4)



Use the above data to examine whether the acids, dil. HCl and dil. H_2SO_4 , can be used to provide acid medium in redox titrations involving KMnO_4 .

Module 2

- 13 a) What is spin-spin splitting? Draw the NMR spectrum of (i) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ (ii) $\text{CH}_3\text{CH}(\text{Br})\text{CH}_3$. Explain how NMR spectrum can be used to identify the two isomers. (10)
- b) A dye solution of concentration 0.08M shows absorbance of 0.012 at 600 nm; while a test solution of same dye shows absorbance of 0.084 under same conditions. Find the concentration of the test solution. (4)

OR

- 14 a) Explain the basic principle of UV-Visible spectroscopy. What are the possible electronic transitions? Explain with examples. (10)
- b) Sketch the vibrational modes of CO_2 and H_2O . Which of them are IR active? (4)

Module 3

- 15 a) Explain the principle, instrumentation and procedure involved in gas chromatography. (10)
b) Explain the DTA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ with a neat sketch. (4)

OR

- 16 a) Explain the various chemical methods used for the synthesis of nanomaterial (10)
b) How TGA is used to analyse the thermal stability of polymers? (4)

Module 4

- 17 a) What are conformers? Draw the *cis* and *trans* isomers of 1, 3-dimethylcyclohexane. (10)
Which conformer (chair form) is more stable in each case?
b) What is ABS? Give properties and applications. (4)

OR

- 18 a) Explain the various structural isomers with suitable example. (10)
b) What is OLED? Draw a labelled diagram. (4)

Module 5

- 19 a) What are ion exchange resins? Explain ion exchange process for removal of hardness of water? How exhausted resins are regenerated? (10)
b) 50 mL sewage water is diluted to 2000 mL with dilution water; the initial dissolved oxygen was 7.7 ppm. The dissolved oxygen level after 5 days of incubation was 2.4 ppm. Find the BOD of the sewage. (4)

OR

- 20 a) What are the different steps in sewage treatment? Give the flow diagram. Explain the working of trickling filter. (10)
b) Calculate the temporary and permanent hardness of a water sample which contains $[\text{Ca}^{2+}] = 160 \text{ mg/L}$, $[\text{Mg}^{2+}] = 192 \text{ mg/L}$ and $[\text{HCO}_3^-] = 122 \text{ mg/L}$. (4)

Syllabus

Module 1

Electrochemistry and Corrosion

Introduction - Differences between electrolytic and electrochemical cells - Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes - SHE - Calomel electrode - Glass Electrode - Construction and Working. Single electrode potential - definition - Helmholtz electrical double layer - Determination of E^0 using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF - Nernst Equation - Derivation - single electrode and cell (Numericals) - Application - Variation of emf with temperature. Potentiometric titration - Introduction - Redox titration only. Lithium ion cell - construction and working. Conductivity- Measurement of conductivity of a solution (Numericals).

Corrosion-Electrochemical corrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.

Module 2

Spectroscopic Techniques and Applications

Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications. IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications. ^1H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).

Module 3

Instrumental Methods and Nanomaterials

Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$. Chromatographic methods - Basic principles and applications of column and TLC- Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.

Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).

Module 4

Stereochemistry and Polymer Chemistry

Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations). R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples. Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.

Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping - Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.

Module 5

Water Chemistry and Sewage Water Treatment

Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of

hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. Municipal water treatment (brief) - Disinfection methods - chlorination, ozone and UV irradiation.

Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD- definition, estimation (only brief procedure) and significance (Numericals). Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.

Text Books

1. B. L. Tembe, Kamaluddin, M. S. Krishnan, "Engineering Chemistry (NPTEL Web-book)", 2018.
2. P. W. Atkins, "Physical Chemistry", Oxford University Press, 10th edn., 2014.

Reference Books

1. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw-Hill, 4th edn., 1995.
2. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
3. B. R. Puri, L. R. Sharma, M. S. Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 47th Edition, 2017.
4. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7th Edition, 2005.
5. Ernest L. Eliel, Samuel H. Wilen, "Stereo-chemistry of Organic Compounds", WILEY, 2008.
6. Raymond B. Seymour, Charles E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc; 4th Revised Edition, 1996.
7. MuhammedArif, Annette Fernandez, Kavitha P. Nair "Engineering Chemistry", Owl Books, 2019.
8. Ahad J., "Engineering Chemistry", Jai Publication, 2019.
9. Roy K. Varghese, "Engineering Chemistry", Crownplus Publishers, 2019.
10. Soney C. George, RinoLaly Jose, "Text Book of Engineering Chemistry", S. Chand & Company Pvt Ltd, 2019.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures (hrs)
1	Electrochemistry and Corrosion	9
1.1	Introduction - Differences between electrolytic and electrochemical cells- Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes- SHE - Calomel electrode - Glass Electrode - Construction and Working.	2
1.2	Single electrode potential – definition - Helmholtz electrical double layer - Determination of E^0 using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF - Nernst Equation – Derivation - single electrode and cell (Numericals) -Application -Variation of emf with temperature.	3
1.3	Potentiometric titration - Introduction -Redox titration only. Lithiumion cell - construction and working. Conductivity- Measurement of conductivity of a solution (Numericals).	2
1.4	Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.	2
2	Spectroscopic Techniques and Applications	9
2.1	Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals).	2
2.2	UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.	2
2.3	IR-Spectroscopy – Principle - Number of vibrational modes -Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications.	2
2.4	^1H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).	3
3	Instrumental Methods and Nanomaterials	9
3.1	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$.	2

3.2	Chromatographic methods - Basic principles and applications of column and TLC-Retention factor.	2
3.3	GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.	2
3.4	Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).	3
4	Stereochemistry and Polymer Chemistry	9
4.1	Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations).	2
4.2	R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.	1
4.3	Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.	2
4.4	Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.	4
5	Water Chemistry and Sewage Water Treatment	9
5.1	Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	3
5.2	Municipal water treatment (brief) - Disinfection methods - chlorination, ozone and UV irradiation.	2
5.3	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals).	2
5.4	Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process.	2

EST 100	ENGINEERING MECHANICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	1	0	3	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while stationary or in motion. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to:

CO 1	Recall principles and theorems related to rigid body mechanics
CO 2	Identify and describe the components of system of forces acting on the rigid body
CO 3	Apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	Choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	Solve problems involving rigid bodies, applying the properties of distributed areas and masses

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	15
Understand	10	10	15
Apply	30	30	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Part A

Course Outcome 1 (CO1): (One question from each module to meet the course objective 1: *To recall principles and theorems related to rigid body mechanics*)

1. Explain D'Alembert's principle
2. Distinguish static and dynamic friction
3. State and explain perpendicular axis theorem

Course Outcome 2 (CO2) (One question from each module to meet the course objective 2: *To identify and describe the components of system of forces acting on the rigid body*)

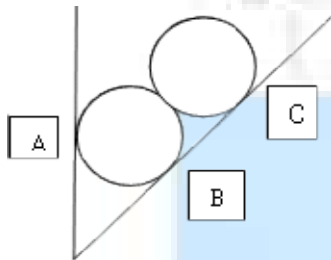
1. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.
2. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar
3. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

Part B

All the questions under this section shall assess the learning levels corresponding to the course outcomes listed below.

CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses

1. Two rollers each of weight 100 N are supported by an inclined plane and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth.

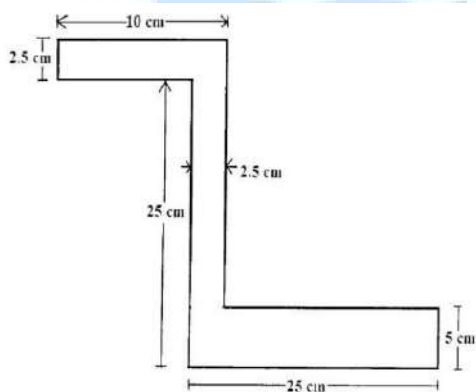


Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent equilibrium state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

2. A cylindrical disc, 50 cm diameter and cm thickness, is in contact with a horizontal conveyor belts running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s. Also compute the moment acting about the axis of the disc in both cases.

Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

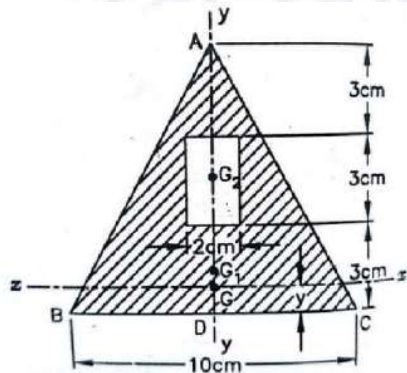
3. Determine the centroid of the given section



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of centroid for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed	Applying (Solve the problem based on the descriptions	6

	areas and masses	given in CO3 and CO4)	
Total			14

4. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC.



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of moment of inertia for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

Model Question Paper

QP CODE:

Reg No.: _____

Name: _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: EST 100

ENGINEERING MECHANICS

Max. Marks: 100

Duration: 3 hours

Part A

(Answer all questions; each question carries 3 marks)

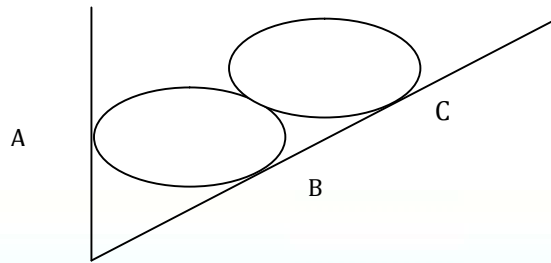
1. Explain D'Alembert's principle
2. Distinguish static and dynamic friction.
3. State and explain perpendicular axis theorem.
4. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.
5. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar
6. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?
7. Compare damped and undamped free vibrations.
8. State the equation of motion of a rotating rigid body, rotating about its fixed axis.
9. Illustrate the significance of instantaneous centre in the analysis of rigid body undergoing rotational motion.
10. Highlight the principles of mechanics applied in the evaluation of elastic collision of rigid bodies.

PART B

(Answer **one full** question from each module, each question carries **14** marks)

Module -I

11. Two identical rollers each of weight 100 N are supported by an inclined plane, making an angle of 30° with the vertical, and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth. (14 marks)

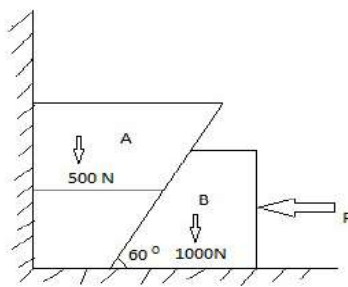


12. A string tied to a wall is made to pass over a pulley placed 2m away from it. A weight P is attached to the string such that the string stretches by 2m from the support on the wall to the location of attachment of weight. Determine the force P required to maintain 200 kg body in position for $\theta = 30^\circ$, The diameter of pulley B is negligible. (14 marks)

Module – 2

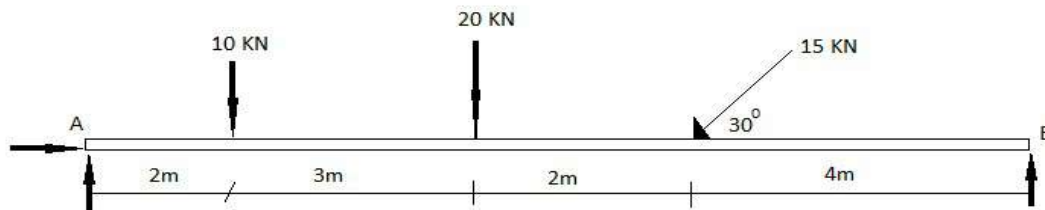
13. Two blocks A & B are resting against a wall and the floor as shown in figure below. Find the value of horizontal force P applied to the lower block that will hold the system in equilibrium. Coefficient of friction are : 0.25 at the floor, 0.3 at the wall and 0.2 between the blocks.

(14 marks)



14. A beam is hinged at A and roller supported at B. It is acted upon by loads as shown below. Find the reactions at A & B.

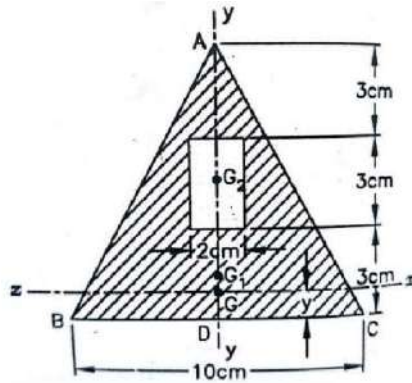
(14 marks)



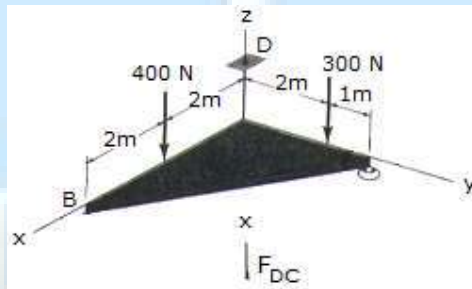
Module – 3

15. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC.

(14 marks)



16. Support A has ball and socket connection. Roller support at B prevents motion in the $-z$ direction. Corner C is tied to D by a rope. The triangle is weightless. Determine the unknown force components acting at A, B, and C. (14 marks)



Module - 4

17. A cricket ball is thrown by a fielder from a height of 2m at an angle of 30° to the horizontal with an initial velocity of 20 m/s, hits the wickets at a height of 0.5 m from the ground. How far was the fielder from the wicket? (14 marks)

18. An engine of weight 500 kN pull a train weighing 1500 kN up an incline of 1 in 100. The train starts from rest and moves with constant acceleration against a resistance of 5 N/kN. It attains a maximum speed of 36 kmph in 1 km distance. Determine the tension in the coupling between train and engine and the traction force developed by the engine. (14marks)

Module – 5

19. A cylindrical disc, 50 cm diameter and 10 cm thickness having mass of 10 kg, is in contact with a horizontal conveyor belt running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s in 10 seconds. Also compute the moment acting about the axis of the disc in both cases. (14 marks)
20. A wheel rotating about fixed axis at 20 rpm is uniformly accelerated for 70 seconds during which time it makes 50 revolutions. Find the (i) angular velocity at the end of this interval and (ii) time required for the velocity to reach 100 revolutions per minute. (14 marks)

SYLLABUS

Module 1

Introduction to Engineering Mechanics-statics-basic principles of statics-Parallelogram law, equilibrium law, principles of superposition and transmissibility, law of action and reaction(review) free body diagrams.

Concurrent coplanar forces-composition and resolution of forces-resultant and equilibrium equations – methods of projections – methods of moments – Varignon's Theorem of moments.

Module 2

Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –wedges, ladder-analysis of connected bodies .

Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads. General coplanar force system - resultant and equilibrium equations.

Module 3

Centroid of composite areas- – moment of inertia-parallel axis and perpendicular axis theorems. Polar moment of inertia, radius of gyration, mass moment of inertia-ring, cylinder and disc.

Theorem of Pappus Guldinus(demonstration only)

Forces in space - vectorial representation of forces, moments and couples –resultant and equilibrium equations – concurrent forces in space (simple problems only)

Module 4

Dynamics – rectilinear translation - equations of kinematics(review)

kinetics – equation of motion – D'Alembert's principle. – motion on horizontal and inclined surfaces, motion of connected bodies. Impulse momentum equation and work energy equation (concepts only).

Curvilinear translation - equations of kinematics –projectile motion(review), kinetics – equation of motion. Moment of momentum and work energy equation (concepts only).

Module 5

Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – rotation under a constant moment.

Plane motion of rigid body – instantaneous centre of rotation (concept only).

Simple harmonic motion – free vibration –degree of freedom- undamped free vibration of spring mass system-effect of damping(concept only)

Text Books

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers
2. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
3. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education.

References

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.
2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications
3. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers
4. F.P.Beer and E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill
5. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd.

Course Contents and Lecture Schedule:

Module	Topic	Course outcomes addressed	No. of Hours
1	Module 1		Total: 7
1.1	Introduction to engineering mechanics – introduction on statics and dynamics - Basic principles of statics – Parellogram law, equilibrium law – Superposition and transmissibility, law of action and reaction (review the topics)	CO1 and CO2	1
1.2	Free body diagrams. Degree of freedom-types of supports and nature of reactions - exercises for free body diagram preparation – composition and resolution of forces, resultant and equilibrium equations (review the topics) - numerical exercises for illustration.	CO1 and CO2	1
1.3	Concurrent coplanar forces - analysis of concurrent forces -methods of projections – illustrative numerical exercise – teacher assisted problem solving.	CO1 and CO2	1
1.4	Analysis of concurrent forces -methods of moment-Varignon's Theorem of Moments - illustrative numerical exercise– teacher assisted problem solving.	CO1 and CO2	1
1.5	Analysis of concurrent force systems – extended problem solving - Session I.	CO3,CO4 and CO5	1
1.6	Analysis of concurrent force systems – extended problem solving - Session II – learning review quiz.	CO3,CO4 and CO5	1
1.7	Analysis of concurrent force systems – extended problem solving - Session III.	CO3,CO4 and CO5	1
2	Module 2		Total: 7
2.1	Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –illustrative examples on wedges and ladder-teacher	CO1 and CO2	1

	assisted problem solving tutorials using problems from wedges and ladder.		
2.2	Problems on friction - analysis of connected bodies. illustrative numerical exercise– teacher assisted problem solving.	CO3, CO4 and CO5	1
2.3	Problems on friction-extended problem solving	CO3,CO4 and CO5	1
2.4	Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads.	CO1 and CO2	1
2.5	General coplanar force system - resultant and equilibrium equations - illustrative examples- teacher assisted problem solving.	CO1 and CO2	1
2.6	General coplanar force system-resultant and equilibrium equations - illustrative examples	CO3, CO4 and CO5	1
2.7	General coplanar force system - Extended problem solving - Quiz to evaluate learning level.	CO3, CO4 and CO5	1
3	Module 3		Total: 7
3.1	Centroid of simple and regular geometrical shapes – centroid of figures in combination - composite areas- examples for illustration – problems for practice to be done by self.	CO1 and CO2	1
3.2	Moment of inertia- parallel axis theorem –examples for illustration - problems for practice to be done by self.	CO1 and CO2	1
3.3	Moment of inertia - perpendicular axis theorem - example for illustration to be given as hand out and discussion on the solved example.	CO1 and CO2	1
3.4	Solutions to practice problems – problems related to centroid and moment of inertia - problems for practice to be done by self.	CO3, CO4 and CO5	1
3.5	Polar moment of inertia, Radius of gyration. Mass moment of inertia of ring, cylinder and uniform disc. Theorem of Pappus Guldinus - Demonstration	CO1 and CO2	1
3.6	Introduction to forces in space – vectorial representation of forces, moments and couples – simple problems to illustrate vector representations of forces, moments and couples to be done in class.	CO1,and CO2	1
3.7	Solution to practice problems - resultant and equilibrium equations for concurrent forces in space – concurrent forces in space - 2 simple problems to illustrate the application of resultant and equilibrium equations for concurrent forces in space.	CO3,CO4 and CO5	1
4	Module 4		Total: 7

4.1	Introduction to dynamics – review of rectilinear translation - equations of kinematics – problems to review the concepts – additional problems involving extended application as exercises .	CO1 and CO2	1
4.2	Solutions to exercises with necessary explanation given as hand out – introduction to kinetics – equation of motion – D’Alembert’s principle – illustration of the concepts using one numerical exercise from motion on horizontal and inclined surfaces.	CO1 and CO2	1
4.3	Motion of connected bodies - example for illustration to be given as hand out and discussion on the solved example – problems for practice to be done by self.	CO3, CO4 and CO5	1
4.4	Motion of connected bodies-extended problem solving.	CO3, CO4 & CO5	1
4.5	Curvilinear translation - Review of kinematics –projectile motion – simple problems to review the concepts – introduction to kinetics – equation of motion – illustration of the concepts using numerical exercises.	CO3, CO4 & CO5	1
4.6	Extended problem solving – rectilinear and curvilinear translation.	CO3, CO4 & CO5	1
4.7	Concepts on Impulse momentum equation and work energy equation (rectilinear translation – discussions to bring out difference between elastic and inelastic collisions). Concepts on Moment of momentum and work energy equation (curvilinear translation).	CO1 and CO2	1
5	Module 5		Total: 7
5.1	Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – simple problems for illustration.	CO1 and CO2	1
5.2	Rotation under a constant moment – teacher assisted problem solving.	CO3,CO4 and CO5	1
5.3	Rotation under a constant moment - extended problem solving.	CO3, CO4 and CO5	1
5.4	Plane motion of rigid body- instantaneous centre of rotation (concept only).	CO1 and CO2	1
5.5	Introduction to harmonic oscillation –free vibrations - simple harmonic motion – differential equation and solution. Degree of freedom – examples of single degree of freedom (SDOF) systems – Idealisation of mechanical systems as spring-mass systems (concept only).	CO1 and CO2	1

5.6	SDOF spring mass system –equation of motion – undamped free vibration response - concept of natural frequency. Free vibration response due to initial conditions. Simple problems on determination of natural frequency and free vibration response to test the understanding level.	CO1 and CO2	1
5.7	Free vibration analysis of SDOF spring-mass systems – Problem solving Effect of damping on free vibration response (concept only).	CO1and CO2	1



EST 102	PROGRAMING IN C	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	2	1	2	4	2019

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of writing readable C programs to solve computational problems that they may have to solve in their professional life. The course content is decided to cover the essential programming fundamentals which can be taught within the given slots in the curriculum. This course has got 2 Hours per week for practicing programming in C. A list showing 24 mandatory programming problems are given at the end. The instructor is supposed to give homework/assignments to write the listed programs in the rough record as and when the required theory part is covered in the class. The students are expected to come prepared with the required program written in the rough record for the lab classes.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Analyze a computational problem and develop an algorithm/flowchart to find its solution
CO 2	Develop readable* C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or Bitwise operators.
CO 3	Write readable C programs with arrays, structure or union for storing the data to be processed
CO 4	Divide a given computational problem into a number of modules and develop a readable multi-function C program by using recursion if required, to find the solution to the computational problem
CO 5	Write readable C programs which use pointers for array processing and parameter passing
CO 6	Develop readable C programs with files for reading input and storing output
readable* - readability of a program means the following: 1. Logic used is easy to follow 2. Standards to be followed for indentation and formatting 3. Meaningful names are given to variables 4. Concise comments are provided wherever needed	

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓		✓				✓	✓	✓
CO2	✓	✓	✓	✓	✓					✓		✓
CO3	✓	✓	✓	✓	✓					✓		✓
CO4	✓	✓	✓	✓	✓					✓	✓	✓
CO5	✓	✓			✓					✓		✓
CO6	✓	✓			✓					✓		✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	10	25
Understand	10	15	25
Apply	20	20	40
Analyse	5	5	10
Evaluate			
Create			

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test 1 (for theory, for 2 hrs) : 20 marks

Continuous Assessment Test 2 (for lab, internal examination, for 2 hrs) : 20 marks

Internal Examination Pattern: There will be two parts; Part A and Part B. Part A contains 5 questions with 2 questions from each module ($2.5 \text{ modules} \times 2 = 5$), having 3 marks for each question. Students should answer all questions. Part B also contains 5 questions with 2 questions from each module ($2.5 \text{ modules} \times 2 = 5$), of which a student should answer any one. The questions should not have sub-divisions and each one carries 7 marks.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1): Write an algorithm to check whether largest of 3 natural numbers is prime or not. Also, draw a flowchart for solving the same problem.

Course Outcome 2 (CO2): Write an easy to read C program to process a set of n natural numbers and to find the largest even number and smallest odd number from the given set of numbers. The program should not use division and modulus operators.

Course Outcome 3 (CO3): Write an easy to read C program to process the marks obtained by n students of a class and prepare their rank list based on the sum of the marks obtained. There are 3 subjects for which examinations are conducted and the third subject is an elective where a student is allowed to take any one of the two courses offered.

Course Outcome 4 (CO4): Write an easy to read C program to find the value of a mathematical function f which is defined as follows. $f(n) = n! / (\text{sum of factors of } n)$, if n is not prime and $f(n) = n! / (\text{sum of digits of } n)$, if n is prime.

Course Outcome 5 (CO5): Write an easy to read C program to sort a set of n integers and to find the number of unique numbers and the number of repeated numbers in the given set of numbers. Use a function which takes an integer array of n elements, sorts the array using the Bubble Sorting Technique and returns the number of unique numbers and the number of repeated numbers in the given array.

Course Outcome 6 (CO6): Write an easy to read C program to process a text file and to print the Palindrome words into an output file.

Model Question paper

QP CODE:

PAGES:3

Reg No: _____

Name : _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: EST 102

Course Name: Programming in C (Common to all programs)

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. Write short note on processor and memory in a computer.
2. What are the differences between compiled and interpreted languages? Give example for each.
3. Write a C program to read a Natural Number through keyboard and to display the reverse of the given number. For example, if "3214567" is given as input, the output to be shown is "7654123".
4. Is it advisable to use *goto* statements in a C program? Justify your answer.
5. Explain the different ways in which you can *declare & initialize* a single dimensional array.
6. Write a C program to read a sentence through keyboard and to display the count of white spaces in the given sentence.
7. What are the advantages of using functions in a program?
8. With a simple example program, explain *scope* and *life time* of variables in C.
9. Write a function in C which takes the address of a single dimensional array (containing a finite sequence of numbers) and the number of numbers stored in the array as arguments and stores the numbers in the same array in reverse order. Use pointers to access the elements of the array.
10. With an example, explain the different modes of opening a file. (10x3=30)

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. (a) Draw a flow chart to find the position of an element in a given sequence, using linear searching technique. With an example explain how the flowchart finds the position of a given element. (10)
(b) Write a pseudo code representing the flowchart for linear searching. (4)

OR

12. (a) With the help of a flow chart, explain the bubble sort operation. Illustrate with an example. (10)
(b) Write an algorithm representing the flowchart for bubble sort. (4)

13. (a) Write a C program to read an English Alphabet through keyboard and display whether the given Alphabet is in upper case or lower case. (6)
(b) Explain how one can use the builtin function in C, *scanf* to read values of different data types. Also explain using examples how one can use the builtin function in C, *printf* for text formatting. (8)

OR

14. (a) With suitable examples, explain various operators in C. (10)
(b) Explain how characters are stored and processed in C. (4)

15. (a) Write a function in C which takes a 2-Dimensional array storing a matrix of numbers and the order of the matrix (number of rows and columns) as arguments and displays the sum of the elements stored in each row. (6)
(b) Write a C program to check whether a given matrix is a diagonal matrix. (8)

OR

16. (a) Without using any builtin string processing function like *strlen*, *strcat* etc., write a program to concatenate two strings. (8)
(b) Write a C program to perform bubble sort. (6)

17. (a) Write a function namely *myFact* in C to find the factorial of a given number. Also, write another function in C namely *nCr* which accepts two positive integer parameters *n* and *r* and returns the value of the mathematical function $C(n,r) = \frac{n!}{r! \times (n-r)!}$. The function *nCr* is expected to make use of the factorial function *myFact*. (10)
(b) What is recursion? Give an example. (4)

OR

18. (a) With a suitable example, explain the differences between a structure and a union in C. (6)
(b) Declare a structure namely *Student* to store the details (*roll number*, *name*, *mark_for_C*) of a student. Then, write a program in C to find the average mark obtained by the students in a class for the subject *Programming in C* (using the field *mark_for_C*). Use array of structures to store the required data (8)

19. (a) With a suitable example, explain the concept of pass by reference. (6)
(b) With a suitable example, explain how pointers can help in changing the content of a single dimensionally array passed as an argument to a function in C. (8)

OR

20. (a) Differentiate between sequential files and random access files? (4)

(b) Using the prototypes explain the functionality provided by the following functions. (10)

rewind()

i. *fseek()*

ii. *ftell()*

iii. *fread()*

iv. *fwrite()*

(14X5=70)

SYLLABUS

Programming in C (Common to all disciplines)

Module 1

Basics of Computer Hardware and Software

Basics of Computer Architecture: processor, Memory, Input & Output devices

Application Software & System software: Compilers, interpreters, High level and low level languages

Introduction to structured approach to programming, Flow chart Algorithms, Pseudo code (*bubble sort, linear search - algorithms and pseudocode*)

Module 2

Program Basics

Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf

Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence

Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements. (Simple programs covering control flow)

Module 3

Arrays and strings

Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array

String processing: In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets)

Linear search program, bubble sort program, simple programs covering arrays and strings

Module 4

Working with functions

Introduction to modular programming, writing functions, formal parameters, actual parameters Pass by Value, Recursion, Arrays as Function Parameters structure, union, Storage Classes, Scope and life time of variables, *simple programs using functions*

Module 5

Pointers and Files

Basics of Pointer: declaring pointers, accessing data through pointers, NULL pointer, array access using pointers, pass by reference effect

File Operations: open, close, read, write, append

Sequential access and random access to files: In built file handling functions (*rewind()*, *fseek()*, *ftell()*, *feof()*, *fread()*, *fwrite()*), simple programs covering pointers and files.

Text Books

1. Schaum Series, Gottfried B.S., Tata McGraw Hill, Programming with C
2. E. Balagurusamy, McGraw Hill, Programming in ANSI C
3. Asok N Kamthane, Pearson, Programming in C
4. Anita Goel, Pearson, Computer Fundamentals

Reference Books

1. Anita Goel and Ajay Mittal, Pearson, Computer fundamentals and Programming in C
2. Brian W. Kernighan and Dennis M. Ritchie, Pearson, C Programming Language
3. Rajaraman V, PHI, Computer Basics and Programming in C
4. Yashavant P, Kanetkar, BPB Publications, Let us C

Course Contents and Lecture Schedule

Module 1: Basics of Computer Hardware and Software		(7 hours)
1.1	Basics of Computer Architecture: Processor, Memory, Input & Output devices	2 hours
1.2	Application Software & System software: Compilers, interpreters, High level and low level languages	2 hours
1.3	Introduction to structured approach to programming, Flow chart	1 hours
1.4	Algorithms, Pseudo code (<i>bubble sort, linear search - algorithms and pseudocode</i>)	2 hours
Module 2: Program Basics		(8 hours)
2.1	Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf	2 hours
2.2	Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, sizeof operator, Assignment operators and Bitwise Operators. Operators Precedence	2 hours

2.3	Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements.(<i>Simple programs covering control flow</i>)	4 hours
Module 3: Arrays and strings:		(6 hours)
3.1	Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array	2 hours
3.2	String processing: In built String handling functions(<i>strlen, strcpy, strcat and strcmp, puts, gets</i>)	2 hours
3.3	Linear search program, bubble sort program, <i>simple programs covering arrays and strings</i>	3 hours
Module 4: Working with functions		(7 hours)
4.1	Introduction to modular programming, writing functions, formal parameters, actual parameters	2 hours
4.2	Pass by Value, Recursion, Arrays as Function Parameters	2 hours
4.3	structure, union, Storage Classes, Scope and life time of variables, <i>simple programs using functions</i>	3 hours
Module 5: Pointers and Files		(7 hours)
5.1	Basics of Pointer: declaring pointers, accessing data through pointers, NULL pointer, array access using pointers, pass by reference effect	3 hours
5.2	File Operations: open, close, read, write, append	1 hours
5.3	Sequential access and random access to files: In built file handling functions (<i>rewind(), fseek(), ftell(), feof(), fread(), fwrite()</i>), <i>simple programs covering pointers and files.</i>	2 hours

C PROGRAMMING LAB (Practical part of EST 102, Programming in C)

Assessment Method: The Academic Assessment for the Programming lab should be done internally by the College. The assessment shall be made on 50 marks and the mark is divided as follows: Practical Records/Outputs - 20 marks (internal by the College), Regular Lab Viva - 5 marks (internal by the College), Final Practical Exam – 25 marks (internal by the College).

The mark obtained out of 50 will be converted into equivalent proportion out of 20 for CIE computation.

LIST OF LAB EXPERIMENTS

1. Familiarization of Hardware Components of a Computer
2. Familiarization of Linux environment – How to do Programming in C with Linux
3. Familiarization of console I/O and operators in C
 - i) Display “Hello World”
 - ii) Read two numbers, add them and display their sum
 - iii) Read the radius of a circle, calculate its area and display it
 - iv) Evaluate the arithmetic expression $((a - b / c * d + e) * (f + g))$ and display its solution. Read the values of the variables from the user through console.
4. Read 3 integer values and find the largest among them.
5. Read a Natural Number and check whether the number is prime or not
6. Read a Natural Number and check whether the number is Armstrong or not
7. Read n integers, store them in an array and find their sum and average
8. Read n integers, store them in an array and search for an element in the array using an algorithm for Linear Search
9. Read n integers, store them in an array and sort the elements in the array using Bubble Sort algorithm
10. Read a string (word), store it in an array and check whether it is a palindrome word or not.
11. Read two strings (each one ending with a \$ symbol), store them in arrays and concatenate them without using library functions.
12. Read a string (ending with a \$ symbol), store it in an array and count the number of vowels, consonants and spaces in it.
13. Read two input each representing the distances between two points in the Euclidean space, store these in structure variables and add the two distance values.
14. Using structure, read and print data of n employees (*Name, Employee Id and Salary*)
15. Declare a union containing 5 string variables (*Name, House Name, City Name, State and Pin code*) each with a length of C_SIZE (user defined constant). Then, read and display the address of a person using a variable of the union.
16. Find the factorial of a given Natural Number n using recursive and non recursive functions
17. Read a string (word), store it in an array and obtain its reverse by using a user defined function.
18. Write a menu driven program for performing matrix addition, multiplication and finding the transpose. Use functions to (i) read a matrix, (ii) find the sum of two matrices, (iii) find the product of two matrices, (iv) find the transpose of a matrix and (v) display a matrix.
19. Do the following using pointers
 - i) add two numbers
 - ii) swap two numbers using a user defined function
20. Input and Print the elements of an array using pointers
21. Compute sum of the elements stored in an array using pointers and user defined function.
22. Create a file and perform the following
 - iii) Write data to the file
 - iv) Read the data in a given file & display the file content on console
 - v) append new data and display on console
23. Open a text input file and count number of characters, words and lines in it; and store the results in an output file.

EST 130	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

This course aims to (1) equip the students with an understanding of the fundamental principles of electrical engineering (2) provide an overview of evolution of electronics, and introduce the working principle and examples of fundamental electronic devices and circuits (3) provide an overview of evolution of communication systems, and introduce the basic concepts in radio communication.

Prerequisite: Physics and Mathematics (Pre-university level)

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO 2	Develop and solve models of magnetic circuits
CO 3	Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state
CO 4	Describe working of a voltage amplifier
CO 5	Outline the principle of an electronic instrumentation system
CO 6	Explain the principle of radio and cellular communication

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	1	-	-	-	-	-	-	-	-	-	2
CO 3	3	1	-	-	-	-	-	-	-	-	-	2
CO 4	2	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	2
CO 6	2	-	-	-	-	-	-	-	-	-	-	2

Assessment Pattern

Bloom's Category	Basic Electrical Engineering			Basic Electronics Engineering		
	Continuous Assessment Tests		End Semester Examination (Marks)	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)		Test 1 (Marks)	Test 2 (Marks)	
Remember	0	0	10	10	10	20
Understand	12.5	12.5	20	15	15	30
Apply	12.5	12.5	20			
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part I – Basic Electrical Engineering and Part II – Basic Electronics Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts - Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Solve problems based on current division rule.
2. Solve problems with Mesh/node analysis.
3. Solve problems on Wye-Delta Transformation.

Course Outcome 2 (CO2):

1. Problems on series magnetic circuits
2. Problems on parallel magnetic circuits
3. Problems on composite magnetic circuits

4. Course Outcome 3 (CO3):

1. problems on self inductance, mutual inductance and coefficient of coupling
2. problems on rms and average values of periodic waveforms
3. problems on series ac circuits
4. Compare star and Delta connected 3 phase AC systems.

Course Outcome 4 (CO4): Describe working of a voltage amplifier

1. What is the need of voltage divider biasing in an RC coupled amplifier?

2. Define operating point in the context of a BJT amplifier.
3. Why is it required to have a voltage amplifier in a public address system?

Course Outcome 5 (CO5): Outline the principle of an electronic instrumentation system

1. Draw the block diagram of an electronic instrumentation system.
2. What is a transducer?
3. Explain the working principle of operation of digital multimeter.

Course Outcome 6 (CO6): Explain the principle of radio and cellular communication

1. What is the working principle of an antenna when used in a radio transmitter?
2. What is the need of two separate sections RF section and IF section in a super heterodyne receiver?
3. What is meant by a cell in a cellular communication?

Model Question Paper

QP CODE:

Pages: 3

Reg No.: _____

Name: _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: EST 130

Course Name: BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Max. Marks: 100

Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

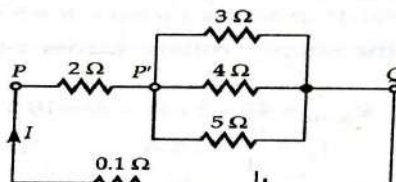
PART I

BASIC ELECTRICAL ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Calculate the current through the 4Ω resistor in the circuit shown, applying current division rule:



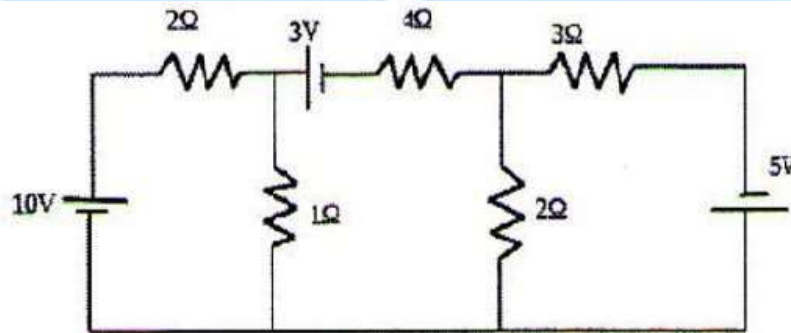
2. Calculate the RMS and average values of a purely sinusoidal current having peak value 15A.
3. An alternating voltage of $(80+j60)V$ is applied to an RX circuit and the current flowing through the circuit is $(-4+j10)A$. Calculate the impedance of the circuit in rectangular and polar forms. Also determine if X is inductive or capacitive.
4. Derive the relation between line and phase values of voltage in a three phase star connected system.
5. Compare electric and magnetic circuits. (5x4=20)

PART B

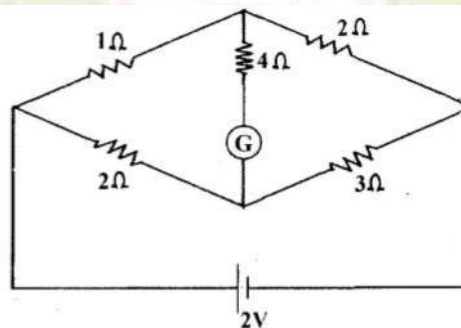
Answer one question from each module; each question carries 10 marks.

Module 1

6. . Calculate the node voltages in the circuit shown, applying node analysis:



7. (a) State and explain Kirchhoff's laws. (4 marks)
- (b) Calculate the current through the galvanometer (G) in the circuit shown:



(6 marks)

Module 2

8. (a) State and explain Faraday's laws of electromagnetic induction with examples. (4 marks)
- (b) Differentiate between statically and dynamically induced emf. A conductor of length 0.5m moves in a uniform magnetic field of flux density 1.1T at a velocity of 30m/s. Calculate the emf induced in the conductor if the direction of motion of the conductor is inclined at 60° to the direction of field. (6 marks)
9. (a) Derive the amplitude factor and form factor of a purely sinusoidal waveform. (5 marks)
- (b) A current wave is made up of two components-a 5A dc component and a 50Hz ac component, which is a sinusoidal wave with a peak value of 5A. Sketch the resultant waveform and determine its RMS and average values. (5 marks)

Module 3

10. Draw the power triangle and define active, reactive and apparent powers in ac circuits. Two coils A and B are connected in series across a 240V, 50Hz supply. The resistance of A is 5Ω and the inductance of B is 0.015H. If the input from the supply is 3kW and 2kVAR, find the inductance of A and the resistance of B. Also calculate the voltage across each coil.
11. A balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the loads are connected in (i) star (ii) delta.

(3x10=30)

PART II

BASIC ELECTRONICS ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Give the specifications of a resistor. The colour bands marked on a resistor are Blue, Grey, Yellow and Gold. What are the minimum and maximum resistance values expected from that resistance?
2. What is meant by avalanche breakdown?
3. Explain the working of a full-wave bridge rectifier.
4. Discuss the role of coupling and bypass capacitors in a single stage RC coupled amplifier.
5. Differentiate AM and FM communication systems.

(5x4=20)

PART B

Answer one question from each module; each question carries 10 marks.

Module 4

6. a) Explain with diagram the principle of operation of an NPN transistor. (5)
b) Sketch and explain the typical input-output characteristics of a BJT when connected in common emitter configuration. (5)

OR

7. a) Explain the formation of a potential barrier in a P-N junction diode. (5)
b) What do you understand by Avalanche breakdown? Draw and explain the V-I characteristics of a P-N junction and Zener diode. (5)

Module 5

8. a) With a neat circuit diagram, explain the working of an RC coupled amplifier. (6)
b) Draw the frequency response characteristics of an RC coupled amplifier and state the reasons for the reduction of gain at lower and higher frequencies. (4)

OR

9. a) With the help of block diagram, explain how an electronic instrumentation system. (6)
b) Explain the principle of an antenna. (4)

Module 6

10. a) With the help of a block diagram, explain the working of Super hetrodyne receiver. (6)
b) Explain the importance of antenna in a communication system. (4)

OR

11. a) With neat sketches explain a cellular communication system. (5)
b) Explain GSM communication with the help of a block diagram. (5)

(3x10=30)

SYLLABUS

MODULE 1: Elementary Concepts of Electric Circuits

Elementary concepts of DC electric circuits: Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.

Analysis of DC electric circuits: Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.

MODULE 2: Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals

Magnetic Circuits: Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.

Electromagnetic Induction: Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling

Alternating Current fundamentals: Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.

MODULE 3: AC Circuits

AC Circuits: Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.

Three phase AC systems: Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems

MODULE 4

Introduction to Semiconductor devices: Evolution of electronics – Vacuum tubes to nano electronics. Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, color coding. PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration.

MODULE 5

Basic electronic circuits and instrumentation: Rectifiers and power supplies: Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

MODULE 6

Introduction to Communication Systems: Evolution of communication systems – Telegraphy to 5G. Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge. Mobile communication: basic principles of cellular communications, principle and block diagram of GSM.

Text Books

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. ChinmoySaha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.
4. M.S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
5. Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010.

Reference Books

1. Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
3. Hayt W H, Kemmerly J E, and Durbin S M, "Engineering Circuit Analysis", Tata McGraw-Hill
4. Hughes, "Electrical and Electronic Technology", Pearson Education.
5. V. N. Mittle and Arvind Mittal, "Basic Electrical Engineering," Second Edition, McGraw Hill.
6. Parker and Smith, "Problems in Electrical Engineering", CBS Publishers and Distributors.
7. S. B. Lal Seksena and Kaustuv Dasgupta, "Fundamentals of Electrical Engineering", Cambridge University Press.
8. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
9. Bernard Grob, Basic Electronics, McGraw Hill.
10. A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lectures
1	<i>Elementary Concepts of Electric Circuits</i>	
1.1	Elementary concepts of DC electric circuits: Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.	1 2 1
1.2	Analysis of DC electric circuits: Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.	1 1 2
2	Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals	
2.1	Magnetic Circuits: Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.	1 2
2.2	Electromagnetic Induction: Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling	1 2
2.3	Alternating Current fundamentals: Generation of alternating voltages- Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.	2
3	AC Circuits	

3.1	AC Circuits: Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power, Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.	1 2 1 2
3.2	Three phase AC systems: Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems.	2
4	Introduction to Semiconductor devices	
4.1	Evolution of electronics – Vacuum tubes to nano electronics (In evolutionary perspective only)	1
4.2	Resistors, Capacitors and Inductors: types, specifications. Standard values, color coding (No constructional features)	2
4.3	PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown	2
4.4	Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration	3
5	Basic electronic circuits and instrumentation	
5.1	Rectifiers and power supplies: Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator	3
5.2	Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing	4
5.3	Electronic Instrumentation: Block diagram of an electronic instrumentation system	2
6	Introduction to Communication Systems	
6.1	Evolution of communication systems – Telegraphy to 5G	1

6.2	Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge	4
6.3	Mobile communication: basic principles of cellular communications, principle and block diagram of GSM.	2

Suggested Simulation Assignments for Basic Electronics Engineering

1. Plot V-I characteristics of Si and Ge diodes on a simulator
2. Plot Input and Output characteristics of BJT on a simulator
3. Implementation of half wave and full wave rectifiers
4. Simulation of RC coupled amplifier with the design supplied
5. Generation of AM signal

Note: The simulations can be done on open tools such as QUCS, KiCad, GNURadio or similar software to augment the understanding.

HUN 102	PROFESSIONAL COMMUNICATION	CATEGORY	L	T	P	CREDIT
		MNC	2	0	2	--

Preamble: Clear, precise, and effective communication has become a *sine qua non* in today's information-driven world given its interdependencies and seamless connectivity. Any aspiring professional cannot but master the key elements of such communication. The objective of this course is to equip students with the necessary skills to listen, read, write, and speak so as to comprehend and successfully convey any idea, technical or otherwise, as well as give them the necessary polish to become persuasive communicators.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to

CO 1	Develop vocabulary and language skills relevant to engineering as a profession
CO 2	Analyze, interpret and effectively summarize a variety of textual content
CO 3	Create effective technical presentations
CO 4	Discuss a given technical/non-technical topic in a group setting and arrive at generalizations/consensus
CO 5	Identify drawbacks in listening patterns and apply listening techniques for specific needs
CO 6	Create professional and technical documents that are clear and adhering to all the necessary conventions

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1										3		2
CO 2										1		3
CO 3						1			1	3		
CO 4										3		1
CO 5		1							2	3		
CO 6	1					1			1	3		

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

Continuous Internal Evaluation

Total Marks: 50

Attendance	: 10 marks
Regular assessment	: 25 marks
Series test (one test only, should include verbal aptitude for placement and higher studies, this test will be conducted for 50 marks and reduced to 15)	: 15 marks

Regular assessment

Project report presentation and Technical presentation through PPT	: 7.5 marks
Listening Test	: 5 marks
Group discussion/mock job interview	: 7.5 marks
Resume submission	: 5 marks

End Semester Examination

Total Marks: 50, Time: 2 hrs.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List down the ways in which gestures affect verbal communication.
2. Match the words and meanings
Ambiguous promotion
Bona fide referring to whole
Holistic not clear
Exaltation genuine
3. Expand the following Compound Nouns - a. Water supply. b. Object recognition. c. Steam turbine

Course Outcome 2 (CO2)

1. Read the passage below and prepare notes:

Mathematics, rightly viewed, possesses not only truth, but supreme beauty—a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show. The true spirit of delight, the exaltation, the sense of being more than man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry. What is best in mathematics deserves not merely to be learnt as a task, but to be assimilated as a part of daily thought, and brought again and again before the mind with ever-renewed encouragement. Real life is, to most men, a long second-best, a perpetual compromise between the ideal and the possible; but the world of pure reason knows no compromise, no practical limitations, no barrier to the creative activity embodying in splendid edifices the passionate aspiration after the perfect from which all great work springs. Remote from human passions, remote even from the pitiful facts of nature, the generations have gradually created an ordered cosmos, where pure thought can dwell as in its natural home, and where one, at least, of our nobler impulses can escape from the dreary exile of the actual world.

So little, however, have mathematicians aimed at beauty, that hardly anything in their work has had this conscious purpose. Much, owing to irrepressible instincts, which were better than avowed

beliefs, has been moulded by an unconscious taste; but much also has been spoilt by false notions of what was fitting. The characteristic excellence of mathematics is only to be found where the reasoning is rigidly logical: the rules of logic are to mathematics what those of structure are to architecture. In the most beautiful work, a chain of argument is presented in which every link is important on its own account, in which there is an air of ease and lucidity throughout, and the premises achieve more than would have been thought possible, by means which appear natural and inevitable. Literature embodies what is general in particular circumstances whose universal significance shines through their individual dress; but mathematics endeavours to present whatever is most general in its purity, without any irrelevant trappings.

How should the teaching of mathematics be conducted so as to communicate to the learner as much as possible of this high ideal? Here experience must, in a great measure, be our guide; but some maxims may result from our consideration of the ultimate purpose to be achieved.

- From "On the teaching of mathematics" – Bertrand Russell

2. Enumerate the advantages and disadvantages of speed reading. Discuss how it can impact comprehension.

Course Outcome 3(CO3):

1. What are the key elements of a successful presentation?
2. Elucidate the importance of non-verbal communication in making a presentation
3. List out the key components in a technical presentation.

Course Outcome 4 (CO4):

1. Discuss: 'In today's world, being a good listener is more important than being a good Speaker.'
2. Listen to a video/live group discussion on a particular topic, and prepare a brief summary of the proceedings.
3. List the do's and don'ts in a group discussion.

Course Outcome 5 (CO5):

1. Watch a movie clip and write the subtitles for the dialogue.
2. What do you mean by barriers to effective listening? List ways to overcome each of these.
3. What are the different types of interviews? How are listening skills particularly important in Skype/telephonic interviews?

Course Outcome 6 (CO6):

1. Explain the basic structure of a technical report.
2. You have been offered an internship in a much sought-after aerospace company and are very excited about it. However, the dates clash with your series tests. Write a letter to the Manager – University Relations of the company asking them if they can change the dates to coincide with your vacation.
3. You work in a well-reputed aerospace company as Manager – University Relations. You are in charge of offering internships. A student has sent you a letter requesting you to change the dates allotted to him since he has series exams at that time. But there are no vacancies available during the period he has requested for. Compose an e-mail informing him of this and suggest that he try to arrange the matter with his college.

Syllabus

Module 1

Use of language in communication: Significance of technical communication Vocabulary Development: technical vocabulary, vocabulary used in formal letters/emails and reports, sequence words, misspelled words, compound words, finding suitable synonyms, paraphrasing, verbal analogies. Language Development: subject-verb agreement, personal passive voice, numerical adjectives, embedded sentences, clauses, conditionals, reported speech, active/passive voice.

Technology-based communication: Effective email messages, slide presentations, editing skills using software. Modern day research and study skills: search engines, repositories, forums such as Git Hub, Stack Exchange, OSS communities (MOOC, SWAYAM, NPTEL), and Quora; Plagiarism

Module 2

Reading, Comprehension, and Summarizing: Reading styles, speed, valuation, critical reading, reading and comprehending shorter and longer technical articles from journals, newspapers, identifying the various transitions in a text, SQ3R method, PQRS method, speed reading. Comprehension: techniques, understanding textbooks, marking and underlining, Note-taking: recognizing non-verbal cues.

Module 3

Oral Presentation: Voice modulation, tone, describing a process, Presentation Skills: Oral presentation and public speaking skills, business presentations, Preparation: organizing the material, self-Introduction, introducing the topic, answering questions, individual presentation practice, presenting visuals effectively.

Debate and Group Discussions: introduction to Group Discussion (GD), differences between GD and debate; participating GD, understanding GD, brainstorming the topic, questioning and clarifying, GD strategies, activities to improve GD skills

Module 4

Listening and Interview Skills Listening: Active and Passive listening, listening: for general content, to fill up information, intensive listening, for specific information, to answer, and to understand. Developing effective listening skills, barriers to effective listening, listening to longer technical talks, listening to classroom lectures, talks on engineering /technology, listening to documentaries and making notes, TED talks.

Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (skype) interviews, one-to-one interview & panel interview, FAQs related to job interviews

Module 5

Formal writing: Technical Writing: differences between technical and literary style. Letter Writing (formal, informal and semi formal), Job applications, Minute preparation, CV preparation (differences between Bio-Data, CV and Resume), and Reports. Elements of style, Common Errors in Writing: describing a process, use of sequence words, Statements of Purpose, Instructions, Checklists.

Analytical and issue-based Essays and Report Writing: basics of report writing; Referencing Style (IEEE Format), structure of a report; types of reports, references, bibliography.

Lab Activities

Written: Letter writing, CV writing, Attending a meeting and Minute Preparation, Vocabulary Building

Spoken: Phonetics, MMFS (Multimedia Feedback System), Mirroring, Elevator Pitch, telephone etiquette, qualities of a good presentation with emphasis on body language and use of visual aids.

Listening: Exercises based on audio materials like radio and podcasts. Listening to Song. practice and exercises.

Reading: Speed Reading, Reading with the help of Audio Visual Aids, Reading Comprehension Skills

Mock interview and Debate/Group Discussion: concepts, types, Do's and don'ts- intensive practice

Reference Books

1. English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Blackswan 2010.
2. Meenakshi Raman and Sangeetha Sharma, "Technical Communication: Principles and Practice", 2nd Edition, Oxford University Press, 2011
3. Stephen E. Lucas, "The Art of Public Speaking", 10th Edition; McGraw Hill Education, 2012.
4. Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw Hill Education, 2017.
5. William Strunk Jr. & E.B. White, "The Elements of Style", 4th Edition, Pearson, 1999.
6. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Wiley. New York, 2004.
7. Goodheart-Willcox, "Professional Communication", First Edition , 2017.
8. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6 edition, 2015.
9. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.
10. Anand Ganguly, "Success in Interview", RPH, 5th Edition, 2016.
11. Raman Sharma, "Technical Communications", Oxford Publication, London, 2004.

CYL 120	ENGINEERING CHEMISTRY LAB	CATEGORY	L	T	P	CREDIT
		BSC	0	0	2	1

Preamble: To impart scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters

Prerequisite: Experiments in chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Understand and practice different techniques of quantitative chemical analysis to generate experimental skills and apply these skills to various analyses
CO 2	Develop skills relevant to synthesize organic polymers and acquire the practical skill to use TLC for the identification of drugs
CO 3	Develop the ability to understand and explain the use of modern spectroscopic techniques for analysing and interpreting the IR spectra and NMR spectra of some organic compounds
CO 4	Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO 5	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
CO 6	Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economical and environmental problems and why it is an integral part of curriculum

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				2							3
CO 2	3				3							3
CO 3	3				3							3
CO 4	3				3							3
CO 5	3				1							3
CO 6	3				1							3

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment/Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS**LIST OF EXPERIMENTS (MINIMUM 8 MANDATORY)**

1. Estimation of total hardness of water-EDTA method
2. Potentiometric titration
3. Determination of cell constant and conductance of solutions.
4. Calibration of pH meter and determination of pH of a solution
5. Estimation of chloride in water
6. Identification of drugs using TLC
7. Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
8. Determination of molar absorptivity of a compound (KMnO_4 or any water soluble food colorant)
9. Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
10. Estimation of iron in iron ore
11. Estimation of copper in brass
12. Estimation of dissolved oxygen by Winkler's method
13. (a) Analysis of IR spectra (minimum 3 spectra) (b) Analysis of ^1H NMR spectra (minimum 3 spectra)
14. Flame photometric estimation of Na^+ to find out the salinity in sand
15. Determination of acid value of a vegetable oil
16. Determination of saponification of a vegetable oil

Reference Books

1. G. Svehla, B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson, 2012.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning, 2017.
3. Muhammed Arif, "Engineering Chemistry Lab Manual", Owl publishers, 2019.
4. Ahad J., "Engineering Chemistry Lab manual", Jai Publications, 2019.
5. Roy K Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers, 2019.
6. Soney C George, Rino Laly Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company Pvt Ltd, New Delhi, 2019.

ESL 130	ELECTRICAL & ELECTRONICS WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	0	0	2	1	2019

Preamble: Electrical Workshop is intended to impart skills to plan and carry out simple electrical wiring. It is essential for the practicing engineers to identify the basic practices and safety measures in electrical wiring.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Demonstrate safety measures against electric shocks.
CO 2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols
CO 3	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings
CO 4	Identify and test various electronic components
CO 5	Draw circuit schematics with EDA tools
CO 6	Assemble and test electronic circuits on boards
CO 7	Work in a team with good interpersonal skills

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	3	-	-	-	-	-	1
CO 2	2	-	-	-	-	-	-	-	-	1	-	-
CO 3	2	-	-	1	-	1	-	1	2	2	-	2
CO 4	3	-	-	-	-	-	-	-	-	-	-	2
CO 5	3	-	-	-	2	-	-	-	-	-	-	2
CO 6	3	-	-	-	2	-	-	-	-	-	-	1
CO 7	-	-	-	-	-	-	-	-	3	2	-	2

Mark distribution

Total Marks	CIE	ESE	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment/Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

Syllabus**PART 1****ELECTRICAL****List of Exercises / Experiments**

1. a) Demonstrate the precautionary steps adopted in case of Electrical shocks.
b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.
2. Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)
3. Wiring of light/fan circuit using Two way switches . (Staircase wiring)
4. Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6. a) Identify different types of batteries with their specifications.
b) Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.

PART II**ELECTRONICS****List of Exercises / Experiments (Minimum of 7 mandatory)**

1. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.]

2. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as Dia or Xcircuit), Interpret data sheets of discrete components and IC's, Estimation and costing.
3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.]
4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]
5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]
6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]
7. Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
8. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning (**Any Two circuits**).
 1. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
 2. Square wave generation using IC 555 timer in IC base.
 3. Sine wave generation using IC 741 OP-AMP in IC base.
 4. RC coupled amplifier with transistor BC107.

DISCRETE MATHEMATICAL STRUCTURES

MAT 203	DISCRETE MATHEMATICAL STRUCTURES	CATEGORY	L	T	P	CREDITS
		BSC	3	1	0	4

Preamble:

The purpose of this course is to create awareness in students about the basic terminologies used in advanced courses in Computer Science and develop rigorous logical thinking for solving different kinds of problems in Computer Science. This course helps the learner to apply the theory and applications of elementary Counting Principles, Propositional Logic, Predicate Logic, Lattices, Generating Functions, Recurrence Relations and Algebraic Structures eventually in practical applications.

Prerequisite: A sound background in higher secondary school Mathematics

Course Outcomes: After the completion of the course the student will be able to

CO#	CO
CO1	Check the validity of predicates in Propositional and Quantified Propositional Logic using truth tables, deductive reasoning and inference theory on Propositional Logic (Cognitive Knowledge Level: Apply)
CO2	Solve counting problems by applying the elementary counting techniques - Rule of Sum, Rule of Product, Permutation, Combination, Binomial Theorem, Pigeonhole Principle and Principle of Inclusion and Exclusion (Cognitive Knowledge Level: Apply)
CO3	Classify binary relations into various types and illustrate an application for each type of binary relation, in Computer Science (Cognitive Knowledge Level: Understand)
CO4	Illustrate an application for Partially Ordered Sets and Complete Lattices, in Computer Science (Cognitive Knowledge Level: Apply)
CO5	Explain Generating Functions and solve First Order and Second Order Linear Recurrence Relations with Constant Coefficients (Cognitive Knowledge Level: Apply)
CO6	Illustrate the abstract algebraic systems - Semigroups, Monoids, Groups, Homomorphism and Isomorphism of Monoids and Groups (Cognitive Knowledge Level: Understand)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓	✓	✓								✓
CO3	✓	✓	✓	✓		✓						✓
CO4	✓	✓	✓	✓		✓						✓
CO5	✓	✓	✓	✓								✓
CO6	✓	✓	✓	✓								✓

Abstract POs defined by National Board of Accreditation			
PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test 1 (%)	Test 2 (%)	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3

Continuous Internal Evaluation Pattern:

Attendance	10 marks
Continuous Assessment Tests (Average of Series Tests 1 & 2)	25 marks
Continuous Assessment Assignment	15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 full questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module – 1 (Fundamentals of Logic)

Mathematical logic - Basic connectives and truth table, Statements, Logical Connectives, Tautology, Contradiction. Logical Equivalence - The Laws of Logic, The Principle of duality, Substitution Rules . The implication - The Contrapositive, The Converse, The Inverse.

Logical Implication - Rules of Inference. The use of Quantifiers - Open Statement, Quantifier. Logically Equivalent – Contrapositive, Converse , Inverse , Logical equivalences and implications for quantified statement, Implications , Negation .

Module - 2 (Fundamentals of Counting Theory)

The Rule of Sum – Extension of Sum Rule . The Rule of Product - Extension of Product Rule . Permutations. Combinations. The Binomial Theorem (without proof). Combination with Repetition. The Pigeon hole Principle. The Principle of Inclusion and Exclusion Theorem (Without Proof) - Generalization of the Principle. Derangements.

Module - 3 (Relations and Functions)

Cartesian Product - Binary Relation. Function – domain , range-one to one function, Image-restriction. Properties of Relations- Reachability Relations, Reflexive Relations, Symmetric Relations, Transitive relations, Anti-symmetric Relations, Partial Order relations, Equivalence Relations, Irreflexive relations.

Partially ordered Set – Hasse Diagram, Maximal-Minimal Element, Least upper bound (lub), Greatest Lower bound(glb) (Topological sorting Algorithm- excluded). Equivalence Relations and Partitions - Equivalence Class.

Lattice - Dual Lattice , Sub lattice , Properties of glb and lub , Properties of Lattice , Special Lattice , Complete Lattice, Bounded Lattice, Completed Lattice , Distributive Lattice.

Module - 4 (Generating Functions and Recurrence Relations)

Generating Function - Definition and Examples , Calculation techniques, Exponential generating function. First order linear recurrence relations with constant coefficients – homogeneous, non-homogeneous Solution. Second order linear recurrence relations with constant coefficients, homogeneous, non-homogeneous Solution.

Module - 5 (Algebraic Structures)

Algebraic system-properties- Homomorphism and Isomorphism. Semi group and monoid – cyclic monoid , sub semi group and sub monoid, Homomorphism and Isomorphism of Semi group and monoids. Group- Elementary properties, subgroup, symmetric group on three symbols ,The direct product of two groups, Group Homomorphism, Isomorphism of groups, Cyclic group. Rightcosets - Leftcosets. Lagrange's Theorem

Text Book

1. Discrete and Combinatorial Mathematics (An Applied Introduction), Ralph P Grimaldi, B V Ramana , 5th Edition, Pearson

Reference Books

- 1) Kenneth H. Rosen, Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, Seventh Edition, MGH, 2011
- 2) Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 2003.
- 3) Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Pearson Education Pvt Ltd., New Delhi, 2003
- 4) Kenneth H. Rosen, "Discrete Mathematics and its Applications", 5/e, Tata Mc Graw Hill Pub. Co. Ltd, New Delhi 2003
- 5) Richard Johnsonbaugh, "Discrete Mathematics", 5/e, Pearson Education Asia, New Delhi, 2002.
- 6) Joe L Mott, Abraham Kandel, Theodore P Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", 2/e, Prentice-Hall India, 2009.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Show that $R \vee M$, $\neg R \vee S$, $\neg M$, $\neg S$ cannot exist simultaneously (without using truth table)
2. Represent the following statement in symbolic form "Not every city in Canada is clean".

Course Outcome 2 (CO2):

1. How many possible arrangements are there for the letters in MASSASAUGA in which 4 A's are together?
2. Find the number of integers between 1 and 1000 inclusive, which are not divisible by 5, 6 or 8

Course Outcome 3 (CO3):

1. If $A = \{1, 2, 3, 4\}$, give an example of a relation R that is reflexive and symmetric but not transitive.
2. Let Z be the set of integers. R is a relation called "Congruence Modulo 3" defined by $R = \{ (x, y) / x \in Z, y \in Z, x - y \text{ is divisible by } 3 \}$. Show that R is an equivalence relation.

Course Outcome 4 (CO4):

1. Assume $A = \{ a, b, c \}$. Let $P(A)$ be its power set and ' $\leq$ ' be the subset relation on the power set. Draw the Hasse diagram of $(P(A), \leq)$.
2. What is meant by Bounded Lattice? Give an example.

Course Outcome 5 (CO5):

1. Solve $a_r - 3a_{r-1} - 4a_{r-2} = 3^r$ using Generating function method; Given $a_0 = 1, a_1 = 2$.
2. Find the generating function for the sequence $1, 3, 3^2, 3^3, \dots$

Course Outcome 6 (CO6):

1. Prove that the group $\{ 1, -1, i, -i \}$ is cyclic with generators i and $-i$.
2. State and prove Lagrange's Theorem.

Model Question Paper

QP CODE:

Reg No: _____

Name : _____

PAGES : 3

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MAT 203

Course Name: Discrete Mathematical Structures

Max.Marks :100

Duration: 3 Hrs

PART A

Answer all Questions. Each question carries 3 Marks

1. Show the following implication without constructing the truth table: $(P \wedge Q) \Rightarrow P \rightarrow Q$
2. Write the negation of the following statement. "If I drive, then I will not walk"
3. What is pigeon hole principle? Explain. If you select any five numbers from 1 to 8 then prove that at least two of them will add up to 9 .
4. In how many ways can the letters of the word ALLAHABAD be arranged ?
5. Show that the divisibility relation ' / ' is a partial ordering on the set Z^+ .
6. Consider the functions given by $f(x) = 2x+3$ and $g(x) = x^2$. Find $(g \circ f)$ and $(f \circ g)$.
7. What is meant by exponential generating function? Explain.
8. Provide one example of linear homogeneous recurrence relation. Mention the degree also.
9. What is a monoid ? Explain.
10. Let $(A, .)$ be a group. Show that $(ab)^{-1} = b^{-1}a^{-1}$

(10 x 3 = 30 Marks)

PART B

(Answer any one Question from each Module. Each question carries 14 Marks)

11.

- (a) Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$

(6 marks)

(b) Show that from

(ii) $(\exists x)(F(x) \wedge S(x)) \rightarrow (y)(M(y) \rightarrow W(y))$.

(iii) $(\exists y)(M(y) \wedge \neg W(y))$ the conclusion $(x)(F(x) \rightarrow \neg S(x))$ follows.

(8 marks)

OR

12.

(a) Show that $(x)(P(x) \vee Q(x)) \Rightarrow ((x)P(x) \vee (\exists x)Q(x))$ using indirect method of proof.

(6 marks)

(b) Discuss indirect method of proof. Show that the following premises are inconsistent

(i) If Jack misses many classes through illness, then he fails high school.

(ii) If Jack fails high school, then he is uneducated.

(iii) If Jack reads a lot of books, then he is not uneducated.

(iv) Jack misses many classes through illness and reads a lot of books.

(8 marks)

13.

(a) Explain binomial theorem. Determine the coefficient of x^9y^3 in the expansion of $(x+y)^{12}$, $(x+2y)^{12}$ and $(2x-3y)^{12}$ using binomial theorem.

(6 marks)

(b) How many 5 digit numbers can be formed from the digits 1,2,3,4,5 using the digits without repetition?

(i) How many of them are even?

(ii) How many are even and greater than 30,000?

(8 marks)

OR

14.

(a) There are 8 guests in a party. Each guest brings a gift and receives another gift in return. No one is allowed to receive the gift they bought. How many ways are there to distribute the gifts?

(6 marks)

(b) Six papers are set in an examination of which two are mathematical. Only one examination will be conducted in a day. In how many different orders can the papers be arranged so that

(i) Two mathematical papers are consecutive?

(ii) Two mathematical papers are not consecutive?

(8 marks)

15.

- (a) Let $A = \{1, 2, 3, 4, \dots, 11, 12\}$ and let R be the equivalence relation on $A \times A$ defined by $(a, b) R (c, d)$ iff $a+d = b+c$. Prove that R is an equivalence relation and find the equivalence class of $(2, 5)$

(8 marks)

- (b) What is a chain lattice? Explain. Also show that every chain is a distributive lattice.

(6 marks)

OR

16.

- (a) Suppose $f(x) = x+2$, $g(x) = x-2$, and $h(x) = 3x$ for $x \in \mathbb{R}$, where $\mathbb{R}$ is the set of real numbers. Find $(g \circ f)$, $(f \circ g)$, $(f \circ f)$ and $(g \circ g)$

(8 marks)

- (b) Let R and S be two relations on a set A . If R and S are symmetric, Prove that $(R \cap S)$ is also symmetric.

(6 marks)

17.

- (a) Solve the recurrence relation $a_r - 7a_{r-1} + 10a_{r-2} = 0$ for $r \geq 2$; Given $a_0 = 0$; $a_1 = 41$ using generating functions

(8 marks)

- (b) Solve the recurrence relation $a_r - 4a_{r-1} + 4a_{r-2} = (r+1)^2$ using generating function.

(6 marks)

OR

18.

- (a) Solve $a_n - 3a_{n-1} + 2 = 0$; $a_0 = 1$ $n \geq 1$, using generating functions.

(8 marks)

- (b) Use generating function to solve the following recurrence relation $a_n = 2a_{n-1} + 2^n$; with $a_0 = 2$.

(6 marks)

19.

- (a) Prove that the set 'Q' of rational numbers other than 1 forms an abelian group with respect to the operation '*' defined by $a * b = a+b-ab$.

(8 Marks)

- (b) Show that the direct product of two group is a group.

(6 Marks)

OR

20.

- (a) Show that the subgroup of a cyclic group is cyclic.

(8 Marks)

- (b) Let $(A, *)$ be a group. Show that $(A, *)$ is an abelian group if and only if $a^2 * b^2 = (a * b)^2$ for all 'a' and 'b' in A

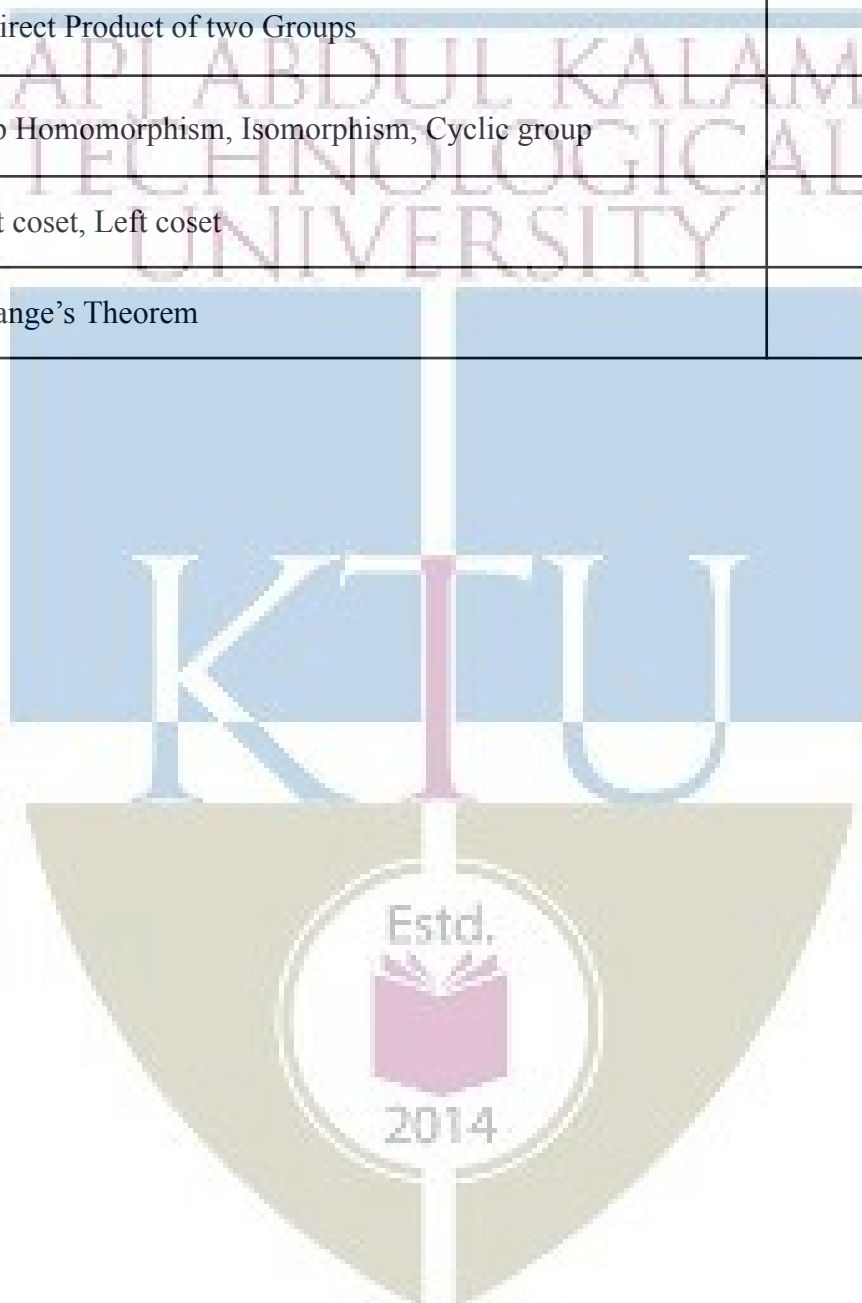
(6 Marks)

TEACHING PLAN

No	Contents	No of Lecture Hrs
Module – 1 (Fundamentals of Logic) (9 hrs)		
1.1	Mathematical logic, Basic Connectives and Truth Table	1
1.2	Statements, Logical Connectives, Tautology, Contradiction	1
1.3	Logical Equivalence, The Laws of Logic	1
1.4	The Principle of duality, Substitution Rules	1
1.5	The implication, The Contrapositive, the Converse , the Inverse	1
1.6	Logical Implication, Rules of Inference, Logical Implication	1
1.7	The use of Quantifiers, Open Statement, Quantifier, Negation	1
1.8	Logically Equivalent, Contrapositive, The Converse, The Inverse	1
1.9	Logical Implications	1
Module - 2 (Fundamentals of Counting Theory) (9 hrs)		
2.1	The Pigeon-hole Principle	1
2.2	The Rule of Sum	1
2.3	Extension of Sum Rule	1
2.4	The Rule of Product	1
2.5	Extension of Product Rule , Permutations	1
2.6	Combinations, Combination with repetition	1
2.7	The Binomial Theorem	1
2.8	The Principle of Inclusion and Exclusion Theorem (Without Proof) Generalization of the Principle	1
2.9	Derangements	1
Module - 3 (Relations and Functions) (9 hrs)		
3.1	Cartesian Product, Binary Relation, Function, Domain, Range , One to One Function Image - Restriction	1
3.2	Properties, Reachability Relations, Reflexive Relations, Symmetric Relations, Transitive relations, Antisymmetric Relations.	1

3.3	Partial Order relations	1
3.4	Equivalence Relation, Irreflexive Relations.	1
3.5	Partially ordered Set, Hasse Diagram.	1
3.6	Maximal-Minimal Element, Least Upper bound, Greatest Lower Bound	1
3.7	Equivalence Relations and Partitions, Equivalence Class	1
3.8	Lattice- Dual Lattice, sub lattice, Properties of glb and lub	1
3.9	Properties of Lattice, Special Lattice, Complete Lattice, Bounded Lattice, Completed Lattice, Distributive Lattice	1
Module - 4 (Generating Functions and Recurrence Relations) (9 hrs)		
4.1	Generating Function, Definition and Examples	1
4.2	Exponential Generating Function.	1
4.3	First Order Linear Recurrence Relations with Constant Coefficients (Lecture I)	1
4.4	First Order Linear Recurrence Relations with Constant Coefficients (Lecture II)	1
4.5	Homogeneous Solution	1
4.6	Non homogeneous Solution	1
4.7	Second order linear recurrence relations with constant coefficients	1
4.8	Homogeneous Solution	1
4.9	Non homogeneous Solution	1
Module - 5 (Algebraic Structures) (9 hrs)		
5.1	Algebraic System-Properties, Homomorphism and Isomorphism	1
5.2	Semi group, Monoid, Cyclic monoid	1

5.3	Sub semigroup and sub monoid	1
5.4	Homomorphism and Isomorphism of Semigroup, Monoids and Groups	1
5.5	Elementary Properties, Subgroup, Symmetric group on three symbols	1
5.6	The direct Product of two Groups	1
5.7	Group Homomorphism, Isomorphism, Cyclic group	1
5.8	Right coset, Left coset	1
5.9	Lagrange's Theorem	1





SEMESTER -3

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT201	DATA STRUCTURES	PCC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of understanding essential concept of data structures, designing algorithms to perform operations involving these data structures and to choose appropriate data structures to solve real world problems.

Prerequisite: programming in C

Course Outcomes: After the completion of the course the student will be able to

CO_No.	Course Outcome(CO)	Bloom's Category
CO 1	Summarize different categories of data structures	Level 2 : Understand
CO 2	Identify different parameters to analyze the performance of an algorithm.	Level 3 : Apply
CO 3	Explain the significance of dynamic memory management Techniques.	Level 2 : Understand
CO 4	Design algorithms to perform operations with Linear and Nonlinear data structures	Level 3 : Apply
CO 5	Illustrate various technique to for searching, Sorting and hashing	Level 2 : Understand
CO 6	Choose appropriate data structures to solve real world problems efficiently.	Level 3 : Apply

Mapping of course outcomes with program outcomes

COs	PROGRAMME OUTCOMES (PO)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	1	-	-	-	-	-	1
CO 2	3	2	2	2	1	1	-	-	-	-	-	1
CO 3	3	3	3	2	1	1	-	-	-	-	-	1
CO 4	3	3	3	2	1	1	-	-	-	-	-	1
CO 5	3	2	2	1	1	-	-	-	-	-	-	1
CO 6	3	3	3	2	1	1	-	-	-	-	-	1

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Differentiate CDT and ADT
2. Classify classical datstructures
3. Compare array and linked list
4. Represent single and double dimensional array
5. Describe any three applications of array

Course Outcome 2 (CO2):

1. Identify the needs of algorithm analysis
2. Select two parameters to do the performance analysis of an algorithm
3. Identify 3 possible cases of time complexity

Course Outcome 3 (CO3):

1. Classify linked list
2. Illustrate different operations on singly, doubly and circular linked list
3. Represent linked list in memory (static and dynamic).

4. Summarize different dynamic memory management schemes.
5. Demonstrate the first fit , best fit , worst fit and next fit allocation of given process queue and free list

Process queue

85 K	35 K	70 K	100 K

Free list

80K	130K	90 K	40 K

Course Outcome 4 (CO4):

1. Design the algorithms to perform PUSH()and POP() and STATUS() operations on stack using array and linked list
2. Apply Stack data structure in infix to postfix conversion, expression evaluation, recursion and delimiter matching.
3. Design the algorithms for pre-order, in-order and post-order traversal on binary trees
4. Develop the algorithms for ENQUEUE(), and DEQUEUE() operations on queue data structures
5. Construct the algorithms for graph traversal(BFS, DFS)

Course Outcome 5 (CO5):

1. Classify Sorting Techniques (internal and external, n^2 and $n \log n$)
2. Compare Linear and binary search
3. Illustrate bubble, selection and insertion sort.
4. Describe quick and merge sort
5. Represent the following values in the given order in a hash table (Size of hash table is 7 and hash function used is $h(k)=k \bmod 7$) for each of the scenario.
19, 26, 13, 48, 17
 - a) When collisions are handled by linear probing
 - b) When collisions are handled by double using second hash function $h=5-(k \bmod 5)$

Course Outcome 6 (CO6):

1. Develop an application program which is to be used in Ticket counter, where First person gets ticket first and go out first, using suitable data structure.
2. Make use of suitable data structure to store the details of pass percentage of the college in chronological order of years (oldest to newest) and retrieve the information in reverse chronological order of years, using suitable data structure.

Model Question Paper

PART A
(Each Question carries 3 Marks)

(10*3=30)

1. Classify Sorting Techniques
2. Differentiate CDT and ADT
3. Classify linked list
4. Compare First fit and Next Fit Algorithms
5. Design the algorithms to perform PUSH()and POP()
6. Summarize operations Queue data structure
7. List out the features of binary tree
8. Explain binary sorting
9. Define hashing
10. Illustrate separate chaining with an example

PART B

(5*14=70)

11. Classify classical data structures
- OR**
12. Illustrate Quick sort with the help of an example
13. Illustrate different operations on singly linked list

OR

14. Demonstrate the first fit , best fit , worst fit and next fit allocation of given process queue and free list

Process queue

85 K	35 K	70 K	100 K

Free list

80K	130K	90 K	40 K

15. Apply Stack data structure in infix to postfix conversion

OR

16. Develop the algorithms for ENQUEUE(), and DEQUEUE() operations on queue data structures

17. Construct the algorithms for graph traversal(BFS, DFS)

OR

18. Explain 3 types of binary tree traversal

19. Explain Any 3 types of hash functions

OR

20. Represent the following values in the given order in a hash table (Size of hash table is 7 and hash function used is $h(k)=k \bmod 7$) for each of the scenario.

19, 26, 13, 48, 17

a) When collisions are handled by linear probing

b) When collisions are handled by double using second hash function $h=5-(k \bmod 5)$

Syllabus

Module 1: Introduction to data structures (9 Hours)
Data Structures-Introduction and Overview- Arrays, Algorithm/Program Development, Searching and Sorting.
Module 2: Linked lists (10 Hours)
Linked lists, singly linked list, Doubly linked list, Circular linked list, Applications of linked list, Dynamic Memory management.
Module 3 : Stacks and Queues (9 Hours)
Stack, Applications of stacks, Queues, Types of queues
Module 4 : Trees and graphs (10 Hours)
Trees, Binary Tree Traversals, Binary tree Applications, Graph, and Graph Applications.
Module 5 : Hash Table (7 Hours)
Hash Tables, Different Hash Functions, Collision Resolution Techniques, closed hashing and Open Hashing (Separate Chaining).

Text Books

T1. Samanta D., Classic Data Structures, Prentice Hall India, 2/e, 2009.

T2. Ellis horowitz, Sartaj Sahni, Fundamentals of Data structures, Galgotia Booksource

Reference Books

R1. Horwitz E., S. Sahni and S. Anderson, Fundamentals of Data Structures in C, University Press (India), 2008.

R2. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication, 1983.

R3. Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill, 1995.

R4. Peter Brass, Advanced Data Structures, Cambridge University Press, 2008

R5. Lipschuts S., Theory and Problems of Data Structures, Schaum's Series, 1986.

R6. Wirth N., Algorithms + Data Structures = Programs, Prentice Hall, 2004.

R7. Hugges J. K. and J. I. Michtm, A Structured Approach to Programming, PHI, 1987.

R8. Martin Barrett, Clifford Wagner, And Unix: Tools For Software Design, John Wiley, 2008 reprint.

Course Contents and Lecture Schedule

	Module 1: Introduction to data structures	9hrs
1.1	Data Structures-Introduction and Overview: Definitions, Concept of data structure, classifications of data structure- ADT and CDT- Linear and nonlinear.	1
1.2	Arrays: definition, Representation of Single/Two dimensional arrays, Applications of array – searching –Sorting - Sparse Matrix- conversion of sparse matrix into 3 tuple form.	2
1.3	Algorithm/Program Development: Analysis of algorithms. Space Complexity, Time Complexity - Best case, worst case, average case. Searching : linear and binary search – Complexity Analysis (Detailed analysis is not required)	2
1.4	Sorting: classifications- Internal sorting – External sorting , N^2 Sorting : Selection, bubble and insertion- Complexity analysis (Detailed analysis is not required)	2
1.5	$N \log_n$ Sorting : Quick Sort and Merge Sort (Recursive Algorithms)- Complexity Analysis (Detailed analysis is not required)	2
	Module 2: Linked lists	10 hrs
2.1	Linked lists: static and dynamic representation, Classification -Singly linked list- Doubly linked list- Circular linked list, array and linked list. Singly linked list: Operations on Singly linked list- Traversal-Insertion-deletion, copying -searching - Merging.	2
2.2	Doubly linked list: Operations on doubly linked list- Insertion-deletion.	2
2.3	Circular Linked list : Operations on circular linked list-Insertion and deletion	2
2.4	Applications of linked list: Polynomial representation and manipulation (addition)- Dynamic Memory management.	2
2.5	Dynamic Memory management: Fixed sized and variable sized memory allocation and de-allocation. First-fit, best-fit and worst-fit allocation schemes and problems.	2
	Module 3: Stacks and Queues	9 hrs
3.1	Stack: Definition, Schematic Diagram of stack, Array and Linked list representation of stack , operations on stack using array and linked list (PUSH(),POP(),STATUS()) .	2
3.2	Applications of stacks: Infix to postfix conversion- post fix evaluation, string reversal, delimiter matching.	3
3.3	Queues: Definition, Schematic Diagram of queue, Array and Linked list representation of queue , operations on queue using array and linked list (EQQUEUE(),DEQUEUE(),STATUS()) .	2
3.4	Types of queue : circular queue-priority queue- doubly ended queue	2

	Module 4: Trees and graphs	10 hrs
4.1	Trees: Basic terminologies, Binary Trees, Properties of binary trees, linear and linked representations, Complete and full Binary Tree.	2
4.2	Binary Tree Traversals: Preorder -In order and post order (Recursive, non-recursive)-problems	1
4.3	Binary tree Applications: Expression tree creation, heap trees (concepts), Binary search tree – creation, insertion and deletion and search operations	3
4.4	Graph: Terminologies, set representations, linked/adjacency list representation, Adjacency matrix linear representation Graph traversal: Breadth First Search (BFS), Depth First Search (DFS) - related problems.	2
4.5	Graph Applications: Shortest Path Problem-Dijkstras Algorithm	2
	Module 5: Hash Table	7 hrs
5.1	Hash Tables- Hash Functions- Features of hash function.	1
5.2	Different Hash Functions: Division Method- Multiplication Method - Mid Square Method, Folding Method- related problems.	2
5.3	Collision Resolution Techniques: Closed hashing (Linear probing) and Open Hashing (Separate Chaining) . Closed hashing(Linear probing) -Drawbacks- Remedies - Radom Probing – Double hashing/Re-hashing –Quadratic Probing, problems to create hash tables using linear probing and Random probing, double hash and quadratic probing .	3
5.4	Open Hashing (Separate Chaining)	1



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT203	DIGITAL SYSTEM DESIGN	PCC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of understanding the basic digital logic design and implementation. All students of computing should acquire some understanding and appreciation of a computer system's functional components, their characteristics, their performance, and their interactions.

Prerequisite: NIL

Course Outcomes: After the completion of the course, the student will be able

CO No.	Course Outcome(CO)	Bloom's Category
CO 1	To perform base conversion and arithmetic operations in various number systems.	Apply
CO 2	To design digital circuits using simplified Boolean functions	Create
CO 3	To develop simple design of combinational circuits	Apply
CO 4	To develop simple design of sequential circuits	Apply
CO 5	To interpret the generalization of synchronous and asynchronous sequential circuits	Understand

Mapping of course outcomes with program outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3			3	-	-	-	-	-	-	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	2	-	1	-	-	-	2
CO 4	3			3	-	-	-	-	-	-	-	2
CO 5	3	3	3	3	2	2	-	1	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	5	20
Understand	15	10	20
Apply	10	10	25
Analyse	10	10	15
Evaluate	5	10	10
Create		5	10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	4 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1): To understand the basic concepts of Number systems

1. Convert the given number from decimal number system to binary, octal, and hexadecimal number system.
2. Perform Arithmetic operations on different number system.
3. Represent the different coding schemes.

Course Outcome 2 (CO2): To design digital circuits using simplified Boolean functions

1. Simplify the given expression using Postulates of Boolean algebra.

2. Convert a given expression to standard and canonical forms.
3. Simplify the given expression using Karnaugh Map or Quine –McClusky minimization technique.

Course Outcome 3 (CO3): To analyze and design combinational circuits

1. Analyse a given circuit and explain the results obtained by the circuit.
2. Design a Carry look ahead adder.
3. Design a four-bit magnitude comparator.

Course Outcome 4 (CO4): To understand the basics of sequential circuits

1. Understand the functioning of Latches and Flip Flops.
2. Design Master-Slave Flip Flops.
3. Understand the basics of different types of Flip Flops.

Course Outcome 5 (CO5): To analyze and design synchronous and asynchronous sequential circuits

1. Analyse a given circuit and explain the results obtained by the circuit.
2. Implement a serial adder using a shift register.
3. Design and construct a 4-bit ring counter with only one flip-flop is clear at any particular time and all other flip-flops are set. Give its timing diagram.
4. Using an example, show the Race-Free State Assignment in an asynchronous sequential circuit.

Model Question Paper

Course Code: ITT203

Course Name: DIGITAL SYSTEM DESIGN

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

1. Convert $(76.75)_{10}$ to binary, octal and hexadecimal.
2. Determine the base of the numbers in the operation; $58/4 = 15$.
3. Simplify the Boolean expression to minimum number of literals.

$$F = BC + AB + ABC + ABCD + ABCD + ABCD$$
4. Find the complement of the Boolean function $F = \bar{A} + ABC$. And prove that $F + \bar{F} = 1$ and $F \cdot \bar{F} = 0$.
5. Design a 4-to-2 line priority encoder.

6. Explain the difference between a latch and a flip-flop.
7. Give the characteristics equations for D, JK and T flip-flops.
8. Discuss in detail about Race condition.
9. With a neat diagram, discuss about SISO.
10. Design a 4-bit ring counter.

PART B

Answer all questions, each carries 14 marks.

11. a) Using Booth algorithm, perform multiplication of (-14) and (-7). (5)
- b) Represent the unsigned decimal numbers 572.36 and 382.71 in BCD. Show the necessary steps to form their sum and difference. (9)
- OR
12. a) (i) Find the decimal equivalent of $(A40F)_{16}$
 (ii) Find the 16's complement of $(A40F)_{16}$
 (iii) Convert to binary $(A40F)_{16}$
 (iv) Finds the 2's complement of the result in (iii) (8)
- b) Perform addition, subtraction, multiplication, and division of the following binary numbers without converting them to decimal : 1000110 and 110. (6)
13. a) For the Boolean function

$$F = w'xy' + xy'z + x'y'z + w'xy + wx'y + wxy$$
 (i) Draw the logic diagram, using the original Boolean expression.
 (ii) Simplify the Boolean algebra to a minimum number of literals.
 (iii) Obtain the truth table of the function from the simplified expression and show that it is the same as the original Boolean expression. (9)
- b) Prove that $A + \bar{A}B = A + B$ using Boolean postulates. (5)
- OR
14. a) Simplify the following functions using Quine- McClusky method :
 $f(a,b,c,d) = \sum m(2, 3, 4, 5, 13, 15) + \sum d(8, 9, 10, 11)$. (7)
- b) Using K-map simplify following Boolean expression & give implementation of same using gates $F(A,B,C,D) = \sum (2,4,8,15) + \sum D(0,3,9,12)$ (7)
15. a) Design a combinational circuit to implement a 4-bit carry look-ahead adder. (7)
- b) Design a 4-bit code-converter to convert BCD to gray code. (7)

OR

16. a) Implement the Boolean function $f(w,x,y,z) = \Sigma m(0,1,5,6,7,9,12,15)$ using 8-to-1 multiplexer. (7)
 b) Implement a 2-bit Magnitude comparator and write down its design procedure. (7)

17. a) For the following state table

Present State	Next State		Output	
	x=0	x=1	x=0	x=1
a	b	c	0	0
b	d	f	1	0
c	b	e	0	0
d	f	h	1	0
e	b	e	0	0
f	g	a	1	1
g	a	h	0	0
h	g	e	1	1

- i. Draw the corresponding state diagram.
 ii. Tabulate the reduced state table.
 iii. Draw the state diagram corresponding to the reduced state table.
 iv. Design the sequential circuit using flip-flops. [Hint: Unused states may be considered, as don't cares.] (9)

- b) Design D Flip Flop by using SR Flip Flop and draw the timing diagram. (5)

OR

18. a) Explain the state reduction in the sequential circuits using an example. (9)

- b) Draw the circuit of JK flip flop using NAND gates and explain its operation. (5)

19. a) Implement a four-bit universal shift register. Explain its design. (7)

- b) What do you mean by ripple counter? Design and implement a BCD ripple counter. (7)

OR

20. a) Tabulate the PLA programming table for the four Boolean functions listed below. Minimize the numbers of product terms.

$$A(x, y, z) = \Sigma m(1, 3, 5, 6)$$

$$B(x, y, z) = \Sigma m(0, 1, 6, 7)$$

$$C(x, y, z) = \Sigma m(3, 5)$$

$$D(x, y, z) = \Sigma m(1, 2, 4, 5, 7) \quad (9)$$

- b) What are the operations that can be performed on a RAM? (5)

Syllabus

Module 1: NUMBER SYSTEM (9 Hours)
Number Systems – Decimal, Binary, Octal, Hexadecimal - conversion from one system to another – Representation of negative numbers using 2's complement. Arithmetic Operations – Addition, Subtraction, Multiplication, Division of Binary numbers, Booths algorithm for multiplication, Representation of negative numbers, Representation of floating point numbers. Representation of BCD numbers, BCD Addition, Binary Codes – Gray codes – excess 3 code- Character Coding Schemes – ASCII, EBCDIC.
Module 2: BOOLEAN ALGEBRA & LOGIC GATES (9 Hours)
Boolean Algebra - Postulates of Boolean algebra - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Product-of-Sums Simplification — Don't-Care Conditions – Quine –McClusky minimization technique – Basic Gates- Universal Gates.
Module 3: COMBINATIONAL LOGIC (9 Hours)
Combinational Circuits – Analysis and Design Procedures - Binary Adder-Sub tractor (Half & Full) - Carry look ahead adder, BCD adder, code converter, - Magnitude Comparator - Decoders – Encoders Parity Generator– Multiplexers – DE multiplexers – Implementation of Boolean functions using MUX.
Module 4: SEQUENTIAL LOGIC CIRCUITS (9 Hours)
Sequential Circuits - Storage Elements: Latches , Flip-Flops – RS, JK, D, T, Triggering of flip-flops, Master-Slave- Analysis of Clocked Sequential Circuits - Design Procedure-using JK,D & T.
Module 5: COUNTERS AND SHIFT REGISTERS (9 Hours)
Registers - Shift Registers – SISO, PIPO, SIPO, PISO- Universal shift registers, Counters- Design of Counters- Synchronous & Asynchronous Counters — up-down counter, Decade counter, BCD counter, Johnson counter, Ring counter ,Memory & Programmable logic- RAM, ROM, PLA,PAL

Text Books

1. Mano M. M. and Michael D. Ciletti, *Digital Design*, 4/e, Pearson Education, 2013.
2. Thomas L. Floyd, *Digital Fundamentals*, 11th Edition, Pearson Education, 2015.
3. N. N. Biswas, "Minimization of Boolean Functions," in *IEEE Transactions on Computers*, vol. C-20, no. 8, pp. 925-929, Aug. 1971. doi: 10.1109/T-C.1971.223373

Reference Books

1. Charles H Roth ,Jr, Lizy Kurian John, *Digital System Design using VHDL*,2/e, Cengage Learning
2. Mano M. M. and Michael D. Ciletti, *Digital Design with an Introduction to the Verilog HDL*, 5/e, Pearson Education, 2013.
3. Tokheim R. L., *Digital Electronics Principles and Applications*, 7/e, Tata McGraw Hill, 2007.
4. Rajaraman V. and T. Radhakrishnan, *An Introduction to Digital Computer Design*, 5/e, Prentice Hall India Private Limited, 2012.
5. Leach D, Malvino A P, Saha G, *Digital Principles and Applications*, 8/e, McGraw Hill Education, 2015.
6. M. Morris Mano, *Computer System Architecture*, 3/e, Pearson Education, 2007.

7. Harris D. M. and, S. L. Harris, *Digital Design and Computer Architecture*, 2/e, Morgan Kaufmann Publishers, 2013

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	NUMBER SYSTEM	9 Hours
1.1	Number Systems – Decimal, Binary, Octal, Hexadecimal - conversion from one system to another – Representation of negative numbers using 2's compliment.	3 hours
1.2	Arithmetic Operations – Addition, Subtraction, Multiplication, Division of Binary numbers, Booths algorithm for multiplication, representation of negative numbers, Representation of floating point numbers.	4 Hours
1.3	Representation of BCD numbers , BCD Addition Binary Codes – Gray codes – excess 3 code- Character Coding Schemes – ASCII, EBCDIC	2 Hours
2	BOOLEAN ALGEBRA & LOGIC GATES	9 Hours
2.1	Boolean Algebra - Postulates of Boolean algebra - Canonical and Standard Forms	2 Hours
2.2	Simplification of Boolean Functions using Karnaugh Map - Product-of-Sums Simplification — Don't-Care Conditions	2 Hours
2.3	Quine –McClusky minimization technique	2 Hours
2.4	Basic Gates-Universal Gates.	3 Hours
3	COMBINATIONAL LOGIC	9 Hours
3.1	Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Carry look ahead adder, BCD adder	3 Hours
3.2	Code converter, - Magnitude Comparator - Decoders – Encoders – Multiplexers	3 Hours
3.3	Parity Generator– Multiplexers – DE multiplexers – Implementation of Boolean functions using MUX.	3 Hours
4	SEQUENTIAL LOGIC CIRCUITS	9 Hours
4.1	Sequential Circuits - Storage Elements: Latches , Flip-Flops – RS, JK, D, T, Triggering of flip-flops, race condition- Master-Slave	3 Hours
4.2	Analysis of Clocked Sequential Circuits	3 Hours
4.3	State Reduction and Assignment - Design Procedure- using JK,D & T	3 Hours
5	COUNTERS AND SHIFT REGISTERS	9 Hours
5.1	Registers - Shift Registers – SISO, PIPO, SIPO, PISO- Universal shift registers	2 Hours
5.2	Design of Counters- Synchronous & Asynchronous Counters — up-down counter.	3 Hours
5.3	Counters-, Decade counter, BCD counter, Johnson counter, Ring counter	2 Hours
5.4	Memory & Programmable logic-RAM, ROM, PLA,PAL	2 Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT205	PROBLEM SOLVING USING PYTHON	PCC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of writing readable PYTHON programs to solve computational problems that they may have to solve in their professional life. The course content is decided to cover the essential programming fundamentals which can be taught within the given slots in the curriculum. This course has got 3 lecture hours and 1 tutorial hour per week for learning and practicing programming using PYTHON. The instructor is supposed to give homework/assignments to write simple programs in the rough record as and when the required theory part is covered in the class. The programs that require time and effort can be done in the Lab sessions. The students are expected to come prepared with the required program written in the rough record for the lab classes.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcomes	Bloom's Category
CO 1	Write programs using Python and learn its execution environment	Understand
CO 2	Apply programs to implement various computational tasks which requires loops and conditional statements	Apply
CO 3	Write programs using functions and packages	Understand
CO 4	Apply programs to implement the concept of file handling using python	Apply
CO 5	Design object oriented programs to implement daily life problems and their solutions	Apply

Mapping of course outcomes with program outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	-	-	-	-	-	-	-	-	-
CO 2	2	2	1	1	-	-	-	-	-	-	-	-
CO 3	3	2	2	2	2	-	-	-	-	-	-	1
CO 4	1	1	1	2	1	-	-	-	-	-	-	1
CO 5	3	1	3	2	1	1	-	-	-	-	-	1

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	25
Understand	20	20	35
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

Describe identifiers, variables, keywords, expressions and statements, Operators and operands.

Describe the expression evaluation in Python.

Describe the syntax of control statements in Python.

Write programs to solve problems using various control structures.

Differentiate between Break and Continue.

Course Outcome 2 (CO2):

Build applications of various string manipulations by using methods and functions available with string module in python.

Build applications of various List operations, including matrix representation.
Build applications of Tuple and various Tuple operations.
Build applications of Dictionary and its related operations, functions and methods.

Course Outcome 3(CO3):

Describe function definition and function access in python.
Differentiate between parameters and arguments.
Differentiate between type conversion and coercion.
Describe mathematical & lambda functions in Python.
Explain the concept of composition of functions in Python.
Explain Recursion and its implementation in Python.
Explain the concepts of modules and packages in Python. How and why import method is used.
Write programs to solve problems using the concept of functions and recursion.

Course Outcome 4 (CO4):

Apply the concept of file operations including opening, writing to and reading from files, and writing variables using Python.
Build applications to demonstrate the concept of Pickling.
Build programs to demonstrate the concept of Exception Handling in python.

Course Outcome 5 (CO5):

Build classes using python & Access class variables.
Build programs in Python to demonstrate the use of instances as arguments and return values.
Build programs in Python to demonstrate the concept of Constructors, class attributes and destructors.
Model the concept of Inheritance using Python.

Model Question paper

Course Code: ITT 205

Course Name: Problem Solving Using Python

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. Write a python program to find the sum of all odd terms in a group of n numbers entered by the user.
2. What is the use of *pass* statement in Python?
3. Write a Python code to check whether two strings are equal or not.
4. Write a Python code to search an element in a list.
5. List the advantages of using functions in a program.
6. State the use of *dump* method with suitable example.

7. Write a function exists() which returns True if the given file exists and False if it does not.
8. Why exceptional handling is required in programming?
9. Describe the concept of Constructor with an example.
10. Explain the purpose of __init__() method in Python.

(10x3=30)

Part B**Answer any one Question from each module. Each question carries 14 Marks**

11. (a) Write a Python program to find the largest and second largest of n numbers. Assume $n \geq 3$ and all the numbers are distinct. No sorting algorithm should be used. (7)
- (b) What are arithmetic operators used in Python? Explain each using an example (7)

OR

12. (a) Write a Python program to print the odd composite numbers between m and n, where m and n are positive integers greater than 1. (8)
- (b) Define the following
- i) Atoms
 - ii) Identifiers
 - iii) Literals

13. (a) Write a Python code to add two matrices using list. (6)
- (b) Write a Python program to reverse a string and print whether its palindrome or not. (8)

OR

14. (a) How to create Dictionary in Python? Write a Python program to read and display a sparse matrix using dictionary. (7)
- (b) Write a program to
- i) convert all small letters in a string into capital letters
 - ii) find the occurrence of a given substring. (7)

- 15.(a) Compare the built-in functions int() and str() with examples. (4)
- (b) Write a program using function to display a multiplication table of $n \times n$ size, for any given 'n'. (5)
- (c) Write a program using function to display a find the binomial coefficient, ${}^nC_r$. (5)

OR

- 16 (a). What is recursion? Write a recursive function to find the factorial of a number. (6)
- (b) Write a program using function to check the type of a triangle by getting the values from the user. (8)
17. (a) How exceptions are handled in Python? Illustrate with example. (10)
- (b) Write a program to read numbers sorted in one file and store the sorted numbers in another file after deleting duplicates. (4)

OR

18. (a). Describe the use of try-except method in Python with suitable Illustrations. (6)

(b) Write a Python code to read a text file, copy the contents to another file after removing the blank lines. (8)

19. (a). Write a Python code to create a class named 'Member' having the following members: Data members Name, Age, Phone number, Address, Salary. It also has a method named 'printSalary' which prints the salary of the members. Two classes 'Employee' and 'Manager' inherits the 'Member' class. The 'Employee' and 'Manager' classes have data members 'specialization' and 'department' respectively. Now, assign name, age, phone number, address and salary to an employee and a manager by making an object of both of these classes and print the same. (8)

(b) Create a class person with attributes Name, age, salary and a method display() for showing the details. Create two instances of the class and call the method for each instance. (6)

OR

20. (a) Define the terms class, attribute, method and instance with the help of an example. (4)

(b) Write a Python program to find out the total mark of a student using multiple inheritance. Declare a Student class. Student class should have the member functions for accept and display student details. Declare a Sports class to accept and display sports marks of the student. Derive a class statement from both the classes. This class should have the member functions to accept marks of three subjects and add those marks with sports marks and display the result. (10)

(14 x 5=70)

Syllabus

Module 1	9 hours
Introduction To Python: Understanding Python-identifiers, variables, keywords, expressions and statements, evaluation of expressions, Operators and operands, operator precedence, indentation. Python Program Flow Control: Decision making- if, if..else, elif. Loops - for, while, for...else, while...else, Control statements using pass, continue, break.	
Module 2	9 hours
Strings and lists – string traversal, string slices and comparison with examples, The string module, character classification. List- List values, accessing elements, list membership, Lists and for loops, List operations, List slices, List deletion, Matrices. Tuples - mutability and tuples, tuple assignment, Tuples as return values, Tuple operations. Dictionaries – operations and methods.	
Module 3	9 hours
Python Functions, Modules and Packages: Function definition, calling functions, parameters and arguments, the return statement, type conversion and coercion, composition of functions, Lambda function, mathematical functions, user-defined functions, Recursion, Modules- Built-in modules, creating modules, import statement. Packages in Python - importing modules from a package.	

Module 4	9 hours
Python Files and exceptions: Python file handling, open, write, read text files, writing variables, Directories in Python, Pickling, Exception Handling.	
Module 5	9 hours
Python Object Oriented Programming: Introduction to classes and objects - class definition, attributes, instances, sameness, instances as arguments and return values. Constructor, class attributes and destructors, Inheritance.	

Text Books

1. Allen Downey, Jeffrey Elkner, Chris Meyers, “How to think like a Computer Scientist-Learning with Python”, Green Tea Press, First edition, 2002.
2. Mark Lutz, ”Learning Python: Powerful Object-Oriented Programming”, O’Reilly Media Inc., 5th, 2013

Reference Books

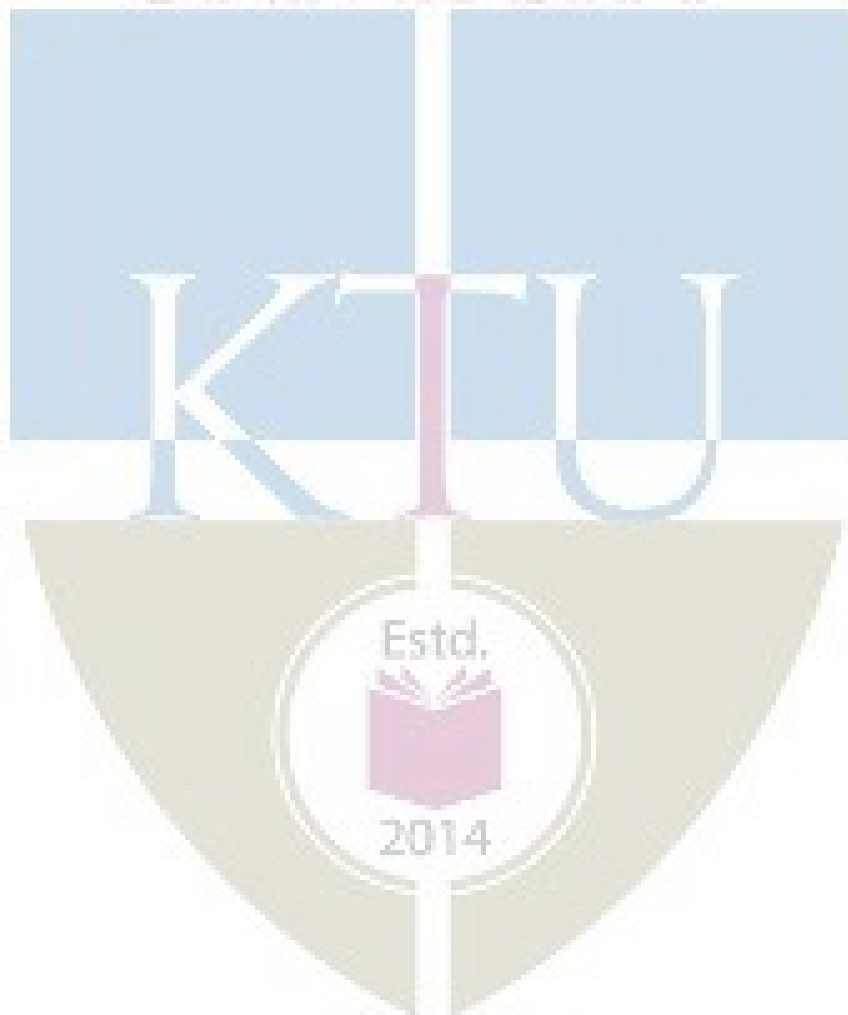
1. Kenneth A. Lambert, B. L. Juneja, “Fundamentals of Python”, Cengage Learning India Pvt. Ltd., 2015.
2. S.A.Kulkarni, “Problem Solving and PYTHON Programming”, 2nd edition, Yes Dee Publishing Pvt Ltd, 2018
3. Mark Summerfield, ”Programming in Python 3: A Complete Introduction to the Python Language”, Pearson Education, 2nd, 2018
4. Yashavant Kanetkar, Aditya Kanetkar, ”Let Us Python”, BPB Publications, 1st Edition, 2019
5. Allen Downey, “Learning with Python”, Dreamtec Press, 1st Edition, 2015
6. <https://docs.python.org/3/reference/>

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction To Python:	9 hours
1.1	Understanding Python-identifiers, variables, keywords, expressions and statements.	2
1.2	Evaluation of expressions, Operators and operands, operator precedence, indentation	1

1.3	Python Program Flow Control: Decision making- if, if..else, elif.	2
1.4	Loops - for, while, for...else, while...else	2
1.5	Control statements using pass, continue, break.	2
2	Strings and lists:	9 hours
2.1	String traversal, string slices and comparison with examples	1
2.2	The string module, character classification.	1
2.3	List- List values, accessing elements, list membership, Lists and for loops, List operations, List slices, List deletion	2
2.4	Matrices	1
2.5	Tuples- mutability and tuples, tuple assignment, tuples as return values, Tuple operations.	2
2.6	Dictionaries – operations and methods.	2
3	Python Functions, Modules And Packages:	9 hours
3.1	Function definition, calling functions, parameters and arguments, the return statement.	1
3.2	Type conversion and coercion, composition of functions	1
3.3	Lambda function, mathematical functions	1
3.4	user-defined functions	1
3.5	Recursion	1
3.6	Modules -Built-in modules	1
3.7	Creating modules, import statement.	1
3.8	Packages in Python - importing modules from a package.	2
4	Python Files and exceptions:	9 hours
4.1	Python file handling, open, write, read text files	4
4.2	Writing variables	1
4.3	Directories in Python	1
4.4	Pickling	1
4.5	Exception Handling.	2

5	Python Object Oriented Programming:	9 hours
5.1	Introduce classes and objects	1
5.2	Class definition, attributes, instances, sameness	1
5.3	Instances as arguments and return values.	1
5.4	Constructor	2
5.5	Class attributes and destructors	2
5.6	Inheritance	2



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL201	DATA STRUCTURES LAB	PCC	0	0	3	2

Preamble:

This lab is intended to make the students capable of

- understanding the importance of data structures, abstract data type, and their basic usability in different application,
- Implementing linear and non-linear data structures using linked lists and arrays.
- Applying various data structure such as stacks, queues, trees, graphs, etc. to solve various computing problems
- Identifying suitable data structure and algorithm to solve a real world problem.

Prerequisite: programming in C

Course Outcomes: After the completion of the course the student will be able to

CO_No	Course Outcome(CO)	Bloom's Category
CO 1	Compare various kinds of searching and sorting techniques	level 5: Evaluate
CO 2	Construct Linear and nonlinear data structures using arrays and linked list	level 6:Create
CO 3	Develop Programs employing dynamic memory management	level 6:Create
CO 4	Choose appropriate data structure to solve various computing problems.	level 5: Evaluate
CO 5	Originate hash tables and collision resolution Techniques	level 6:Create
CO 6	Identify suitable data structure and algorithm to solve a real world problem.	level 3:Apply

Mapping of course outcomes with program outcomes

COs	PROGRAMME OUTCOMES (PO)											
	PO 1	4 PO 2	5 PO 3	5 PO 4	6 PO 5	3 PO 6	2 PO 7	3 PO 8	3 PO 9	3 PO 10	3 PO 11	3 PO 12
CO 1	3	3	3	2	2	1	-	-	-	-	2	1
CO 2	3	3	3	3	3	1	-	-	-	-	2	1
CO 3	3	3	3	3	3	1	-	-	-	-	2	1
CO 4	3	3	3	3	3	1	-	-	-	-	2	1
CO 5	3	3	3	3	3	1	-	-	-	-	2	1
CO 6	3	3	3	3	3	1	-	-	-	-	2	1

3/2/1: high/medium/low

Assessment Pattern**Mark distribution**

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	:	15 marks
Continuous Assessment	:	30 marks
Internal Test (Immediately before the second series test):	:	30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	: 15 Marks
(b) Implementing the work/Conducting the experiment	: 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting)	: 25 Marks
(d) Viva voce	: 20 marks
(e) Record	: 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Develop a C program to implement insertion sort, selection sort and bubble sort.
2. Design a program to Implement i) Quick sort ii) Merge sort.
3. Create programs for i) Linear Search ii) Binary Search.

Course Outcome 2 (CO2)

1. Design a Menu driven program to implement singly linked list operations with options for insertion, deletion, search and traversal.
2. Develop Menu driven program to implement doubly linked list operations with options for insertion at front, insertion at end, deletion at front, deletion at end and traversal.

Course Outcome 3(CO3):

1. Design a Menu driven program to implement singly linked list operations with options for insertion, deletion, search and traversal.
2. Simulate first fit, best fit and worst fit memory allocation strategies using linked list.

Course Outcome 4 (CO4):

1. Device Dijkstra's Algorithm for finding Shortest path
2. Apply Queue and stack in Breadth First Search and Depth First Search respectively

Course Outcome 5 (CO5):

1. Implement hash table using various mapping functions
2. Resolve the collisions if any using collision resolution techniques like linear Probing, Random Probing, Double hashing and Quadratic Probing

Course Outcome 6 (CO6):

1. Design and implement an application program which is to be used in Ticket counter, where First person gets ticket first and go out first, using suitable data structure. The program should do the following functions
 - a) When new person come to the counter the details of the person (Name and age) should be added to the data structure.
 - b) After issuing tickets, the details of the corresponding person should be deleted from the data structure

(Hint: Each node of linked list should contain fields Name, Age and Rlink)
2. Design and implement an application program to store the details of pass percentage of the college in chronological order of years (oldest to newest) and retrieve the information in reverse chronological order of years, using suitable data structure.
Hint: A Node of linked list may contain the fields Year, Pass Percentage and Rlink.

Menu may contain

- a) Store details
- b) Retrieve details

LIST OF EXPERIMENTS

1. Develop a C program to implement insertion sort, Selection sort and bubble sort*.
2. Design a program to Implement i) Quick sort ii) Merge sort*.
3. Create Programs for i) Linear Search ii) Binary Search*.
4. Create a menu driven program to implement singly linked list operations with options for insertion, deletion, search and traversal*.
5. Device a menu driven program to implement doubly linked list operations with options for insertion at front, insertion at end, deletion at front, deletion at end and traversal.
6. Apply linked list concept to perform polynomial addition*
7. Simulate first fit, best fit and worst fit memory allocation strategies using linked list*.
8. Develop a program to perform stack operations using i) array ii) linked list*.
9. Perform queue operations using i) array ii) linked list*.

10. Apply stack to perform i) Infix to postfix conversion ii) Postfix evaluation *
11. Develop a program to perform preorder, in-order, post order traversals on binary trees*
12. Construct binary search trees to perform insertion, deletion, search
13. Apply Queue and stack in Breadth First Search and Depth First Search respectively *
14. Devise Dijkstra's Algorithm for finding Shortest path
15. Resolve the collisions if any using collision resolution techniques like linear Probing, Random Probing, Double hashing and Quadratic Probing*
(* indicates mandatory experiments.)

Text Books

1. Samanta D., Classic Data Structures, Prentice Hall India, 2/e, 2009.
2. Ellis horowitz, Sartaj Sahni, Fundamentals of Data structures, Galgotia Booksource

Reference Books

1. Horwitz E., S. Sahni and S. Anderson, F
2. Fundamentals of Data Structures in C, University Press (India), 2008.
3. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication, 1983.
4. Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill, 1995.
5. Peter Brass, Advanced Data Structures, Cambridge University Press, 2008
6. Lipschuts S., Theory and Problems of Data Structures, Schaum's Series, 1986.
7. Wirth N., Algorithms + Data Structures = Programs, Prentice Hall, 2004.
8. Hugges J. K. and J. I. Michtm, A Structured Approach to Programming, PHI, 1987.
9. Martin Barrett, Clifford Wagner, And Unix: Tools For Software Design, John Wiley, 2008 reprint.



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL203	PROGRAMMING AND SYSTEM UTILITIES LAB	PCC	0	0	3	2

Preamble: This laboratory course is meant for understanding the fundamental system utilities. The course is also aimed for understanding and practicing the programming language Python.

Prerequisite: PYTHON programming knowledge and Computer Fundamentals.

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcomes	Bloom's Category
CO 1	Develop readable* Python programs by making use of basic constructs- Decision controls, Looping controls, Lists, Tuple and Strings	Create
CO 2	Design modular Python programs using normal and recursive functions	Create
CO3	Design programs using Dictionaries and Files	Create
CO 4	Experiment with the basic Windows/ Linux administration & network configuration utilities	Apply
CO 5	Experiment with version control tools using git	Apply
readable* - readability of a program means the following: 1. Logic used is easy to follow 2. Standards to be followed for indentation and formatting 3. Meaningful names are given to variables 4. Concise comments are provided wherever needed		

Mapping of course outcomes with program outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	3	1	3	-	-	-	-	-	-	-
CO 2	2	3	3	3	3	-	-	-	-	-	-	-
CO 3	2	3	3	3	3	-	-	-	-	-	-	-
CO 4	2	2	1	2	1	-	-	-	-	-	-	-
CO 5	-	-	2	-	3	-	-	-	3	2	-	-

3/2/1: High/Medium/Low

Assessment Pattern**Mark distribution**

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	:	15 marks
Continuous Assessment	:	30 marks
Internal Test (Immediately before the second series test)	:	30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	:	15 Marks
(b) Implementing the work/Conducting the experiment	:	10 Marks
(c) Performance, result and inference (Usage of equipments and troubleshooting)	:	25 Marks
(d) Viva voce	:	20 marks
(e) Record	:	5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

Develop a python program to

1. Print all prime numbers with in an interval
2. Search an element in a list
3. Input a list of n numbers. Calculate and display the average of numbers. Also display the square of each value in the list
4. Add two matrices.
5. Find the number of occurrences of a given substring in a string.
6. Count the number of vowels, consonants, words and question marks in a given string.

Course Outcome 2 (CO2):

Develop a python program to

1. Find the value of nCr using function.
2. Implements calculator with functions like add, subtract, multiply, divide, exponent etc.
3. Find factorial of a given number using recursion.
4. Find n^{th} Fibonacci number using recursion.

Course Outcome 3 (CO3):

1. Develop a python program to create dictionary of phone numbers and names of n persons. Display the contents of the dictionary in alphabetical order of their names

2. Develop a Python program to implement the following scenario. A book shop details contains the Title of book and Number of copies of each title. As books are added to shop the number of copies in each should increase and as books are sold the number of copies in each should decrease.
3. Develop a python code to read a text file, copy the contents to another file after removing the blank lines.
4. Develop a python program to implement the following scenario. Given a file “**data.txt**” with three columns of data separated by spaces. Read it into 3 separate simple sequences.
5. Create a class student with attributes name, rollno and a method showData() for showing the details. Create two instances of the class and call the method for each instance. Develop a python program to implement the scenario.

Course Outcome 4 (CO4):

Perform the following operations:

1. Apply the use of ATTRIB windows command to change the attributes of a file.
2. Create a file **xyz.txt** and change the ownership of this file to some other user on your machine.
3. Create a file **hello.txt** and make it executable.
4. Create a new user account and home directory called "Duck" and Set the user account "Duck's" expiry date as 07 - 07 - 2020
5. Check the network connectivity of your computer using suitable Linux commands

Course Outcome 5 (CO5):

Perform the following:

1. Create a directory in your machine and make it as a repository and perform the following
 - a. Create a text file and add some content into it.
 - b. Add the file to the staging area of the Git repository.
 - c. Commit the file to your repository.
 - d. See the commit details using git log command.
2. Go to your Git repository and perform the following
 - a. Do some modifications in your text file. Commit the changes.
 - b. Try to revert to your old revision, again do some modifications in your text file and try to discard the changes.

List of Experiments**Part A : Programming in Python**

1. **Basic programming experiments** to familiarization of data types and input-output statements
2. **Decision making, branching and looping statements**
3. **Function & Function calls**
 1. Function definitions and access
 2. Parameters and arguments
 3. Recursion
4. **Strings**
 - a) String traversal, join, slicing
 - b) String searching, Comparison

- c) Other important String methods
- 5. Lists, Tuples and Dictionaries**
 - a) Creation of List & List Operations
 - b) Tuple and Tuple operations
 - c) Creation of Dictionary and Operations
 - d) Comparison of List and Tuple
- 6. Matrix representation**
 - a) Creating matrix
 - b) Matrix operations - addition, subtraction and multiplication
- 7. Files and Operations**
 - a) Files - defining, opening/closing, read/write operations
 - b) Exceptions in Python
 - c) Pickling
- 8. Object Oriented Programming using Python**
 - c) Creation of Classes & Instances, method calling
 - d) Constructor & Destructor concepts
 - e) Implementation of Inheritance

Part B : System Utilities

Basic Windows/Linux Administration Utilities

1. Experiments on Windows Operating System

- a. Perform the following commands

DIR, TYPE, DEL, ERASE, MD, CD, COPYCON, RMDIR, REN, VER, DATE, TIME, TREE, PATH, CLS, RMDIR, BREAK, SET, EXIT, APPEND, CHKDISK, ATTRIB, SYS, EDIT, XCOPY, DISKCOPY

- b. Explore and describe some system utility like **regedit**, memory partitioning, control panel and window tools

2. Experiments on Linux Operating System

- a) Perform general purpose utilities in Linux:

echo, uname, whoami, passwd, date, date +%T, date +%h, date +%m, date +%y, date +"%h%y", cal, cal 12 2030, echo \$HOME, pwd, ls, ls -all, ls -l, cat, cat > file1, cat >> file2, ls -l >fileinfo

- b) Familiarize working with files and managing file attributes

3. Network Configuration Utilities

- a) **ifconfig** utility, enable/disable network interface, **traceroute**, **telnet**, **nslookup**, **netstat**, **w**, **scp**, etc
- b) Connecting to the internet

4. GIT for version control

- a. Installation and configuration of Git on Ubuntu and Windows operating systems
- b. Perform Basic Git Commands (**git init**, **add**, **status**, **commit**, and **log**) and Git **checkout** command

Text Books

1. Allen Downey, Jeffrey Elkner, Chris Meyers, “How to think like a Computer Scientist- Learning with Python”, Green Tea Press, First edition, 2002.
2. Mark Lutz, ”Learning Python: Powerful Object-Oriented Programming” , O’Reilly Media Inc., 5th, 2013

Reference

1. S.A.Kulkarni, “Problem Solving and PYTHON Programming”, 2nd edition, Yes Dee Publishing Pvt Ltd, 2018
2. Kenneth A. Lambert, B. L. Juneja, “Fundamentals of Python”, Cengage Learning India Pvt. Ltd., 2015.
3. Mark Summerfield, ”Programming in Python 3: A Complete Introduction to the Python Language”, Pearson Education, 2nd, 2018
5. Yashavant Kanetkar ,Aditya Kanetkar ,”Let Us Python ”,BPB Publications, 1st Edition, 2019
6. Allen Downey, “Learning with Python”, Dreamtec Press, 1st Edition, 2015
7. <https://docs.python.org/3/reference/>
8. Version Control with Git: Powerful tools and techniques for collaborative software development 2nd Edition, Kindle Edition by Jon Loeliger, Matthew McCullough
9. <https://spoken-tutorial.org/>





CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT281	JAVA PROGRAMMING	VAC	3	1	0	4

Preamble: The syllabus is prepared with the intended to deliver students the elementary concepts of Java Programming and equip them to code java application built over those concepts. It also introduces to them advanced level areas like event driven programming with Java.

Prerequisite: Basics of Programming

Course Outcome (CO): After completion of the course, the student will be able to

CO No.	Course Outcome	Bloom's Category
CO1	Summarize Object Oriented Programming concepts and basic characteristics of Java	Understand
CO2	Summarize basic java packages, inheritance and interfaces	Understand
CO3	Summarize exceptions and I/O streams concepts	Understand
CO4	Demonstrate the usage of threads and generics classes	Understand
CO5	Build simple Graphical User Interface programs with Java	Apply

Mapping of Course Outcomes with Program Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	1	-	-	-	-	-	-	-
CO2	1	1	2	1	-	-	-	-	-	-	-	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	1	1	1	-	-	-	-	-	-	-	-
CO5	3	1	1	2	2	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain core principles of Object Oriented Design.
2. Describe the characteristics of Java.
3. Illustrate the concept of Polymorphism with an example.
4. Describe Java Source File Structure.
5. Explain constructors in detail

Course Outcome 2 (CO2):

1. Explain the concept of Super classes and sub classes.
2. Differentiate classes and interfaces.
3. Illustrate the concept of Interfaces with an example.
4. Describe Final methods and classes in java.
5. Explain extending interfaces in Java.

Course Outcome 3 (CO3):

1. Explain throwing and catching exceptions in Java.
2. Describe the different built-in exceptions in Java.
3. Illustrate the concept of Exception handling with an example.
4. Describe Byte and character streams in java.
5. Explain stack trace elements.

Course Outcome 4 (CO4):

1. Explain the concept of multithreading in Java.
2. Describe the different bounded types in Java.
3. Illustrate thread synchronization with example.
4. Describe inter-thread communication in java.
5. Explain the concept of generic programming in Java.

Course Outcome 5 (CO5):

1. Experiment with AWT in Java.
2. Build AWT programs for simulating Calculator.
3. Experiment with different Form components in Swing.

Model Question Paper

PART A

Answer all questions, each carries 3 marks

1. Why are java programs said to be platform independent?
2. Explain how access modifiers are used to control the visibility of identifiers?
3. What is the use of interface in java? Give example.
4. What is a package? How a class within a package is compiled and executed?
5. List out different exception classes in Java.
6. Write a note on byte stream and character stream classes in java
7. List out different bounded types in java
8. Draw the life cycle of a thread showing different stages and methods invoked.
9. List any 3 event sources and their corresponding generated event type and listeners used
10. What are the advantages of using swing?

PART B**INFORMATION TECHNOLOGY**

11.

- a. What is the use of constructor in java? Give examples for different types of constructors. (7)
- b. Define a java class having overloaded methods to calculate the area of a rectangle and circle. (7)

OR

12.

- a. Write a Java program that counts the number of odd and even numbers in an array of 10 integers. (8)
- b. Briefly explain the architecture of JVM. (6)

13.

- a. List any five methods of String class, give examples. (5)
- b. With the help of examples, explain how inheritance is implemented in java. (9)

OR

14.

- a. Write a java program to count the number of occurrences of a particular word in a sentence using string handling methods. (8)
- b. Differentiate between abstract class and interface. (6)

15.

- a. Explain exception handling in java. Briefly explain various exception handling keywords in java with examples(9)
- b. Write a Java program that counts the number of words in a text file. (6)

OR

16.

- a. Write a Java program that accepts N integers through console and sort them in ascending order.(8)
- b. Explain the scenario under which the following three exceptions occur, NumberFormatException, ArrayIndexOutOfBoundsException and ArithmeticException (6)

17.

- a. Explain the different ways of creating threads in java (9)
- b. Explain the concept of generic programming in Java. (5)

OR

18.

- a. Write a java program to create two threads, one for writing even numbers and the other for writing odd numbers upto 100 in two different files. (12)
- b. What are the uses of synchronized keyword?(2)

19.

- a. Demonstrate the usage of any four Form components in Swing with an example. (4)
- b. Implement a Java AWT program for simulating Calculator(10)

OR

- 20. Write a java AWT based java program to display Fibonacci numbers in a list control upto a limit entered using TextField.The event handling as well as code for clearing the

Syllabus

MODULE 1: INTRODUCTION TO OOP AND JAVA FUNDAMENTALS (10 Hours)
Object Oriented Programming – Abstraction – objects and classes – Encapsulation- Inheritance – Polymorphism- OOP in Java – Characteristics of Java – The Java Environment – Java Virtual Machine- Java Source File Structure – Compilation. data types, operators, control statements, Introduction to Java programming.– Classes fundamentals, objects, methods, constructors, parameter passing, overloading, access control keywords– static members -Comments, Arrays-Java Documentation usage
MODULE 2: INHERITANCE AND INTERFACES (10 Hours)
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Defining and importing packages. Strings-Java Built-in Classes and it's usage
MODULE 3: EXCEPTION HANDLING AND I/O (7 Hours)
Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files
MODULE 4: MULTITHREADING AND GENERIC PROGRAMMING (8 Hours)
Differences between multithreading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations
MODULE 5: EVENT DRIVEN PROGRAMMING (10 Hours)
Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images – Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

Text Books

1. Herbert Schildt, —Java The complete referencel, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentalsl, 9th Edition, Prentice Hall, 2013.

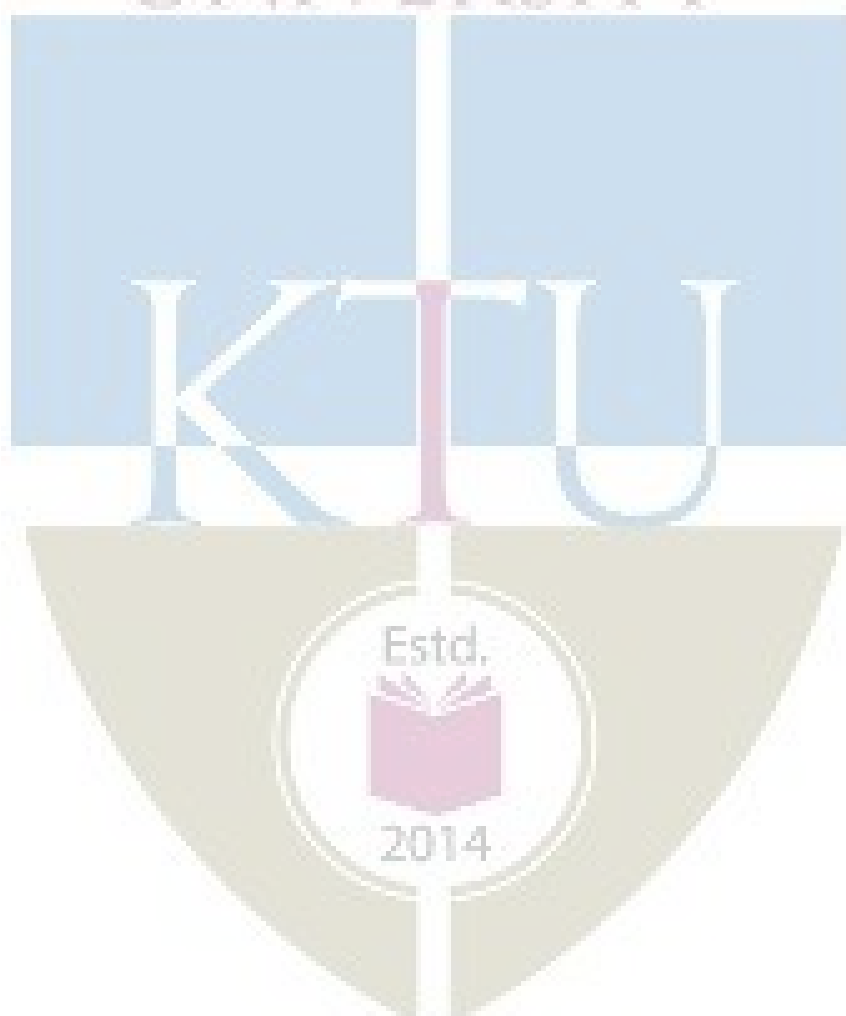
Reference Books

1. Paul Deitel, Harvey Deitel, —Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
2. Steven Holzner, —Java 2 Black book, Dreamtech press, 2011.
3. Timothy Budd, —Understanding Object-oriented programming with Java, Updated Edition, Pearson Education, 2000.

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	Introduction	10
1.1	Fundamentals of Object Oriented Programming: Abstraction, objects and classes, Encapsulation, Inheritance, Polymorphism	3
1.2	OOP in Java: Characteristics of Java, The Java Environment – Java Virtual Machine-, Java Source File Structure , Compilation, data types, operators, control statements	3
1.3	Introduction to Java programming: Classes fundamentals, objects, methods, constructors, parameter passing, overloading, access control keywords, static members ,Comments, Arrays, -Java Documentation usage	4
2	Inheritance And Interfaces	10
2.1	Inheritance: Super classes, sub classes, Protected members, – constructors in sub classes, the Object class, abstract classes and methods, final methods and classes	5
2.2	Interfaces: defining an interface, implementing interface, differences between classes and interfaces and extending interfaces, Defining and importing packages. Strings, Java Built-in Classes and it's usage	5
3	Exception Handling And I/O	7
3.1	Exceptions: exception hierarchy, throwing and catching exceptions, built-in exceptions, creating own exceptions, Stack Trace Elements.	4
3.2	Input / Output Basics: Streams, Byte streams and Character streams, Reading and Writing Console, Reading and Writing Files	3
4	Multithreading And Generic Programming	8
4.1	Multithreading: Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication.	4

4.2	Generic Programming: Generic classes, generic methods, Bounded Types, Restrictions and Limitations	4
5	Event Driven Programming	10
5.1	Graphics programming: Frame, Components, working with 2D shapes, Using color, fonts, and images	3
5.2	Basics of event handling: Event handlers, adapter classes, actions, mouse events, AWT event hierarchy	3
5.3	Introduction to Swing: layout management, Swing Components, Text Fields , Text Areas, Buttons, Check Boxes, Radio Buttons, Lists, choices, Scrollbars, Windows, Menus, Dialog Boxes.	4



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT283	DATA COMMUNICATION	VAC	3	1	0	4

Preamble: The syllabus is prepared in view of devising students capable of understanding the essential concepts and terminology used for data communication.

Prerequisite: NIL

Course objectives

- To introduce basic terminology and concepts used in data transmission
- To understand encoding techniques used in data communication
- Familiarize students the fundamental knowledge about computer networks

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category
CO 1	Describe the fundamental concepts of data communication, network models, and standards and wired networks.	Understand
CO 2	Identify different transmission media, data and signals.	Apply
CO 3	Demonstrate different encoding techniques used for analog to digital conversion and vice versa.	Understand
CO 4	Describe the different types of bandwidth utilization techniques and basic principles of switching.	Understand
CO 5	Describe the different access methods, channelization and wireless networks.	Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	1
CO 2	1	2	-	2	2	-	-	-	-	-	-	1
CO 3	2	1	1	-	-	-	-	-	-	-	-	1
CO 4	3	2	2	1	1	-	-	-	-	-	-	1
CO 5	1	-	1	-	2	-	-	-	-	-	1	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	30
Understand	20	20	50
Apply	20	20	20
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain the fundamentals of data communication.
2. Explain the different types of networks.
3. Explain the different types of network models and standards.
4. Explain the different types of wired networks.

Course Outcome 2 (CO2)

1. Identify the different types of transmission media.

2. Identify the different types of data and signals.
3. Identify data rate limits for noisy and noiseless channel.

Course Outcome 3 (CO3):

1. Explain the fundamentals of data transmission.
2. Describe about different transmission modes.
3. Demonstrate the analog data conversion to analog signals and analog data into digital signals.
4. State and explain different keying techniques.

Course Outcome 4 (CO4):

1. Describe the functionality of different multiplexing techniques.
2. Illustrate about different spread spectrum techniques.
3. Describe basic principles of switching.

Course Outcome 5 (CO5):

1. Illustrate the random access methods used for collision avoidance.
2. Explain different controlled access methods.
3. Describe about different channelization protocols.
4. Demonstrate different services provided by wireless networks

Model Question Paper

PART A

(10*3=30)

(Each Question carries 3 Marks)

1. List out the key components of data communication.
2. Summarize the essential criteria's required for an ideal network?
3. Mention Shannon's Theorem. Find out the channel capacity of a noisy channel which is having signal to noise ratio almost zero.
4. Analyze different characteristics used to measure the network performance.
5. Define the role of scrambling in digital transmission.
6. Calculate the baud rate for the given bit rate and type of modulation
 - a. 4000 bps,QPSK

b. 36000 bps, 64-QAM

7. Identify the different phases used for communication in circuit switched network.
8. Define frequency division multiplexing and mention its applications.
9. Compare and contrast Pure ALOHA and Slotted ALOHA.
10. Examine the significance of transmission convergence sublayer in WiMax.

PART B

(5*14=70)

11. Illustrate different types of connections and topologies used in network for connecting devices with the help of diagram.

OR

12. Substantiate the need of OSI model in network communication? Briefly explain the functionalities of each layer in OSI model.
13. Analyse different types of transmission impairments occurring in transmission media in detail.

OR

14. Explain in detail about guided and unguided media used for data transmission.
15. Discuss in detail about different line coding schemes.

OR

16. Identify the different techniques used for changing an analog signal to digital data.
17. Illustrate in detail about Time division multiplexing. With the help of neat sketch explain different schemes of Time division multiplexing.

OR

18. Examine the need of spread spectrum? Which are different spread spectrum techniques?
19. Discuss in detail about different channelization protocols.

OR

20. Demonstrate in detail about Bluetooth .List out its applications.

Syllabus

Module 1 (7 Hours)
Introduction to Data Communication- Components, Data Representation, Data Flow. Networks - Network Criteria, Physical structures, Physical Topology, Network Types- LAN, WAN, Switching -Internet -Network Models-OSI Model.
Module 2 (9 Hours)
Transmission media – Guided media – Twisted pair cable, coaxial cable, fiber optic cable, Unguided media - Radio waves, Microwaves, Infrared. Data and signals - Periodic analog signals-digital signals-transmission impairment - Attenuation, Distortion - Noise- different types of noise – Data rate limits-Noiseless channel, Noisy Channel, Performance
Module 3 (10 Hours)
Digital data transmission – Digital to Digital Conversion –Line Coding, Line Coding Schemes, Block coding, Transmission modes- Serial, Parallel, Synchronous, Asynchronous and Isochronous transmission. Encoding analog data into analog signals - AM, FM, PM. Encoding analog data into digital signals - PCM, DM – Keying Techniques - ASK, FSK, PSK, QAM
Module 4 (7 Hours)
Multiplexing- Frequency Division Multiplexing (FDM) – Time Division Multiplexing (TDM), Synchronous Time Division Multiplexing –Statistical time Division multiplexing Spread spectrum-The concept of spread spectrum – frequency hopping spread spectrum – direct sequence spread spectrum. Basic Principles of Switching-Circuit Switch Networks, Packet Switching, Structure of Switch
Module 5 (12 Hours)
Media Access Control – Random Access - Controlled Access-Channelization. Introduction to Wireless LAN-IEEE 802.11 –Bluetooth- WiMax, Cellular Telephony - 1G, 2G, 3G, 4G, 5G.

Text Books

1. Behrouz A Forouzan, “Data Communication and Networking”, McGraw Hill Education(india)Private limited,Fifth edition, 2013.

Reference Books

1. Stallings W., Data and Computer Communications, 8/e, Prentice Hall, 2007.
2. Tanenbaum A. S and D. Wetherall, Computer Networks, Pearson Education, 2013
3. Taub & Schilling, Principles of Communication Systems: Tata McGraw-Hill

4. Simon Haykin, Communication Systems: John Wiley & Sons. Pvt. Ltd

5. Das, Mullick & Chatterjee, Principles of Digital Communication: Wiley Eastern Ltd.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Overview (7 Hours)	
1.1	Introduction to Data Communication and networks	3
1.2	Network Models-OSI Model	4
2	Transmission media (9 Hours)	
2.1	Guided media and UnGuided media	2
2.2	Data and signals	3
2.3	Transmission impairments	2
2.4	Data rate limits and performance	2
3	Digital data transmission (10 Hours)	
3.1	Digital to digital Conversion	5
3.2	Transmission modes	1
3.3	Encoding analog data into analog signals	1
3.4	Encoding analog data into digital signals	2
3.5	Keying Techniques	1
4	Bandwidth utilization: Multiplexing and Spectrum spreading, Switching (7 Hours)	
4.1	Multiplexing	3
4.2	Spread spectrum	2
4.3	Basic Principles of switching	2
5	Media Access Control and Wireless LANs (12 Hours)	
5.1	Random Access	2
5.2	Channelization	1
5.3	Wireless LANs	5
5.4	Other Wireless networks	4

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT285	SOFTWARE ENGINEERING	VAC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of understanding essential concept of software engineering and software development process.

Prerequisite: Basics of programming

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO1	Summarize different software development models	Level 2: Understand
CO2	Identify methods for requirement analysis, specification, design & testing	Level 3: Apply
CO3	Explain the software quality maintenance measures	Level 2: Understand
CO4	Explain the role of people in Software Engineering	Level 2: Understand
CO5	Analyze the risk factors and project management in Software Development	Level 3: Apply
CO6	Illustrate the legal and business aspects of Software Engineering	Level 2: Understand

Mapping of course outcomes with program outcomes

COs	PROGRAMME OUTCOMES (PO)											
	K3 PO1	4 PO2	5 PO3	5 PO4	6 PO5	3 PO6	2 PO7	3 PO8	3 PO9	3 PO10	3 PO11	3 PO12
CO1	1	2	3	-	3	2	-	2	3	1	2	1
CO2	2	3	3	1	3	-	-	1	2	2	3	1
CO3	1	1	-	-	3	1	-	1	-	1	-	1
CO4	-	1	-	1	-	1	-	1	3	3	2	1
CO5	3	3	-	1	2	-	-	-	-	-	2	1
CO6	-	-	-	-	-	3	-	3	-	-	2	1

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain importance of different phases of software development
2. List out the advantages and disadvantages of Spiral model
3. Illustrate the advantages of Agile model over other models.
4. Describe waterfall model in detail.
5. Explain Agile model in detail

Course Outcome 2 (CO2):

1. List out the requirement specification methods
2. Describe different architecture styles
3. Identify different UML diagrams to do software design
4. Explain unit, integration and system testing in detail.
5. Differentiate different system models.
6. Develop an SRS for a MobileApp that does caller identification.

Course Outcome 3 (CO3):

1. Write short note on reliability metrics.

2. Illustrate the steps in software configuration management.
3. Explain the functioning of DevOps.

Course Outcome 4 (CO4):

1. Analyze the role of users and staff in problem solving.
2. Identify the people factors in human driven software engineering.
3. Discuss the responsibilities of each personnel in a project.

Course Outcome 5 (CO5):

1. Analyze the risk factors in a MobileApp project
2. Describe the phases of software project management
3. Examine different types of documents generated during the software development.
4. Explain the software maintenance methods.
5. Discuss the responsibilities of a project manager.

Course Outcome 6 (CO6):

1. Describe intellectual property in the context of software.
2. Summarize the data privacy policies in software engineering
3. Illustrate different business models with examples.

Model Question Paper

PART A **(10*3=30)**
(Each Question carries 3 Marks)

1. List out the advantages and disadvantages of Spiral model
2. Examine the importance of different phases of software development
3. Classify the software requirements.
4. Compare and contrast decision tree and decision table.
5. Summarize the objectives of testing.
6. Differentiate cohesion and coupling in software design.
7. Write short note on reliability metrics.
8. Analyze the role of users in problem definition.
9. Analyze the risk factors in a MobileApp project
10. Summarize the data privacy policies in software engineering

PART B **(5*14=70)**

11. Describe each phase is software development life cycle in detail.

OR

12. Explain Agile model in detail
13. Discuss the formal methods of requirement specification

OR

14. Demonstrate the format of an SRS with a suitable example.
15. Illustrate different architecture styles with neat diagrams

OR

16. Identify different UML diagrams to do software design
17. Illustrate the steps in software configuration management

OR

18. Discuss the responsibilities of each personnel in a project
19. Describe the phases of software project management

OR

20. Illustrate different business models with examples.

Syllabus

Module 1: Introduction to Software Engineering
Software Engineering -Introduction and Overview- Software Process Models.
Module 2: Feasibility Study, Requirements Analysis & specification
Feasibility Study. Requirements Analysis & specification, Modeling Techniques.SRS
Module 3: Software Design, Software Testing
Software design, System Models, Design Methods. System Architecture, Object Oriented Design. Software Testing -Testing Documentation and Help Facilities.
Module 4: Software Reliability, SCM, People and Software Engineering
Software Reliability, Testing and bug fixing Tools, Software Configuration Management, Software Project Management, People and Software Engineering.
Module 5: Software documentation, delivery & maintenance, SPM, legal & business aspects
Software documentation, delivery & maintenance, Software Project Management, Legal Aspects of Software Engineering, Business Aspects of Software Engineering.

Text Books

- T1. Roger S. Pressman, Software Engineering: A practitioner's approach, 8th Edition (Indian Edition), McGraw Hill. 2019
- T2. Rajib Mall, Fundamentals of Software Engineering, 5th Edition, Prentice Hall India. 2018

Reference Books

- R1. Pankaj Jalote, An integrated approach to Software Engineering, 3rd Edition, Springer/Narosa.
- R2. Ian Sommerville, Software Engineering, 10th Edition, Addison-Wesley
- R3. Sunitha EV, Sarath KS, Software Development Life Cycle: Theory vs Practice, Jyothis Publishers, 2019.
- R4. Pfleeger, Atlee, Software Engineering Theory and Practice, 4 edition, 2009, Pearson.
- R5. Grady Booch, Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson.

Course Contents and Lecture Schedule

Sl.No	Module 1: Introduction to Software Engineering	7hrs
1.1	Introduction to Software Engineering - overview of the software development process, importance of each step in software development, Cases of software project failures of major companies.	1
1.2	Software Process Models - Waterfall model - phases, pros and cons of the model, application (detailed description of each phase is required)	2
1.3	Prototyping model - phases, pros and cons of the model, application	1
1.4	Spiral model - phases, pros and cons of the model, application	1
1.5	Rapid Software Development , Agile model - phases, pros and cons of the model, application	2
	Module 2: Feasibility Study, Requirements Analysis & specification	9 hrs
2.1	Feasibility Study - methods, feasibility report	1
2.2	Requirements Analysis & specification - importance of requirements, types of requirements, Requirement Analysis, modeling and specification steps.	1
2.3	Scenarios and Use Cases - case study	1
2.4	Informal Methods of Specification - advantages and disadvantages Formal Methods of Specification - Axiomatic and Algebraic specifications	2
2.5	Modeling Techniques for Requirements Analysis and Definition - DFD – ER Diagrams – Decision tables – Decision Trees	3
2.6	Software Requirement Specification - format, importance, fit and gap analysis	1
	Module 3: Software Design, Software Testing	12 hrs
3.1	Software design – Cohesion and Coupling, Usability, UI/UX design, System Models: Data-flow models, Semantic data models, Object models. Design Methods- object oriented and function oriented.	3
3.2	System Architecture - Architectural Styles, Software Considerations of System Architectures.	1

3.3	Object Oriented Design – overview of UML diagrams, Tools and Techniques, design reuse.	2
3.4	Web App and Mobile App design – responsive design.	1
3.5	Software Testing - Objectives of testing, Testing Principles. Functional and Structural testing	3
3.6	Generation of test data - Test Plan - Unit testing – Integration testing – System testing. Testing GUIs, Test reporting, Testing Documentation and Help Facilities.	1
3.7	Testing Object-Oriented Applications, Web Apps and Mobile Apps	1
	Module 4: Software Reliability, SCM, People and Software Engineering	9 hrs
4.1	Software Reliability - Reliability metrics, The development process Reviews, Different aspects of reliability Programming techniques, Testing and bug fixing Tools, Performance testing.	3
4.2	Software Configuration Management – steps, features and tools, case study with DevOps.	2
4.3	People and Software Engineering - Software Development Staff and roles, The importance of people in problem solving process: The Role of Users in Problem definition;	2
4.4	Human driven software engineering; The people factor – Multidisciplinary aspects; The team factor; The customer factor.	2
	Module 5: Software documentation, delivery & maintenance, SPM, legal & business aspects	8 hrs
5.1	Software documentation, delivery & maintenance , Categories of Documentation, categories of software products, software maintenance methods.	2
5.2	Software Project Management - phases of Project Management, Project plan, Risk analysis.	2
5.3	Legal Aspects of Software Engineering- Contracts and licenses, Software Copyright, Software Patents, Trade Secrets and Non-Disclosure Agreements, Privacy.	2
5.4	Business Aspects of Software Engineering - Business Models. Emerging Trends in Software Engineering	2



SEMESTER -4

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT202	PRINCIPLES OF OBJECT ORIENTED TECHNIQUES	PCC	3	1	0	4

Preamble:

This course is intended to make the students capable of

1. Compare the capabilities of Object oriented and Procedure oriented programming languages.
2. Model the problem scenarios using object oriented concepts and UML.
3. Develop robust programs by optimally utilising the capabilities JAVA programming language.

Prerequisite: Programming Concepts

Course Outcomes: After the completion of the course the student will be able to

CO No	Course Outcomes	Bloom's Category
CO 1	Describe the specific capabilities of Object-Oriented paradigm compared to procedure oriented paradigm	Understand
CO 2	Explain the use of object oriented concepts to analyse the given problem.	Understand
CO 3	Describe the different inheritance features available in Java	Understand
CO 4	Construct robust programs using Exception Handling	Apply
CO 5	Construct applets utilising multithreading, event handling and Graphical User Interface, also model the problem scenarios using UML diagrams.	Apply

Mapping of course outcomes with program outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	3	-	2	-	-	-	-	-	-	1
CO 2	2	3	3	-	2	-	-	-	-	-	-	-
CO 3	2	3	3	-	2	-	-	-	-	-	-	-
CO 4	2	3	3	-	2	-	-	-	-	-	-	-
CO 5	2	3	3	-	2	-	-	-	-	-	-	-

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember			
Understand	25	25	50
Apply	25	25	50
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Compare and contrast the implementation of data abstraction in procedure oriented and object oriented language.
2. Explain how encapsulation helps in data security. Justify your answer by comparing the scenario in procedure oriented languages.
3. Describe TWO features of object oriented programming languages that promote code reuse.

Course Outcome 2 (CO2):

1. Describe about the statement “String is a primitive data type or not in C++.
2. Describe the use of ‘static’ functions in C and Java.

Course Outcome 3(CO3):

1. Explain the difference between the object oriented design concepts of generalisation and specialisation, and describe how these relate to the inheritance feature in object oriented programming languages.
2. Describe how is-a and has-a inter-class relationships may be implemented in object oriented programming, giving code examples to support your answer.
3. What is multiple inheritance? Discuss how multiple inheritance is implemented in Java.

Course Outcome 4(CO4):

1. Experiment with runtime and compile time errors. Would you rather have an error discovered at run time or compile time?
2. Experiment with out of bound exception with example code.
3. Build java programs using following constructs.
 - a) try {}
 - b) catch {}
 - c) throw()

Course Outcome 5(CO5):

1. Experiment with multithreaded applets.
2. Experiment with inter-process communication mechanism in java.
3. Design a class diagram of the following System: Vending Machine. A vending machine sells small, packaged, ready to eat items (chocolate bars, cookies, candies, etc.). Each item has a price and a name. A customer can buy an item, using a smart card (issued by the vending machine company) to pay for it. No other payment forms (i.e. cash, credit card) are allowed. The smart card records on it the amount of money available. The functions supported by the system are: Sell an item(choose from a list of items, pay item, distribute item)Recharge the machine Set up the machine (define items sold and price of items)Monitor the machine (number of items sold, number of items sold per type, total revenue)The

system can be used by a customer, a maintenance employee (who recharges items in the machines), an administrator (who sets up the machine).

Model Question paper

Course Code: ITT202

Course Name: PRINCIPLES OF OBJECT ORIENTED TECHNIQUES

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. Explain the use of 'static' functions in C and Java.
2. Comment on the statement "String is a primitive data type or not in C++.
3. Explain the use of 'this' keyword in Java.
4. Write a short note on implementation of "write once, run anywhere" concept in Java
5. Explain encapsulation using class in java.
6. Write short note on inner calsss in Java.
7. Explain the use of dynamic method dispatch.
8. Differentiate between 'throw', 'throws', and 'Throwable'.
9. Explain event handling model with diagram.
10. Write short note on sand box security model for applets.

Part B

Answer any one Question from each module. Each question carries 14 Marks

- 11.a) Compare and contrast the implementation of data abstraction in procedure oriented and object oriented language. 7Marks
- b) Discuss how encapsulation helps in data security. Justify your answer by comparing the scenario in procedure oriented languages. 7 Marks

OR

12. a) Write a short note on garbage collection in java. 6 Marks
- b) Describe with example, TWO features of object oriented programming languages that promote code reuse. 8 Marks

13. a) Compare and contrast overriding and overloading with examples.

6 Marks

b) With an example, discuss the use of passing objects as parameters.

8 Marks

OR

14.a) Discuss the uses of 'static' keyword with example scenarios. 7 marks

b) Examine the use of 'final' keyword in the context of access control.

7Marks

15.a) Explain the difference between the object oriented design concepts of generalisation and specialisation, and describe how these relate to the inheritance feature in object oriented programming languages.

6 marks

b) Describe how is-a and has-a inter-class relationships may be implemented in object oriented programming, giving code examples to support your answer.

8 Marks

OR

16.a) What is multiple inheritance? Discuss how multiple inheritance is implemented in Java.

7 marks

b) Compare and contrast the usage of abstract class and interface in Java. Give examples of each.

7 Marks

17.a) Discuss the difference between runtime and compile time errors. Would you rather have an error discovered at run time or compile time?

8 Marks

b) Explain out of bound exception with example code.

6 marks

OR

18. a) Explain the use of following constructs in Java with example.

i)try {}

ii)catch {}

iii)throw()

6 Marks

b) Elaborate on the interprocess communication mechanism in java.

8 Marks

19. a) Discuss how to implement a multithreaded applet with an example.

6 Marks

b) Explain with an example the event model in Java.

8 Marks

OR

20. a) Differentiate between static and dynamic models in UML. 4 Marks

b) Draw a class diagram of the following System: Vending Machine. A vending machine sells small, packaged, ready to eat items (chocolate bars, cookies, candies, etc.). Each item has a price and a name. A customer can buy an item, using a smart card (issued by the vending machine company) to pay for it. No other payment forms (i.e. cash, credit card) are allowed. The smart card records on it the amount of money available. The functions supported by the system are: Sell an item (choose from a list of items, pay item, distribute item) Recharge the machine Set up the machine (define items sold and price of items) Monitor the machine (number of items sold, number of items sold per type, total revenue) The system can be used by a customer, a maintenance employee (who recharges items in the machines), an administrator (who sets up the machine).

10 Marks

Syllabus

Module 1	No. of Lectures
Object-Oriented Programming vs Procedure-Oriented Programming, Procedural Languages - The Object-Oriented Approach - Characteristics of Object-Oriented Languages Objects –Classes – Inheritance – Reusability - Creating New Data Types - Polymorphism and Overloading ,Object oriented concepts in Java -Java Overview: Java virtual machine, data types, operators, control statements, Classes fundamentals, objects, methods, constructors, this keyword, Garbage collection	10 hours
Module 2	
Overloading Methods, Overloading Constructors, Using Objects as Parameters, Call by value and Call by reference, Access control, use of static and final keywords, Nested and Inner classes	8 hours
Module 3	
Derived Class and Base Class, Usage of super keyword, Creating a Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Definition and application of Packages and Interfaces	8 hours
Module 4	
Fundamentals of exception handling, Exception Types, Using try and catch, throw, throws, finally, Java's Built-in Exceptions, Creating Exception subclasses, the Java Thread Model, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization, Interthread	9 hours

Communication	
Module 5	
Event Handling-delegation event model, event classes, sources, listeners. String class - basics. Applet basics and methods, AWT- working with frames, graphics, color, font. AWT Control fundamentals. Swing overview, Introduction to Object Oriented Modelling ,Unified Modeling Language, UML class diagram, Use-case diagram, Familiarisation of UML tools, Case study	10 hours

Text Books

1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
2. Bahrami A., Object Oriented Systems Development using the Unified Modeling Language, McGraw Hill, 1999.

Reference Books

1. Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.
2. Sierra K., Head First Java, 2/e, O'Reilly, 2005.
3. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.
4. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.
5. James Rumbaugh., Unified Modeling Language Reference Manual, Addison-Wesley Professional, 2005

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Object Oriented concepts	10 Hours
1.1	Object-Oriented Programming vs Procedure-orientated Programming, Procedural Languages - The Object-Oriented Approach - Characteristics of Object-Oriented Languages	3 hours
1.2	Objects –Classes – Inheritance – Reusability - Creating New Data Types - Polymorphism and Overloading	3 hours
1.3	Object oriented concepts in Java -Java Overview: Java virtual machine, data types, operators, control statements, Classes fundamentals, objects, methods, constructors, this keyword, Garbage collection	4 hours
2	Method overloading	8 Hours

2.1	Overloading Methods, Overloading Constructors, Using Objects as Parameters	4 hours
2.2	Access control, use of static and final keywords, Nested and Inner classes	4 hours
3	Inheritance	8 Hours
3.1	Derived Class and Base Class, Usage of super keyword, Creating a Multilevel Hierarchy, Method Overriding	4 hours
3.2	Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Definition and application of Packages and Interfaces	4 hours
4	Exception handling and Multithreaded Programming	9 Hours
4.1	Fundamentals of exception handling, Exception Types, Using try and catch, throw, throws, finally, Java's Built-in Exceptions, Creating Exception subclasses.	4 hours
4.2	The Java Thread Model, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization, Interthread Communication	5 hours
5	Event Handling, AWT and UML	10 Hours
5.1	Event Handling-delegation event model, event classes, sources, listeners. String class – basics. Applet basics and methods	3 hours
5.2	AWT- working with frames, graphics, color, font. AWT Control fundamentals. Swing overview	3 hours
5.3	Introduction to Object Oriented Modelling-Unified Modelling Language, UML class diagram, Use-case diagram, Familiarisation of UML tools, Case study	4 hours

Estd.



2014

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT204	COMPUTER ORGANIZATION	PCC	3	1	0	4

Preamble

This syllabus has been prepared to meet the following objectives.

1. To impart an understanding of the internal organization and operations of a computer.
2. To introduce the concepts of processor logic design.
3. To introduce the concept of pipe-lining and its hazards.
4. To understand and analyze various issues related to memory hierarchy.
5. To introduce the various modes of data transfer between CPU and I/O devices.

Prerequisite: ITT201 Digital System Design

Course Outcomes: After the completion of the course the student will be able to

CO No	Course Outcome(CO)	Bloom's Category
CO 1	Describe the basic organization of computer and different instruction formats and addressing modes.	Understand
CO 2	Analyze the basic operations and sequencing of control signals	Analyze
CO 3	Represent the design of registers and arithmetic logic unit	Understand
CO 4	Examine the concept of pipe-lining and various hazards associated with it	Analyze
CO 5	Compare the performance of memory systems like cache and DRAM and Select appropriate interfacing standards for I/O devices.	Analyze

Mapping of course outcomes with program outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	1	1
CO2	3	3	3	2	-	-	-	-	-	-	1	1
CO3	3	2	3	-	-	-	-	-	-	-	1	1
CO4	3	3	3	3	2	-	-	-	-	-	1	2
CO5	3	3	3	3	1	-	-	-	-	-	1	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Test		End-Semester Examination
	1	2	
Remember	12	8	16
Understand	10	12	24
Apply	20	20	40
Analyse	8	10	20
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Continuous Assessment Test (2 numbers) : 25 marks
 Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1.Explain the importance of different addressing modes in computer architecture with suitable example

2.How is the operation $X = (A + B) * (C + D) / (E+F)$ is performed using:

- Three address instruction
- Two address instruction
- One address instruction

Course Outcome 2 (CO2):

1. Enumerate the sequence of actions involved in executing an unconditional branch instruction.
2. Write down the sequence of actions needed to fetch and execute the instruction:
Store R6, X(R8).

Course Outcome 3 (CO3):

1. Draw the block diagram for the hardware that implements the following statement $x + yz: AR \leftarrow AR + BR$ where AR and BR are two n-bit registers and x, y, and z are control variables. Include the logic gates for the control function. (The symbol + designates an OR operation in a control or Boolean function and an arithmetic plus in a micro operation.)
2. Illustrate the difference in performance of an Arithmetic Right Shifter & a Logical Right Shifter

Course Outcome 4 (CO4):

1. A 5-stage pipelined processor has Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Perform Operation (PO) and Write Operand (WO) stages. The IF, ID, OF and WO stages take 1 clock cycle each for any instruction. The PO stage takes 1 clock cycle for ADD and SUB instructions, 3 clock cycles for MUL instruction, and 6 clock cycles for DIV instruction respectively. Operand forwarding is used in the pipeline. What is the number of clock cycles needed to execute the following sequence of instructions?

Instruction	Meaning of instruction
I1 :MUL R2 ,R0 ,R1	$R2 = R0 * R1$
I1 :DIV R5 ,R3 ,R4	$R5 = R3 / R4$
I2 :ADD R2 ,R5 ,R2	$R2 = R5 + R2$
I3 :SUB R5 ,R2 ,R6	$R5 = R2 - R6$

2. The instruction pipeline of a RISC processor has the following stages: Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Perform Operation (PO) and Writeback (WB), The IF, ID, OF and WB stages take 1 clock cycle each for every instruction. Consider a sequence of 100 instructions. In the PO stage, 40 instructions take 3 clock cycles each, 35 instructions take 2 clock cycles each, and the remaining 25 instructions take 1 clock cycle each. Assume that there are no data hazards and no control hazards. How many clock cycles are required for completion of execution of the sequence of instruction?

Course Outcome 5 (CO5):

1. A computer has a 256 KByte, 4-way set associative, write-back data cache with block size of 32 Bytes. The processor sends 32 bit addresses to the cache controller. Each cache tag directory entry contains, in addition to address tag, 2 valid bits, 1 modified bit and 1 replacement bit. How many bits are there in the tag, set and word field of an address?
2. Discuss DRAM scheduling policies.

Course Outcome 6 (CO6):

1. What is the basic advantage of using interrupt initiated data transfer over transfer under program control without an interrupt? What is asynchronous data transfer? Explain in detail.
2. Explain the working of Universal Serial Bus (USB).

Model Question Paper**PART A****(10*3=30)****(Each question carries 3 Marks)**

1. What are fundamental phases of the instruction cycle?
2. The register R1 = 12, and R2= 13. The instruction ADD R1, R2 is in memory location 2000H. After the execution of the instruction, what will be the value of PC, MAR, IR and R1?.
3. What do you meant by logic micro operations?
4. Design a 4bit combination logic shifter.
5. "Increasing the number of pipeline stages will decrease the execution time of the program". True or False? Justify your answer.
6. What is operand forwarding? What is its significance?
7. For a 16KB, 4-way associative cache with block size 16 bytes, what is the number of tag bits per block if the physical address capacity is 16MB?
8. List the advantages of memory interleaving
9. Compare Polling and Vectored Interrupts.
10. What is DMA? What do you meant by Burst mode?

PART B**(5*14=70)****(Each full question carries 14 marks)**

- 11.a) Discuss the sequencing of control signals for the following instructions.

i) Load R1,10(R2) ii) Add R1, R2 (8 marks)

b) Compare and contrast memory mapped IO over programmed IO. (6 marks)

- 12.a) Illustrate with example, explain the different types of addressing modes in a RISC processor. (9 marks)

b) Discuss how stack used for subroutine call. (5 marks)

- 13.a) Design a 4 bit arithmetic unit with two selection variables s0 and s1 and two n-bit data inputs A&B and input carry Cin

s1	s2	Cin=0	Cin=1	
0	0	F=A	F=A+1	
0	1	F=A+B	F=A+B+1	
1	0	F=A+B'	F=A+B'+1	
1	1	F=A-1	F=A	

(9 marks)

b) Explain the design of an accumulator.

(5 marks)

OR

14. a) Design an adder/subtractor circuit with one selection variable s and two inputs A and B . When $s=0$, the circuit performs $A+B$ and when $s=1$ it performs $A-B$, by taking 2's complement of B . (9marks)

b) Explain the design of status register. (5 marks)

15.a) Consider an instruction pipeline with four stages with the stage delays 5 nsec, 6 nsec, 11 nsec, and 8 nsec respectively. The delay of an inter-stage register stage of the pipeline is 1 nsec. What is the approximate speedup of the pipeline in the steady state under ideal conditions as compared to the corresponding non-pipelined implementation? (5 marks)

b) Discuss structural hazards and control hazards with examples (9 marks)

OR

16. a) A 5-stage pipelined processor has the stages: Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Execute (EX) and Write Operand (WO). The IF, ID, OF, and WO stages take 1 clock cycle each for any instruction. The EX stage takes 1 clock cycle for ADD and SUB instructions, 3 clock cycles for MUL instruction, and 6 clock cycles for DIV instruction. Operand forwarding is used in the pipeline (for data dependency, OF stage of the dependent instruction can be executed only after the previous instruction completes EX). What is the number of clock cycles needed to execute the following sequence of instructions?

MUL R2,R10,R1

DIV R5,R3,R4

ADD R2,R5,R2

SUB R5,R2,R6

(7 marks)

b) Discuss various types data hazards in a RISC Instruction pipeline with appropriate examples. (7 marks)

17. a) Consider an application running on a multiprocessor system that takes 600 cycles, (during which processors are stalled), to handle a local cache miss leading to referencing a remote memory. The CPI for all references that hit in cache is 1 cycle. If 0.2% of cache access result in a local miss, how much faster will the system run if it has a perfect cache that never miss. (5 marks)

b) Discuss organization of DRAM in detail. (9 marks)

OR

18.a) Discuss open page and closed page row buffer management policy in DRAM Controller (9 marks)

b) Given a cell array of 8K(8192), with Clock cycle=4 and Clock Rate=133MHZ. In DRAM, the period for refreshing all rows is 16ms whereas 64ms in SDRAM. Find out the Refresh Overhead of SDRAM when compared to DRAM (5 marks)

19.a) Discuss different types of interrupt handling methods (7 marks)

b) Explain the working of SCSI. (7 marks)

OR

20.a) Discuss various bus arbitration methods. (7 marks)

b) Explain the working of PCI. (7 marks)

Syllabus

Module 1 (10 hours)
Basic Structure and Operation of Computers – functional units –operational concepts – memory operations – addressing modes – instruction sequencing – basic I/O – subroutine calls – execution of a complete instruction – sequencing of control signals.
Module 2 (8 hours)
Processor Logic Design and Organization – register transfer logic – micro operations – conditional control statements. Design of arithmetic unit, logic unit, ALU and shifter – Accumulator.
Module 3 (9 hours)
RISC – RISC instruction set – pipelining – hazards and mitigation.
Module 4 (11 hours)
Memory – cache memory, mapping and performance improvement. DRAM organization. Memory controllers-scheduling
Module 5 (7 hours)
Peripheral Subsystem – I/O organization – interrupts – DMA – bus arbitration – standard I/O interfaces.

Text Books:

1. Patterson D.A. and J. L. Hennessey, Computer Organization and Design, 5/e, Morgan Kauffmann Publishers, 2013.
2. Hamacher C., Z. Vranesic and S. Zaky, Computer Organization, 5/e, McGraw Hill, 2011.
3. M. Morris Mano, Computer System Architecture, 3/e, Pearson Education, 2007.
4. Bruce Jacob, David T. Wang, and Spencer Ng, Memory Systems: Cache, DRAM, Disk, 1/e Morgan Kauffmann Publishers, 2007.

References:

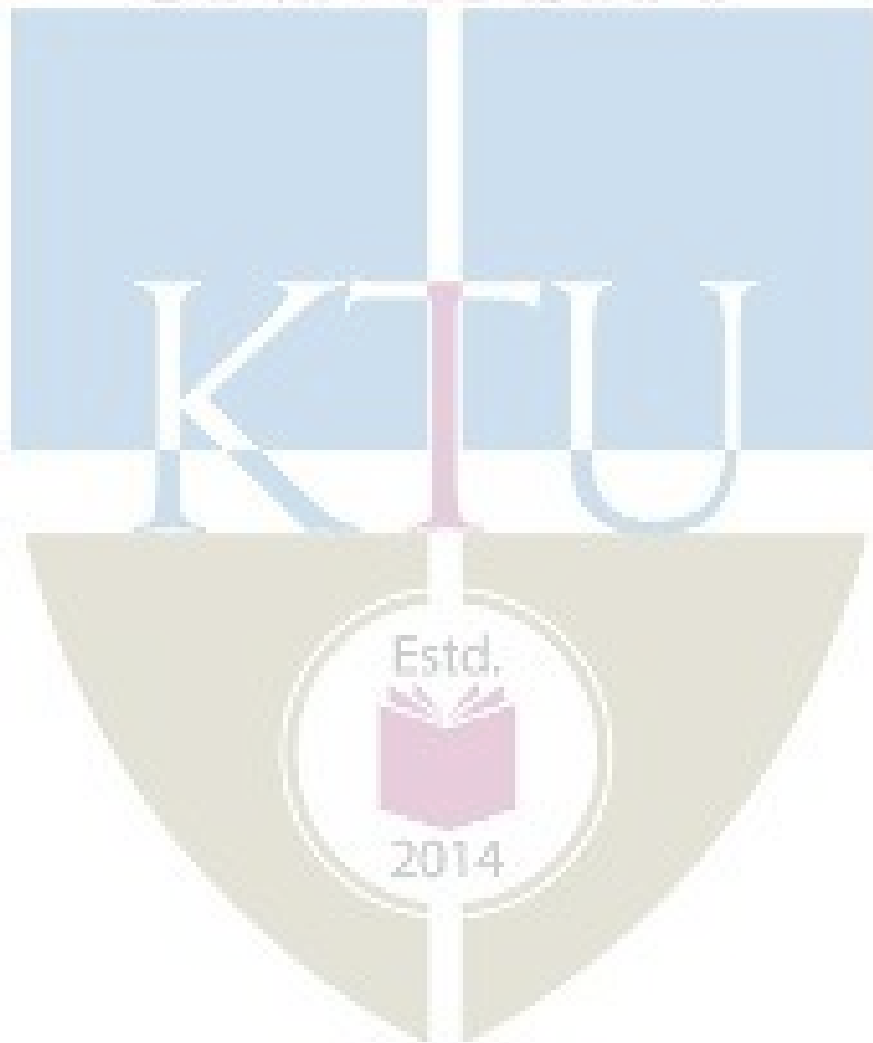
1. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson, 9/e, 2013.
2. Computer Architecture: Pipelined and Parallel Processor Design M.J. Flynn Published by Narosa Publishing House, 2012
3. Rajaraman V. and T. Radhakrishnan, Computer Organization and Architecture, Prentice Hall, 2011.
4. Messmer H. P., The Indispensable PC Hardware Book, 4/e, Addison-Wesley, 2001

Course Content & Lecture Schedule

Module 1: Fundamentals of Computer Organization		10 hours
1.1	Basic Structure of computers – functional units – basic operational concepts – bus structures – software.	2 hours
1.2	Memory locations and addresses – memory operations – instructions and instruction sequencing – addressing modes – ARM Example (programs not required).	4 hours
1.3	Basic I/O operations – stacks, subroutine calls. Basic processing unit – fundamental concepts – instruction cycle – execution of a complete instruction – multiple-bus organization – sequencing of control signals.	4 hours
Module 2: Processor Logic Design		8 hours
2.1	Register transfer logic – inter register transfer – arithmetic, logic and shift micro operations – conditional control statements.	4 hours
2.2	Design of arithmetic unit, logic unit, arithmetic logic unit and shifter – status register – processor unit – design of accumulator.	4 hours
Module 3: RISC Instruction Pipelining		9 hours
3.1	Introduction to RISC instruction set, load store architecture	3 hours
3.2	Overview of pipelining, pipelined datapath and control	2 hours
3.3	Pipeline hazards, hazard mitigation techniques.	4 hours
Module 4: Memory system : Cache & DRAM		11 hours
4.1	Introduction to cache memory, cache mapping, block replacement techniques, measuring and improving cache performance .	4 hours
4.2	Introduction to DRAM system, DRAM organization-Memory interleaving.	2 hours
4.3	Memory controllers, Address mapping, DRAM Scheduling policies, Row Buffer management policies- DRAM Refreshing	5 hours

Module 5: Peripheral Subsystem		7 hours
5.1	I/O organization: accessing of I/O devices –interrupts	2 hours
5.2	Direct memory access –buses –bus arbitration	2 hours
5.3	Interface circuits –standard I/O interfaces (PCI, SCSI, USB)	3 hours

APJ ABDUL KALAM
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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT206	Database Management Systems	PCC	3	1	0	4

Preamble: Database Management Systems course is intended to deliver students the elementary concepts of a database management system and equips them to design and implement a database application built over those concepts. It also introduces to them advanced level areas like transaction processing, concurrency control and recovery management. The current trend, unstructured data - NoSQL is unveiled too.

Prerequisite: NIL

Course Outcome (CO): After completion of the course, the student will be able to

CO No.	CO	Bloom's Category
CO1	Describe the fundamental concepts of databases.	Understand
CO2	Construct an Entity-Relationship (ER) model and transform to relational schema.	Apply
CO3	Develop queries for relational database in the context of practical applications.	Apply
CO4	Model and design relational databases following the design principles.	Apply
CO5	Describe the concepts of control and recovery techniques in transaction processing and NoSQL database.	Understand

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	1	1	2	2	3	-	-	-	-	-	-	2
CO4	2	2	3	2	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		End Semester Examination (Marks)
	1	2	
Remember	5		30
Understand	30	20	30
Apply	15	30	40

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

CO1: Explain 3-Schema architecture of database system with the help of a neat diagram.

CO2: Construct an ER diagram for a college database given the following statements:

- A college contains many departments
- Each department can offer any number of courses
- Many instructors can work in a department
- An instructor can work only in one department
- For each department there is a Head
- An instructor can be head of only one department

- Each instructor can take any number of courses
- A course can be taken by only one instructor
- A student can enroll for any number of courses
- Each course can have any number of students

CO3: Build SQL queries for each of the following relation schema given below:

employee (employee-name, street, city)

works (employee-name, company-name, salary)

company (company-name, city)

manages (employee-name, manager-name)

- Find the names, street addresses, and cities of residence of all employees who work for First Bank Corporation and earn more than \$10,000.
- Find all employees in the database who do not work for First Bank Corporation.
- Find all employees in the database who earn more than each employee of Small Bank Corporation.
- Find the company that has the most employees.
- Find those companies whose employees earn a higher salary, on average, than the average salary at First Bank Corporation.

CO4: Experiment with the table shown below:

<i>branchNo</i>	<i>branchAddress</i>	<i>telNos</i>
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618, 503-555-2727, 503-555-6534
B002	City Center Plaza, Seattle, WA 98122	206-555-6756, 206-555-8836
B003	14 – 8th Avenue, New York, NY 10012	212-371-3000
B004	16 – 14th Avenue, Seattle, WA 98128	206-555-3131, 206-555-4112

- Why is this table not in 1NF?
- Describe and illustrate the process of normalizing the data shown in this table to third normal form (3NF).
- Identify the primary, alternate and foreign keys in your 3NF relations.

CO5: Consider the following four schedules due to three transactions (indicated by the subscript) using read and write on a data item x , denoted by $r(x)$ and $w(x)$ respectively. Check which one of them is conflict serializable.

- a. $r_1(x); r_2(x); w_1(x); r_3(x); w_2(x)$
- b. $r_2(x); r_1(x); w_2(x); r_3(x); w_1(x)$
- c. $r_3(x); r_2(x); r_1(x); w_2(x); w_1(x)$
- d. $r_2(x); w_2(x); r_3(x); r_1(x); w_1(x)$

Model Question paper

Course Code: ITT 206

Course Name: Database Management Systems

Max.Marks:100

Duration: 3 Hours

Part-A

(Answer all questions. Each question carries 3 marks)

1. List three significant differences between a file-processing system and a DBMS.
2. List three reasons why database systems support data manipulation using a declarative query language such as SQL, instead of just providing a library of C or C++ functions to carry out data manipulation.
3. Why are duplicate tuples not allowed in a relation?
4. What is union compatibility? Why do UNION, INTERSECTION, and DIFFERENCE operations require that the relations on which they are applied be union compatible?
5. What is done when INSERT operation violates one or more constraints?
6. What are assertions? How do they differ from triggers?
7. Let $R(A,B,C,D,E,P,G)$ be a relational schema in which the following FDs hold: $\{AB \rightarrow CD, DE \rightarrow P, C \rightarrow E, P \rightarrow C, B \rightarrow G\}$. What is the highest normal form the relation schema R is in?
8. Why are Armstrong's axioms considered sound and complete?
9. What are the ACID properties for data integrity in DBMS? Explain each of them.
10. Discuss about the lock compatibility matrix.

Part -B**(Answer one question from each module. Each question carries 14 marks)****Module -I**

11.

- a. Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted. Make suitable assumptions that are valid. (8 marks)
- b. Explain the 3-schema architecture for database systems with a diagram. (6 marks)

12.

- a. Construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date, and the date when the payment was received. You can make suitable and valid assumptions. (8 marks)
- b. What are the different types of database end users? Discuss the main activities of each. (6 marks)

Module -II

13.

- a. Given below is the schema of a database that keeps track of student enrollment in courses and the books adopted for each course:

STUDENT(ssn, name, major, bdate)

COURSE(course#, cname, dept)

ENROLL(ssn, course#, quarter, grade)

BOOK_ADOPTION(course#, quarter, book_isbn)

TEXT(book_isbn, book_title, publisher, author)

Using relational algebra specify the following queries:

- List the number of courses taken by all students named John Smith in Winter 2009 (i.e., Quarter=W09).
- Produce a list of textbooks (include Course#, Book_isbn, Book_title) for courses offered by the 'IT' department that have used more than two books.
- List any department that has all its adopted books published by 'Pearson Publishing'.

(9 marks)

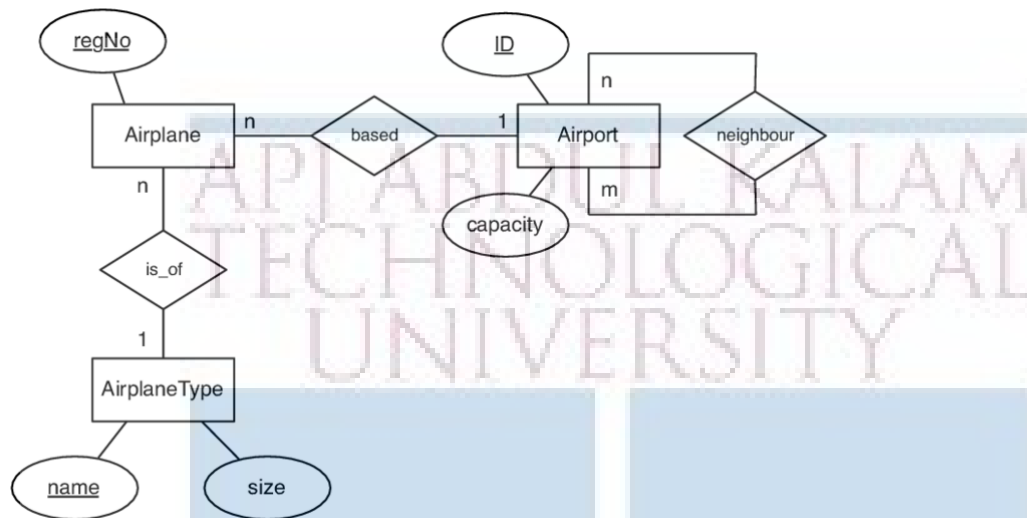
- b. What are the possible approaches for mapping binary 1:1 relations in an ER diagram?

(5 marks)

14.

a. Convert the ER model below into its equivalent relational schema:

(5 marks)



b. Consider the following relational schema for a library:

MEMBER (memb_no, name, dob)

BOOKS (isbn, title, authors, publisher)

BORROWED (memb_no, isbn, date)

Write the following queries in relational algebra:

- Find the names of members who have borrowed any book published by “McGraw-Hill”.
- Find the name and membership number of members who have borrowed more than five different books published by “MorganKaufmann”.
- For each publisher, find the name and membership number of members who have borrowed more than five books of that publisher.

(9 marks)

Module-III

15.

a. For the EMPLOYEE schema given below:

EMPLOYEE (employee_name, street, city)

WORKS (employee_name, company_name, salary)

COMPANY (company_name, city)

MANAGES (employee_name, manager_name)

write SQL queries for the following:

- Find the names and cities of residence of all employees who work for “Gramin Bank Corporation”.

- Find all employees in the database who earn more than each employee of “Co-operative Bank Corporation”.
 - Assume that the companies may be located in several cities. Find all companies located in every city in which “Kerala Bank Corporation” is located.
 - Find the company that has the most employees. (9 marks)
- b. Why does SQL not automatically eliminate duplicate tuples in the results of its queries? (5 marks)

16.

a. For the database schema given below:

STUDENT (name, stud_no, class, major)

COURSE (course_name, course_no, credit_hours, department)

SECTION (section_identifier, course_no, semester, year, instructor)

GRADE_REPORT (stud_No, section_identifier, grade)

PREREQUISITE (course_no, prerequisite_no)

write SQL queries for the following:

- Insert a new student, <‘Nikhila, 25, 1, ‘Math’>, in the database.
- Change the class of student ‘Anirudh’ to 2.
- Insert a new course, <‘Knowledge Engineering’, ‘IT4390’, 3, ‘IT’>.
- Delete the record for the student whose name is ‘Kripa’ and whose student number is

17. (9 marks)

b. What is a correlated nested query in SQL? Give an example. (5 marks)

Module -IV

17.

a. Determine if the FD sets

$F = \{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$ and

$G = \{A \rightarrow CD, E \rightarrow AH\}$ are functionally equivalent. (7 marks)

b. Illustrate the following problems with suitable examples:

- Generation of spurious tuples
- Type-2 insertion anomaly

(7 marks)

18.

a. Using Ullman’s algorithm, check whether the relation schema $R(A,B,C,D,E)$ decomposed into $R_1(A,D)$, $R_2(A,B)$, $R_3(B,E)$, $R_4(C,D,E)$ and $R_5(A,E)$ and the FD set

{A → C

B → C

C → D

DE → C

CE → A}

is lossy or lossless. (7 marks)

b. Given an FD set F= {A → BC, B → C, A → B, AB → C}. Find its minimal cover. (7 marks)

Module -V

19.

a. With a diagram, discuss the various states of a transaction. (4 marks)

b. What is log based recovery? Explain deferred database modification. (10 marks)

20.

a. Explain the two-phase locking protocol. How does it implement lock conversions to assure serializability? (10 marks)

b. What are checkpoints? How are they implemented? (4 marks)

Syllabus

MODULE 1: INTRODUCTION (9 HOURS)
Fundamentals of Database Management Systems (DBMS), Database System Concepts and Architecture, Entity-Relationship Model, ER Diagrams
MODULE 2: RELATIONAL MODEL (8 HOURS)
Relational Model Concepts, Transformation of ER diagram to Relational Schema, Relational Algebra Operations
MODULE 3: STRUCTURED QUERY LANGUAGE (SQL) (11 HOURS)
SQL Overview, Data Manipulation Language (DML), Advanced DML
Module 4: DATABASE DESIGN (7 HOURS)
Database Design Guidelines, Normalization using Functional Dependencies
Module 5: TRANSACTION PROCESSING AND INTRODUCTION TO NoSQL (10 HOURS)
Transaction Processing Concepts, Characterizing Schedules, Concurrency Control Techniques, Recovery Techniques, Introduction to NoSQL Databases

Text Books

1. Elmasri R. and S. Navathe, *Database Systems: Models, Languages, Design and Application Programming*, Pearson Education, 2013.

2. Silberschatz A., H. F. Korth and S. Sudarshan, *Database System Concepts*, 6/e, McGraw Hill, 2011.

Reference Books

1. C.J.Date, A.Kannan, S.Swamynathan, —An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
4. Xun (Brian) Wu, SudarshanKadambi, DevramKandhare, Aaron Ploetz, Seven NoSQL Databases in a Week:1st Edition, Kindle Edition.

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	Introduction	9
1.1	Fundamentals of Database Management Systems: Characteristics of DBMS, Database Users, Advantages of using DBMS.	2
1.2	Database System Concepts and Architecture: Data Models, Schemas, Instances and Database State. Three-Schema Architecture, Data Independence, Database Languages and Interfaces.	3
1.3	Entity-Relationship Model: Basic concepts - Entity, Attributes and Keys, Relationship Sets, Degree of Relationship Types, Roles and Structural Constraints.	2
1.4	ER Diagrams: Naming Conventions and Design Issues.	2
2	Relational Model	8
2.1	Relational Model Concepts: Domains, Attributes, Tuples and Relations, Relational Model Constraints and Relational Database Schemas.	3
2.2	Transformation of ER diagram to Relational Schema.	2
2.3	Relational Algebra Operations: SELECT, PROJECT, RENAME, Set Theoretic Operations, JOIN and DIVISION.	3
3	Structured Query Language	11

3.1	SQL Overview: Basic Structure, Data Definition Language Commands – CREATE, DROP and ALTER, Arithmetic Operations.	3
3.2	Data Manipulation Language: DML Commands - INSERT, SELECT, DELETE and UPDATE, Nested Queries, Set Operations, Aggregate Functions and Grouping, JOIN Operations	4
3.3	Advanced DML: Complex Queries, Views, Stored Procedures, Handling Exceptions and Triggers.	4
4	Database Design	7
4.1	Database Design Guidelines: Anomalies in Database Design – Insertion, Deletion and Modification, Functional Dependency (FD) – Closures, Armstrong's Axioms, Equivalence, Minimal Cover (proofs not required).	3
4.2	Normalization using Functional Dependencies: Normal Forms(NF) - 1NF, 2NF, 3NF and Boyce - Codd Normal Form, Lossless Join and Dependency Preserving Decompositions.	4
5	Transaction Processing and Introduction to NoSQL	10
5.1	Transaction Processing Concepts: Transaction Concepts, ACID Properties, Transaction States.	2
5.2	Characterizing Schedules: Based on Recoverability and Serializability.	2
5.3	Concurrency Control Techniques: Types of Locks, Lock Based Protocols-Two Phase Locking protocol, Timestamp Based Protocols, Deadlock and Starvation.	3
5.4	Recovery Techniques: Recovery Based on Deferred Update and Immediate Update, Shadow Paging.	2
5.5	Introduction to NoSQL Databases	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL202	OBJECT ORIENTED TECHNIQUES LAB	PCC	0	0	3	2

Preamble:

This lab is intended to make the students capable of

Understanding the importance of Object Oriented Programming in designing the Software applications,

Implementing programs using Object oriented concepts of inheritance and polymorphism,

Analysing the given problem to design multithreaded programs,

Developing robust programs using exception handling features in Java.

Prerequisite: ITT202 PRINCIPLES OF OBJECT ORIENTED TECHNIQUES

Course Outcomes: After the completion of the course the student will be able to

CO No	Course Outcome(CO)	Bloom's Category
CO 1	Solve the given problem by applying Object oriented features and Java concepts.	Apply
CO 2	Implement the concept of method and constructor overloading	Apply
CO 3	Implement the concept of inheritance Apply	Apply
CO 4	Use the concept of multithreading and modify an existing program with proper exception handling	Apply
CO 5	Build Robust programs in JAVA using AWT and SWING	Apply

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	2	-	-	-	-	-	-	1
CO 2	2	2	2	-	2	-	-	-	-	-	-	1
CO 3	2	2	2	-	2	-	-	-	-	-	-	1
CO 4	2	3	3	1	2	-	-	-	-	-	-	2
CO 5	2	3	3	1	3	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern**Mark distribution**

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
 Continuous Assessment : 30 marks
 Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

- (a) Preliminary work : 15 Marks
- (b) Implementing the work/Conducting the experiment : 10 Marks
- (c) Performance, result and inference (usage of equipments and trouble shooting) : 25 Marks
- (d) Viva voce : 20 marks
- (e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Develop a program in Java to display the details of bank account using Class.
2. Develop a program in Java to implement Stack operations using Class.
3. Construct a Java class to store some employee details and provide methods to set and get values.

Course Outcome 2 (CO2)

1. Develop a Java program to implement functions to display an input integer, string and float values using the concept of method overloading

2. The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Develop a Java program that uses both recursive and no recursive functions to print the nth value of the Fibonacci sequence

Course Outcome 3(CO3):

1. Develop a Java program to read and print students data using inheritance Class person: name, age, gender
Class student inherits from person: mark1, mark2, mark3, total marks, grade.
2. Develop a java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea() that prints the area of the given shape.
3. Suppose your institution wishes to maintain a database of its employees. The database is divided into a number of classes whose (Assistant Professor, Associate Professor, Professor etc). Construct a Super Class Person to store personal information. Derive all the above classes from the Class. Develop a Java program to specify all the classes and define functions to create the database and retrieve individual information as and when required. Support at least 5 employees on each category.

Course Outcome 4 (CO4):

1. Develop a Java application that executes two threads. One thread displays —"Hello" in every 1000 milliseconds and other displays — "World" in every 3000 milliseconds. Create the threads by extending the Thread class
2. Construct a Stack Class with proper exception handling mechanisms. While doing a Pop operation, if the stack is empty then display an error message. While doing a Push operation, if the stack is full then display corresponding error message.
3. Develop a java program that implements a multi-thread application that has three threads. First thread generates random integer for every 1 second and if the value is even, second thread computes the square of the number and prints and if the value is odd, the third thread will print the value of cube of the number.

Course Outcome 5 (CO5):

1. Develop a java program that simulates a traffic light using AWT. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected colour. Initially there is no message shown.

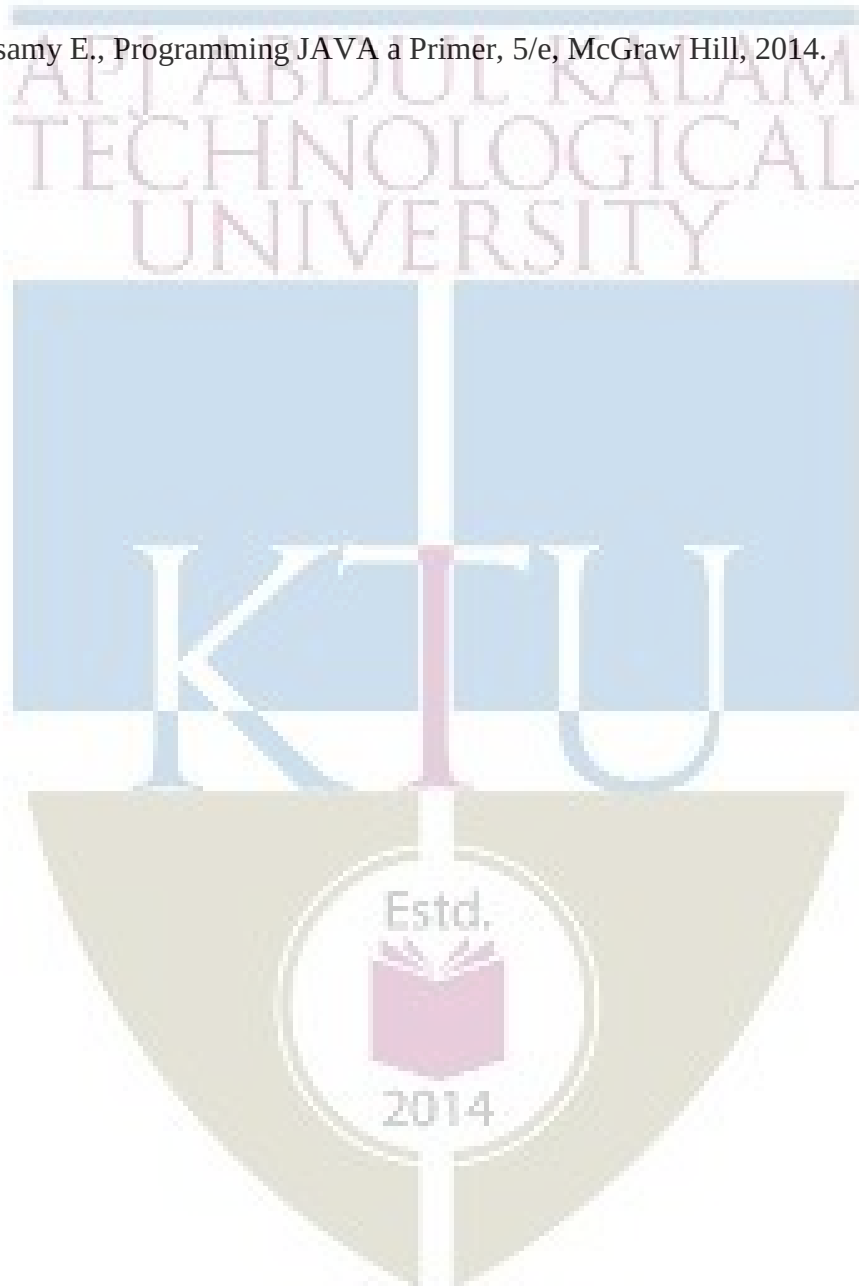
2. Develop a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box
3. Develop a Java program that works as a simple calculator using SWING. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

LIST OF EXPERIMENTS

Cycle	Name of Experiment
I	Program to implement Simple Classes for understanding objects, member functions and Constructors. write Classes having: (i) Methods without arguments (ii) Methods with argument (iii) Constructors (iv) Methods with default arguments
II	Programs to implement (i) Method overloading (ii) Constructor overloading (iii) Static functions (iv) Inner class (v) Nested classes
III	Programs to implement Inheritance
IV	Programs to implement (i) Multi threading (ii) Exception handling (iii) Thread synchronization
V	Program to implement Graphical user Interface using: (i) AWT (i) SWING

Reference Books

1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
2. Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.
3. Sierra K., Head First Java, 2/e, O'Reilly, 2005.
4. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.



CODE	COURSE NAME	CATEGORY	L	T	P	CREDI T
ITL204	DATABASE MANAGEMENT SYSTEMS LAB	PCC	0	0	3	2

Preamble:

Database Management Systems Lab course is intended to provide students a hands on experience in database management concepts. It also provides a strong formal foundation in database concepts, technology and practice to the students. It gives an exposure to design and develop applications.

Prerequisite:

CODE	COURSE NAME	DESCRIPTION	SEM
ITT206	Database Management Systems	Gives concepts of database management systems and exposure to database programming, modelling and design.	4

Course Outcomes: After completion of the course, the student will be able to

CO No.	DESCRIPTION	Blooms' Taxonomy
CO1	Construct database using DDL, DCL and basic DML commands in SQL.	Apply
CO2	Build nested and join queries.	Apply
CO3	Apply procedural SQL concepts like view, exception handling, stored procedure, function, trigger, cursor in various database applications.	Apply
CO4	Design and develop database applications.	Create

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	-	1	-	-	-	-	-	-	1
CO2	2	2	1	1	1	-	-	-	-	-	-	-

CO3	3	2	2	1	-	-	-	-	-	-	-	-
CO4	2	3	3	2	-	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	:15 marks
Continuous Assessment	:30 marks
Internal Test (Immediately before the second series test)	:30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

1.
 - a.Database Design : 10 Marks
 - b. Implementation of Project : 15 Marks
2. Performance, result and inference
(usage of application tool and trouble shooting) : 25 Marks
3. Viva voce : 20 Marks
4. Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

LIST OF EXPERIMENTS (Experiments No.10 & 11 are not mandatory)

1. Familiarization of Data Definition Language (DDL) and Data Control Language (DCL) commands.
2. Familiarization of Data Manipulation Language (DML) commands (INSERT, SELECT, DELETE and UPDATE).
3. Implementation of various Aggregate functions and Grouping in SQL.
4. Implementation of Nested Queries.
5. Implementation of Join Queries.
6. Creation of Views.
7. Creation of Stored Procedures and Functions.
8. Exception Handling in SQL.
9. Creation of Triggers and Cursors.
10. Familiarization of Transaction Control Language (TCL) Commands.
11. Familiarization of NoSQL database using MongoDB.
12. Develop an application to demonstrate database connectivity.

CLASS PROJECT (One project per group of at most four members)

Applications like Library Management System, Hospital Management System, Student Management Systems, Reservation Systems etc. can be considered as project topics.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Create a table project and for each project retrieve the project number, project name and the number of employees who work on that project.
2. Retrieve the social security number of all employees who work on project number 1, 2 or 3

Course Outcome 2 (CO2)

3. Create a table employee with employee number, name, SSN, salary and department number and display the minimum salary of employee whose salary is greater than salary of all employees in department 5.

Course Outcome 3 (CO3):

4. Create a SQL procedure application for exception using continue and exit handler

5. Create a table and perform cursor operations and trigger

Course Outcome 4 (CO4):

6. Develop a data driven GUI application in any domain (bank, library, hospital etc.)
 - a. Implementation of student management system
 - b. Implementation of any reservation system

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, McGraw-Hill Education (Asia), Fifth Edition, 2006.
2. AtulKahate, Introduction to Database Management Systems, Pearson
3. C. J. Date, A. Kannan and S. Swamynathan, An Introduction to Database Systems, Pearson Education, Eighth Edition, 2009.
4. Patrick O'Neil and Elizabeth O'Neil, Database Principles, Programming and Performance, Harcourt Asia Pte. Ltd., First Edition, 2001.
5. Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning-Course Technology, Seventh Edition, 2007.
6. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems (7th Edition), Pearson Education Ltd.
7. Shio Kumar Singh, Database Systems Concepts, Designs and Application, Pearson Education, Second Edition, 2011.





CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT282	DATABASE MANAGEMENT	VAC	3	1	0	4

Preamble: This course aims at facilitating the student to understand the various functionalities of DBMS software and perform many operations related to creating, manipulating and maintaining databases for Real-world applications and student to understand the various designing concepts, storage methods, querying and managing databases.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO_NO	Course Outcome(CO)	Bloom's Category
CO 1	Impart the basic understanding of the theory and applications of database management systems.	Level 2 : Understand
CO 2	Give basic level understanding of internals of database systems.	Level 2 : Understand
CO 3	Construct simple and moderately advanced database queries using Structured Query Language (SQL)	Level 3: Apply
CO 4	Understand and successfully apply logical database design principles and database normalization.	Level 3: Apply
CO 5	Give understanding of organization of Physical Data in DBMS and expose to some of the recent trends in databases	Level 2 : Understand

Mapping of course outcomes with program outcomes

COs \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	1	-	-	-	-	-	-	-	-	-
CO 2	2	1	2	1	-	-	-	-	-	-	-	-
CO 3	3	2	3	2	1	-	-	-	-	-	-	1
CO 4	3	2	3	2	1	-	-	-	-	-	-	1
CO 5	1	1	3	3	1	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40

Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Compare structured data and unstructured data?
2. Explain the advantages of DBMS?
3. Relate Entity, Entity Set, and Entity Type?

Course Outcome 2 (CO2)

1. Explain about Integrity Constraints
2. Describe views in DBMS?
3. Explain the purpose of DML commands in SQL

Course Outcome 3(CO3):

1. Develop SQL queries.
2. Experiment with the use of group by and having clause in sql

3. Build SQL query to find the name of the maximum salaried employee in each department

Course Outcome 4 (CO4):

1. Let $R = (A, B, C, D, E, F)$ be a relation scheme with the following dependencies:

$C \rightarrow F, E \rightarrow A, EC \rightarrow D, A \rightarrow B$. Identify the key for R ?

2. Experiment with 3NF with example
3. Make use of lossless and dependency preserving decompositions?

Course Outcome 5 (CO5):

1. Explain the use of Query Optimization
2. Compare Non-clustered and clustered index
3. Explain the concept of ACID properties in DBMS
4. Explain Semantic Web, RDF, GIS

Model Question paper

Course Code: ITT282

Course Code: DATABASE MANAGEMENT

Max Marks:100

Duration: 3hr

PART A

Answer all questions, each carries 3 marks

1. List any three categories of database users, highlighting any one important characteristic of each category.
2. In a relationship of degree 2, how can we decide if an attribute of the relationship can be moved to one of the entity sets?
3. Distinguish between total and partial participation constraints with the help of real examples.
4. Illustrate DELETE and UPDATE clauses using typical examples.
5. Given a relation $R(A,B,C,D,E,F)$ with functional dependencies $A \rightarrow B, B \rightarrow D, D \rightarrow EF, F \rightarrow A$, compute $\{D\}^+$ and $\{EF\}^+$.

6. What are fully functional dependencies and partial functional dependencies? Give an example to distinguish between these?
7. Define the following:
 - (a) physical record
 - (b) logical record
 - (c) blocking factor
8. How is clustering index different from primary index?
9. What are the desirable properties of transactions? Explain.
10. What is the significance of check-pointing. (10*3=30)

PART B

Answer all questions, each carries 14 marks

11. a) Design an ER diagram to represent the following scenario: A company has many employees working on a project. An employee can be part of one or more projects. Each employee works on a project for certain amount of time. Assume suitable attributes for entities and relations. Mark the primary key(s) and the cardinality ratio of the relations. (9)
- b) What are logical data independence and physical data independence? What is the difference between them? Which of these harder to realize? Why? (5)

OR

12. a) With the help of neat diagram, explain three schema architecture of DBMS. (9)
- b) How is weak entity type different from a strong entity type? Give an example. (5)
13. a) With the help of an example, compare DML and DDL. (6)

b) Consider the following relational schema:

Suppliers(sid:integer, sname:string, city:string, street:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

Write SQL query to find the names of all suppliers who have not supplied only blue parts.(8)

OR

14. a) Explain the aggregate functions in SQL? (6)
- b) Consider the following relational schema:

employee(empId, empName, empDept)

customer(custId, custName, salesRepId, rating)

salesRepId is a foreign key referring to empId of the employee relation. Assume that each employee makes a sale to at least one customer. Write SQL query to find the names of all the employees with all their customers having a 'GOOD' rating. (8)

15. a) Explain three uses of attribute closure algorithm (5)
 b) Given a relation $R(A, B, C, D, E, F, G, H)$ with keys BD and C and functional dependencies $D \rightarrow G$, $E \rightarrow F$ and $H \rightarrow C$, decompose the R into the highest normal form possible. (9)

OR

16. a) What are Armstrong's axioms (5)
 b) Given a relation $R(A_1, A_2, A_3, A_4, A_5)$ with functional dependencies $A_1 \rightarrow A_2 A_4$ and $A_4 \rightarrow A_5$, check if the decomposition $R_1(A_1, A_2, A_3)$, $R_2(A_1, A_4)$, $R_3(A_2, A_4, A_5)$ is lossless. (9)
 17. a) Illustrate structure of B-Tree and B+-Tree and explain how they are different. (5)

b) Consider an EMPLOYEE file with 10000 records where each record is of size 80 bytes. The file is sorted on employee number (15 bytes long), which is the primary key. Assuming un-spanned organization, block size of 512 bytes and block pointer size of 5 bytes, compute the number of block accesses needed for retrieving an employee record based on employee number if (i) No index is used (ii) Multi-level primary index is used. (9)

OR

18. a) Distinguish between dense index and sparse index (5)
 b) Explain heuristics-based query optimization. (9)
 19. a) Check if the following schedules are conflict-serializable using precedence graph. If so, give the equivalent serial schedule(s). $r_3(X)$, $r_2(X)$, $w_3(X)$, $r_1(X)$, $w_1(X)$. (7)

b) Explain the concept behind the following:

- (i) Log base recovery.
 (ii) Deferred database modification. (7)

OR

20. a) Why Concurrency Control Is Needed? What are the different types of problems we may encounter when two transactions run concurrently? Illustrate each problem with suitable examples. (7)
 b) Explain the characteristics of data in GIS. (7)

Syllabus

Module 1 (7 Hours)
Introduction: Data: structured, semi-structured and unstructured data, Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Database architectures and classification. Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets.
Module 2 (8 Hours)
Relational Model: Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema . Database Languages: Concept of DDL and DML relational algebra. Structured Query Language (SQL): Basic SQL Structure, Set operations, Aggregate Functions, nested sub-queries, Views, assertions and triggers.
Module 3 (10 Hours)
Relational Database Design: Different anomalies in designing a database, normalization, functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover. Normalization using functional dependencies, 1NF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions.
Module 4 (10 Hours)
Physical Data Organization: index structures, primary, secondary and clustering indices, Single level and Multi-level indexing, B+- Trees .Query Optimization: heuristics-based query optimization.
Module 5 (10 Hours)
Transaction Processing Concepts: overview of concurrency control and recovery acid properties, serial and concurrent schedules, conflict serializability, Two-phase locking, failure classification, storage structure, stable storage, log based recovery, deferred database modification, check-pointing, Recent topics : Semantic Web and RDF, GIS, biological databases .

Text Books

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, 6e, 2013.
2. Silberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.
3. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, McGrawHill Education, 3rd Edition, 2003.

Reference Books

1. Powers S., *Practical RDF*, O'Reilly Media, 2003.

2. Plunkett T., B. Macdonald, *et al.*, *Oracle Big Data Hand Book*, Oracle Press, 2013.
3. Peter Rob and Carlos Coronel, *Database System- Design, Implementation and Management (7/e)*, Cengage Learning, 2007.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction	7 Hours
1.1	Data: structured, semi-structured and unstructured data, Concept & Overview of DBMS	2
1.2	Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS, Database architectures and classification.	2
1.3	Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity- Relationship Diagram, Weak Entity Sets.	3
2	Relational Model	8 Hours
2.1	Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema	3
2.2	Database Languages, Concept of DDL and DML relational algebra.	2
2.3	Basic SQL Structure, Set operations, Aggregate Functions, nested sub-queries, Views, assertions and triggers.	3
3	Relational Database Design	10 Hours
3.1	Different anomalies in designing a database, normalization	3
3.2	Functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover.	3
3.3	Normalization using functional dependencies, 1NF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions.	4
4	Physical Data Organization	10 Hours
4.1	index structures, primary, secondary and clustering indices	3
4.2	Single level and Multi-level indexing, B+- Trees	3
4.3	Query Optimization: heuristics-based query optimization.	4
5	Transaction Processing Concepts	10 Hours
5.1	overview of concurrency control and recovery, acid properties, serial and concurrent schedules, conflict serializability	3
5.2	Two-phase locking, failure classification, storage structure, stable storage, log based recovery, deferred database modification, check-pointing	4
5.3	Semantic Web and RDF, GIS, biological databases.	3

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT284	COMPUTER NETWORKS	VAC	3	1	0	4

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in computer networking, and to design, inspect and evaluate network models and protocols for real world applications.

Prerequisite: Nil

Course Objectives

- To introduce the basic terminology and concepts used in computer networking
- To understand data link layer services and protocols
- To learn and apply the process of routing and IP addressing in Internet

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Examine different network design models and protocols	Level 1: Remember
CO 2	Inspect data link layer issues and protocols	Level 2: Understand
CO 3	Apply the process of routing and IP addressing in Internet	Level 3: Apply
CO 4	Understand transport layer services and congestion control mechanisms	Level 2: Understand
CO 5	Demonstrate the working of various application layer protocols such as HTTP, SMTP, POP3, FTP and DNS. Explain various Internet control protocols used to manage and monitor network traffic.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	-	-	-	-	-	-	2
CO 2	3	2	-	2	-	-	-	-	-	-	-	-
CO 3	3	3	3	2	1	-	-	-	-	-	-	3
CO 4	2	-	2	2	-	-	-	-	-	-	-	-
CO 5	2	-	2	3	-	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
BL 1: Remember	10	10	20
BL 2: Understand	30	30	60
BL 3: Apply	10	10	20
BL 4: Analyse			
BL 5: Evaluate			
BL 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. List the various layers of the OSI reference model.
2. What are the different types of network topologies?
3. What are the various devices used in different layers of the TCP/IP reference model.
4. Define a Protocol Data Unit (PDU).

Course Outcome 2 (CO 2):

1. Compare and contrast the functionalities of hubs, bridges and switches.
2. Explain the main features of Fast Ethernet?
3. Explain the different fields in IEEE 802.3 frame format?

4. Explain the techniques for detecting burst errors in data transmission.

Course Outcome 3 (CO 3):

1. Experiment with the working of Distance Vector Routing algorithm.
2. A block is assigned an IP address 201.99.88.119/22. Identify the IP address of the first and last host of this block.
3. What is super-netting? What is its application in classless addressing?
4. What is the relevance of Token Bucket algorithm in computer networks?

Course Outcome 4 (CO 4):

1. Explain the appropriateness of using a pseudo-header in TCP for computing checksum.
2. Illustrate the steps involved in TCP connection establishment and release.
3. Explain with the help of an example, the working of Remote Procedure Calls.
4. Describe the various congestion control mechanisms in transport layer.

Course Outcome 5 (CO 5):

1. Explain how a Domain Name System (DNS) works.
2. Compare link state routing algorithms with distance vector routing protocols
3. Explain the suitability of various error correcting codes to deal with single-bit and burst errors in data transmission.
4. Describe the major design issues in network layer.
5. Describe the working of SMTP, IMAP and POP3 mail transfer protocols.

Model Question Paper

Part A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. List the main characteristics of different types of Computer Networks.
2. Define Maximum Transmission Unit (MTU) of a protocol data unit.
3. Briefly explain the various types of CSMA protocols.
4. A message 11001001 has to be transmitted using the CRC polynomial $x^3 + 1$ to protect it from errors. Compute the message that should actually be transmitted.
5. How does link state routing build and distribute the link state packets?
6. One of the IP addresses of a block of address is 201.99.88.119/22. Find the range of the assignable IP address.

7. What is traffic shaping? Compare traffic shaping with traffic policing.
8. Why is Token Bucket algorithm relevant in networks?
9. How can ARP and RARP be used to resolve addresses in computer networks?
10. What happens when an FTP control connection breaks while data transfer is in progress?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. List and explain the main features of all the seven layers of the TCP/IP reference model.

OR

12. Explain the major design issues for the network layer.
13. Why do Ethernet frames require a minimum frame size? Discuss how Gigabit Ethernet solves this problem.

OR

14. How do burst errors occur? Explain how Hamming codes can be effectively used to deal with burst errors.
15. Compute the IP address of the 5th host in the 6th subnet of a network whose network address is given by 192.168.0.1 and subnet mask is given by 255.255.255.240.

OR

16. What is count-to-infinity problem? Discuss any two methods to practically solve this problem.
17. Illustrate with suitable examples, the operation of Go-Back-N and Selective-Repeat sliding window protocols.

OR

18. Describe the TCP segment header format. Clearly indicate the significance of each flag.
19. Differentiate between persistent and non-persistent HTTP connections. Discuss the message formats of HTTP request and response.

OR

20. Describe the working of SMTP, IMAP and POP3 protocols in a simple mail transfer scenario.

Syllabus

Module 1 (7 Hours)
Computer Networks - Types of Networks, Reference models - OSI and TCP/IP, Internet - The network edge, The network core, Network access, Delay and loss, Protocol layers and services - Design issues for the layers - Interface and Services
Module 2 (9 Hours)
Data Link layer design Issues - Flow Control and ARQ techniques, Services - Error detection and correction, Protocols - HDLC, MAC, Multiple access protocols, MAC Sub layer - IEEE 802 for LANs and MANs, IEEE 802.3, 802.4, 802.5, Devices - Hubs, Bridges and Switches, VLAN, High-speed LANs - Gigabit Ethernet.
Module 3 (10 Hours)
Network layer - services, IPv4 - IP Addressing - Classless and Classfull Addressing. Sub-netting and super-netting, Routing in Internet - Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, RIP and OSPF, IPV6, Internet Multicasting, Multicast routing.
Module 4 (10 Hours)
Transport layer services and primitives, UDP - Segment Structure, Remote Procedure Call, TCP - Segment Header, Connection establishment and Release, Transmission Policy, Congestion Control - General principles, Quality-of-Service requirements - Traffic shaping.
Module 5 (9 Hours)
Internet Control and Management Protocols - ICMP, SNMP, ARP and RARP, Application Layer - HTTP - Overview, Persistent and non-persistent connections, Message formats, Cookies, FTP, Electronic Mail - SMTP, POP3 and IMAP, DNS - services and caching policies.

Text Books

1. F. Kurose and K. W. Ross, Computer Networking: A Top-Down Approach Featuring Internet, 6/e, Pearson Education, 2012.
2. A. S. Tanenbaum and D. J. Wetherall, Computer Networks, 5/e, Pearson, 2013.
3. L. L. Peterson and B. S. Davie, Computer Networks, A systems approach, 5/e, Morgan Kaufmann, 2011.

Reference Books

1. William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.
2. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4/e, Mc Graw Hill

3. Behrouz A. Forouzan, Data Communications and Networking, 4/e, Tata McGraw Hill.
4. Fred Halsall, Computer Networking and the Internet, 5/e.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Computer Networks – Fundamentals	7 Hours
1.1	Types of Networks, Reference models - OSI and TCP/IP.	2
1.2	Internet - The network edge, The network core, Network access, Delay and loss.	2
1.3	Protocol layers and services - Design issues for the layers - Interface and Services.	3
2	Data Link layer	9 Hours
2.1	Design Issues - Flow Control and ARQ techniques, Services - Error detection and correction.	3
2.2	Protocols - HDLC, MAC, Multiple access protocols, MAC Sub layer - IEEE 802 for LANs and MANs.	3
2.3	IEEE 802.3, 802.4, 802.5, Devices - Hubs, Bridges and Switches, VLAN, High-speed LANs - Gigabit Ethernet.	3
3	Network layer	10 Hours
3.1	Services, IPv4 - IP Addressing.	3
3.2	Classless and Classfull Addressing. Sub-netting and super-netting	3
3.3	Routing in Internet - Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, RIP and OSPF, IPV6, Internet Multicasting, Multicast routing.	4
4	Transport layer	10 Hours
4.1	Services and primitives, UDP - Segment Structure, Remote Procedure Call.	3
4.2	TCP - Segment Header, Connection establishment and Release, Transmission Policy.	3
4.3	Congestion Control - General principles, Quality-of-Service requirements - Traffic shaping.	4
5	Application layer	9 Hours
5.1	Internet Control and Management Protocols - ICMP, SNMP, ARP and RARP.	3
5.2	Application Layer - HTTP - Overview, Persistent and non-persistent connections, Message formats, Cookies.	2
5.3	FTP, Electronic Mail - SMTP, POP3 and IMAP, DNS - services and caching policies.	4

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT286	SOFTWARE PROJECT MANAGEMENT TECHNIQUES	VAC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of understanding essential concept of software project management and software development process.

Prerequisite: Basics of programming, software engineering.

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO1	List the activities in Software Project Management.	Level 1: Remember
CO2	Summarize different Software Process Models	Level 2: Understand
CO3	Explain methods for software cost estimation	Level 2: Understand
CO4	Analyze Project Scheduling and risk management methods.	Level 3: Apply
CO5	Illustrate the methods to manage and control projects and people in an organization.	Level 2: Understand

Mapping of course outcomes with program outcomes

COs	PROGRAMME OUTCOMES (PO)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	1	-	-	2	-	3	1	3	1
CO2	-	-	-	-	-	-	-	-	2	2	3	1
CO3	2	1	-	1	2	-	-	-	3	3	3	1
CO4	1	3	-	-	1	-	-	-	3	3	3	1
CO5	-	1	-	1	1	-	3	-	2	2	3	1

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. List the characteristics which make software projects different from other project.
2. List out the activities within stepwise planning
3. What are the various activities covered by software project management.
4. Define portfolio management of software projects. Discuss with examples

Course Outcome 2 (CO2):

1. Illustrate SRUM in details
2. Explain the phases of software development
3. Describe the rapid software development method
4. Explain Agile model in detail.

Course Outcome 3 (CO3):

1. Write short note on reliability metrics.
2. Write the steps in cost-benefit analysis comprises
3. Classify the project sizing metrics.
4. Describe COCOMO model with appropriate data

Course Outcome 4 (CO4):

1. Experiment with network planning models.
2. Experiment with the different steps in project scheduling.
3. Make use of resource allocation and cost scheduling methods in software projects.

Course Outcome 5 (CO5):

1. Explain the methods to visualize the progress of the project.
2. Summarize the setting of checkpoints.
3. Illustrate the salient features of fixed price and time and material contract models
4. Explain the procedure of change control
5. Compare intrinsic and extrinsic motivation.
6. Explain the Oldham-Hackman job characteristic model
7. Explain in detail about the team structures

Model Question Paper

PART A
(Each Question carries 3 Marks)

(10*3=30)

1. Identify the characteristics which make software projects different from other project.
2. List out the activities within stepwise planning
3. Examine the steps in cost-benefit analysis comprises
4. Classify the project sizing metrics.
5. Illustrate network planning models with example.
6. Define critical path.
7. Identify the methods to visualize the progress of the project.
8. Summarize the setting of checkpoints.
9. Differentiate intrinsic and extrinsic motivation.
10. List some obstacles for good group decision making

PART B

(5*14=70)

11. Explain the various activities covered by software project management.
- OR
12. Explain portfolio management of software projects. Discuss with examples.
13. Illustrate SRUM in details
- OR
14. Describe COCOMO model with appropriate data.
15. Discuss the steps in project scheduling.
- OR
16. Explain resource allocation and cost scheduling in software projects.
17. Illustrate the salient features of fixed price and time and material contract models
- OR
18. Elaborate on the procedure of change control
19. Discuss in detail about the team structures
- OR
20. Explain the Oldham-Hackman job characteristic model.

Syllabus

Module 1: Project Planning (8 hrs)
Introduction to Software Project Management, Management tasks
Module 2: Project Cost Estimation (10 hrs)
Software process and Process Models, Cost Estimation
Module 3: Project Scheduling and Risk Management (11 hrs)
Project schedules, Critical Path Analysis, Risk identification
Module 4: Project Management And Control (9 hrs)
Framework for Management and control, Analysis and Project tracking
Module 5: Project Staffing (7 hrs)
Managing people, methods of staff selection, Team structures

Text Books

T1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Sixth Edition, Tata McGraw Hill, New Delhi, 2017

Reference Books

- R1. Roger S. Pressman, Software Engineering: A practitioner's approach, 8th Edition (Indian Edition), McGraw Hill. 2019
- R2. Harold Kerzner, Program Management-A System Approach Planning Scheduling And Controlling, 12th Edition, Wiley, 2017.
- R3. Sunitha E.V, Sarath K.S, Software Project Management, Jyothis Publishers 2019.
- R4. Jack Marchewka, Information Technology Project Management 5th edition. John Wiley & Sons (2012). ISBN: 978-1-118-91101-3. 2016.

Course Contents and Lecture Schedule

Sl. No	Module 1: Project Planning	8hrs
1.1	Introduction to Software Project Management – importance, Activities, Methodologies – types of Software Projects – Setting objectives.	2
1.2	Management Principles – Management Control – Project portfolio Management	2
1.3	Cost-benefit evaluation technology – Risk evaluation	2
1.4	Strategic program Management – Stepwise Project Planning.	2
	Module 2 Project Cost Estimation	10 hrs
2.1	Software process and Process Models – Rapid Application development – Agile methods	3
2.2	Extreme Programming – SCRUM – Managing interactive processes.	2
2.3	Basics of cost estimation – Effort and Cost estimation techniques – LOC, FP, COSMIC Full function points	3
2.4	COCOMO models - A Parametric Productivity Model.	2
	Module 3: Project Scheduling and Risk Management	11 hrs
3.1	Objectives of Activity planning – Project schedules – Activities	1
3.2	Sequencing and scheduling –Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method.	3
3.3	Risk identification – Assessment – Monitoring – PERT technique	2
3.4	Monte Carlo simulation –Resource Allocation	2
3.5	Creation of critical patterns – Cost schedules.	3

	Module 4: Project Management And Control	9hrs
4.1	Framework for Management and control – Collection of data.	2
4.2	Project termination – Visualizing progress – Cost monitoring	2
4.3	Earned Value Analysis- Project tracking	2
4.4	Change control - Software Configuration Management	2
4.5	Managing contracts	1
	Module 5: Project Staffing	7 hrs
5.1	Managing people – Organizational behavior	1
5.2	Methods of staff selection – Motivation – The Oldham-Hackman job characteristic model	3
5.3	Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.	3



SEMESTER -4

HONOURS

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT292	MATHEMATICAL FOUNDATION FOR NETWORKING	VAC	3	1	0	4

Preamble: The course is intended to provide the concepts of random variable, random processes and probability distribution. It also covers the basics of queuing theory and linear programming techniques.

Prerequisite: Background in calculus and linear algebra.

Course Outcomes: After the completion of the course the student will be able to

	Course outcomes	Bloom's Category
CO 1	Express linear programming and apply simplex method linear programming problem	Apply
CO 2	Apply sensitivity analysis on LPP and solve transportation problems	Apply
CO 3	Summarize the characteristics of random processes and demonstrate the applications of Poisson processes.	Understand
CO 4	Compare and Contrast the various queuing models	Understand
CO 5	Apply the queuing theory on different applications	Apply

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	2	-	-	1	-	1	-	1	3
CO 2	3	3	3	2	-	-	1	-	1	-	1	2
CO 3	3	3	3	2	-	-	1	-	1	-	1	2
CO 4	3	3	3	2	-	-	1	-	1	-	1	2
CO 5	3	3	3	2	-	-	1	-	1	-	1	3

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	70
Apply	10	10	10
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

A progressive university has decided to keep its library open round the clock and gathered that the following numbers of attendants are required to re-shelve the books:

Time of day (hours)	Minimum number of attendants required
0-4	4
4-8	7
8-12	8
12-16	9
16-20	14
20-24	3

If each attendant works eight consecutive hours per day, formulate the problem of finding the minimum number of attendants necessary to satisfy the requirements above as a LP problem.

Course Outcome 2 (CO2)

Find the solution of the following problem using Karmarkar's method:

$$\text{Minimize } f = 2x_1 + x_2 - x_3$$

subject to:

$$x_2 - x_3 = 0$$

$$x_1 + x_2 + x_3 = 1$$

$$x_i \geq 0, i = 1, 2, 3$$

Course Outcome 3(CO3):

Cars arrive at a gas station according to a Poisson process at an average rate of 12 cars per hour. The station has only one attendant. If the attendant decides to take a 2-minute coffee break when there are no cars at the station, what is the probability that one or more cars will be waiting when he comes back from the break, given that any car that arrives when he is on coffee break waits for him to get back?

Course Outcome 4 (CO4):

Consider an airport runway for arrivals only. Arriving aircraft join a single queue for the runway. Where, the service time is exponentially distributed with a rate $\mu = 27$ arrivals / hour . And the Poisson arrivals with a rate $\lambda = 20$ arrivals / hour.

- i. What will be the quantities of the queuing system?
- ii. Suppose we are in holidays and the arrival rate increases $\lambda = 25$ arrivals / hour How will the quantities of the queuing system change?
- iii. Now suppose we have a bad weather and the service rate decreases $\mu = 22$ arrivals / hour % How will the quantities of the queuing system change?

Course Outcome 5 (CO5):

Consider a steady state open network with three exponential nodes with parameters (μ_1, μ_2, μ_3) and Poisson arrivals to node 1. Customers follow one of two routes through the network: node 1 to node 2 (with probability p) and node 2 to node 3 (with probability $q=1-p$). Write down the arrival rates λ_i at node i ($i=1, 2, 3$). Use Little's theorem and Jackson's theorem to obtain the mean waiting time spent by a customer in the network and show that if $\mu_2 = \mu_3$, this is least when $p = q = 1/2$.

Model Question paper

Course Code: ITT292

Course Name: MATHEMATICAL FOUNDATION FOR NETWORKING

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. How do you solve a maximization problem as a minimization problem?
2. How many basic solutions can an LP problem have? Why?

3. State the following LP problem in standard form:

Maximize $f = -2x_1 - x_2 + 5x_3$
subject to

$$\begin{aligned}x_1 - 2x_2 + x_3 &\leq 8 \\ 3x_1 - 2x_2 &\geq -18 \\ 2x_1 + x_2 - 2x_3 &\leq -4\end{aligned}$$

4. Write the dual of the following linear programming problem:

Maximize $f = 50x_1 + 100x_2$
subject to

$$\begin{aligned}2x_1 + x_2 &\leq 1250 \\ 2x_1 + 5x_2 &\leq 1000 \\ 2x_1 + 3x_2 &\leq 900 \\ x_2 &\leq 150\end{aligned}$$

where

$$x_1 \geq 0 \text{ and } x_2 \geq 0$$

5. University buses arrive at the Students' Centre to take students to their classes according to a Poisson process with an average rate of 5 buses per hour. Chris just missed the last bus. What is the probability that he waits more than 20 minutes before boarding a bus?
6. Calculate the autocorrelation function of the periodic function $X(t) = A\sin(\omega t + \phi)$, where the period $T = 2\pi/\omega$, and A , ϕ , and ω are constants.
7. Prove that the exponential distribution has both the lack of memory and the minimum property.
8. A monitor on a disk server showed that the average time to satisfy an I/O request was 100 milliseconds. The I/O rate was about 100 requests per second. What was the mean number of requests at the disk server?
9. Draw the state transition rate diagram of an M/M/C queueing model.
10. What do you mean by balking and reneging?

PART B

Answer any one Question from each module. Each question carries 14 Marks

11. a. Find the solution of the following LP problem graphically: (7 Marks)

Minimize $f = 3x_1 + 2x_2$
subject to

$$\begin{aligned}8x_1 + x_2 &\geq 8 \\ 2x_1 + x_2 &\geq 6 \\ x_1 + 3x_2 &\geq 6 \\ x_1 + 6x_2 &\geq 8 \\ x_1 \geq 0, x_2 &\geq 0\end{aligned}$$

- b. Prove that the feasible region of a linear programming problem is convex. (7 Marks)

OR

12. A manufacturer produces three machine parts, A, B, and C. The raw material costs of parts A, B, and C are \$5, \$10, and \$15 per unit, and the corresponding prices of the finished parts are \$50, \$75, and \$100 per unit. Part A requires turning and drilling operations, while part B needs milling and drilling operations. Part C requires turning and

milling operations. The number of parts that can be produced on various machines per day and the daily costs of running the machines are given below:

Machine part	Number of parts that can be produced on		
	Turning lathes	Drilling machines	Milling machines
A	15	15	
B		20	30
C	25		10
Cost of running the machines per day	\$250	\$200	\$300

Formulate the problem of maximizing the profit.

(14Marks)

13. A metallurgical company produces four products, A, B, C, and D, by using copper and zinc as basic materials. The material requirements and the profit per unit of each of the four products, and the maximum quantities of copper and zinc available are given below:

	Product				Maximum quantity available
	A	B	C	D	
Copper (lb)	4	9	7	10	6000
Zinc (lb)	2	1	3	20	4000
Profit per unit (\$)	15	25	20	60	

- Find the number of units of the various products to be produced for maximizing the profit.
- Find the effect of changing the profit per unit of product D to \$30.
- Find the effect of changing the available quantities of copper and zinc to 4000 and 6000 lb, respectively.
- If product C requires 5 lb of copper and 4 lb of zinc (instead of 7 lb of copper and 3 lb of zinc) per unit, find the change in the optimum solution.

(14Marks)

OR

14. The Childfair Company has three plants producing child push chairs that are to be shipped to four distribution centers. Plants A, B, and C produce 12, 17, and 11 shipments per month, respectively. Each distribution center needs to receive 10 shipments per month. The distance from each plant to the respective distributing centers is given below:

	Distance			
	Distribution Centres			
	1	2	3	4

Plants	A	80 KM	130 KM	40 KM	70 KM
	B	110 KM	140 KM	60 KM	100 KM
	C	60 KM	120 KM	80 KM	90 KM

The freight cost for each shipment is Rs.100 per Kilometer. How much should be shipped from each plant to each of the distribution centers to minimize the total shipping cost?

- Formulate this problem as a transportation problem by constructing the appropriate parameter table.
- Draw the network representation of this problem.
- Obtain an optimal solution.

(14 Marks)

15. Alan is conducting an experiment to test the mean lifetimes of two sets of electric bulbs labelled A and B. The manufacturer claims that the mean lifetime of bulbs in set A is 200 hours, while the mean lifetime of the bulbs in set B is 400 hours. The lifetimes for both sets are exponentially distributed. Alan's experimental procedure is as follows: He started with one bulb from each set. As soon as a bulb from a given set fails (or burns out), he immediately replaces it with a new bulb from the same set and writes down the lifetime of the burnt-out bulb. Thus, at any point in time he has two bulbs on, one from each set. If at the end of the week Alan tells you that 8 bulbs have failed, determine the following:

- The probability that exactly 5 of those 8 bulbs are from set B.
- The probability that no bulb will fail in the first 100 hours.
- The mean time between two consecutive bulb failures.

(14Marks)**OR**

16. Two random processes $X(t)$ and $Y(t)$ are defined as follows:

(14Marks)

$$X(t) = A \cos(\omega_1 t + \Theta)$$

$$Y(t) = B \sin(\omega_2 t + \Phi)$$

where ω_1 , ω_2 , A, and B are constants, and Θ and Φ are statistically independent random variables, each of which is uniformly distributed between 0 and 2π .

- Find the cross correlation function $R_{XY}(t, t + \tau)$, and show that $X(t)$ and $Y(t)$ are jointly wide-sense stationary.
- If $\Theta = \Phi$, show that $X(t)$ and $Y(t)$ are not jointly wide-sense stationary.
- If $\Theta = \Phi$, under what condition are $X(t)$ and $Y(t)$ jointly wide-sense stationary?

17. a. An airport has a single runway. Airplanes have been found to arrive at the rate of 15 per hour. It is estimated that each landing takes 3 minutes. Assuming a Poisson process for arrivals and an exponential distribution for landing times. Find the expected number of airplanes waiting to land and expected waiting time. What is the probability that the waiting will be more than 5 minutes?

(6 marks)

- Explain Markovian Birth Death process and obtain the expressions for steady state probabilities.

(8 marks)**OR**

18. a. A tax consulting firm has 3 counters in its office to receive people who have problems concerning their income, wealth and sales taxes. On the averages 48 persons arrive in an 8 hr day. Each tax advisor spends 15 mins on the average on an arrival. If the arrivals are Poisson distributed and service times are according to exponential distribution, find (i) the average number of customers in the system. (ii) the average number of customers waiting to be serviced. (iii) the average time a customer spends in the system. **(6 marks)**
 b. Derive Erlang B formula. **(8 marks)**
19. a. What is Pollaczek-Khinchin formula? Derive the expression. **(8 marks)**
 b. Consider a closed Jackson network where the service time at each queue is independent of the number of customers at the queue. Suppose that for a given number of customers, the utilization factor of one of the queues, say queue I, is strictly larger than the utilization factors of the other queues. Show that as the number of customers increases, the proportion of time that a customer spends in queue I approaches unity. **(6 marks)**
- OR**
20. a. State and prove Jackson's theorem. **(8 marks)**
 b. Write short notes on closed Jackson networks and cyclic queues. **(6 marks)**

Syllabus

Module 1: 9 hours
(Text-1: Relevant topics from chapter-3) Linear Programming I: Simplex Method – Applications of Linear Programming – Standard Form of a Linear Programming Problem – Geometry of Linear Programming Problems– Definitions and Theorems – Solution of a System of Linear Simultaneous Equations – Pivotal Reduction of a General System of Equations – Identifying an Optimal Point – Improving a Nonoptimal Basic Feasible Solution – Two Phases of the Simplex Method
Module 2 : 10 hours
(Text-1: Relevant topics from chapter-4) Linear Programming II: Duality in Linear Programming – Symmetric Primal–Dual Relations – General Primal–Dual Relations – Primal–Dual Relations When the Primal Is in Standard Form – Duality Theorems – Dual Simplex Method – Sensitivity or Postoptimality Analysis – Changes in the Right-Hand-Side Constants b_i – Changes in the Cost Coefficients c_j – Addition of New Variables – Changes in the Constraint Coefficients a_{ij} – Transportation Problem – Karmarkar's Interior Method – Statement of the Problem – Conversion of an LP Problem into the Required Form.
Module 3: 9 hours
(Text-2: Relevant topics from sections-8.1-8.5, 8.7, 10.5)

Random processes and classification, mean and autocorrelation, wide sense stationary (WSS) processes, autocorrelation and power spectral density of WSS processes and their properties, Poisson process-distribution of inter-arrival times, combination of independent Poisson processes(merging) and subdivision (splitting) of Poisson processes (results without proof)

Module 4: 9 hours

(Text-3: Chapter 1, Chapter 2 – Section 2.1 to 2.7)

Introduction - Measures of System Performance, Characteristics of Queueing Systems, Little's Law, Some General Results. Stochastic Processes - Poisson Process, Exponential Distribution, Discrete Time Markov Chains, Continuous Time Markov Chains. Simple Markovian Queueing Models - Birth-Death Processes - Single-Server Queues (M/M/1) – Multi server Queues (M/M/c) - Choosing the Number of Servers, Queues with truncation (M/M/c/K), Erlang's loss formula (M/M/c/c), Queues with unlimited service

Module 5 : 8 hours

(Text-3: Chapter 2- Section 2.8 to 2.12, Chapter 4- Section 4.1 to 4.4)

(M/G/1 Queue – Text-4 : Chapter 3, Section 3.5)

Finite Source Queues, State Dependent Service, Queues with Impatience, Transient Period, Busy Period Analysis, M/G/1 Queue, Series Queues, Open Jackson Networks, Closed Jackson Networks, Cyclic Queues

Text Books

1. Singiresu S. Rao, "Engineering Optimization: Theory and Practice, 4th Edition", Wiley 2009
2. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes (Second Edition)", Academic Press, 2014
3. John F. Shortle, James M. Thompson, Donald Gross, Carl M. Harris, "Fundamentals of Queueing Theory, 5th Edition", Wiley 2018
4. Dimitri P. Bertsekas and Robert G. Gallager, "Data Networks," (2nd edition) Prentice Hall, 1992, ISBN 0132009161

Reference Books

1. Geoffrey R. Grimmett, David R. Stirzaker, Probability and Random Processes, Oxford University Press, USA; 3 edition, 2001.
2. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, Wiley, 2006.

3. Hamdy A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson Education (2008).
4. G. V. Reklaitis, A. Ravindran, K. M. Ragsdell, "Engineering Optimization: Methods and Applications", Wiley (2006).
5. Leonard Kleinrock, "Queueing Systems. Volume 1: Theory", Wiley-Interscience, 1975.
6. Leonard Kleinrock, "Computer Applications, Volume 2, Queueing Systems", Wiley-Interscience, 1975.
7. Karlin, K. and Taylor, H. M., "A First Course in Stochastic Processes", Academic Press, 1975

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	MODULE 1	9 hours
1.1	Linear Programming I: Simplex Method – Applications of Linear Programming – Standard Form of a Linear Programming Problem	2 Hrs
1.2	– Geometry of Linear Programming Problems– Definitions and Theorems	2 Hrs
1.3	Solution of a System of Linear Simultaneous Equations – Pivotal Reduction of a General System of Equations	2 Hrs
1.4	Identifying an Optimal Point	1 Hrs
1.5	Improving a Nonoptimal Basic Feasible Solution – Two Phases of the Simplex Method	2Hrs
2	MODULE 2	10 hours
2.1	Duality in Linear Programming – Symmetric Primal–Dual Relations – General Primal–Dual Relations – Primal–Dual Relations When the Primal Is in Standard Form – Duality Theorems – Dual Simplex Method	3 Hrs
2.2	Sensitivity or Postoptimality Analysis – Changes in the Right-Hand-Side Constants b_i – Changes in the Cost Coefficients c_j – Addition of New Variables – Changes in the Constraint Coefficients a_{ij}	3 Hrs
2.3	Transportation Problem – Karmarkar's Interior Method – Statement of the Problem – Conversion of an LP Problem into the Required Form	4 Hrs
3	MODULE 3	9 hours
3.1	Random processes and classification, mean and autocorrelation,	3 Hrs

3.2	wide sense stationary (WSS) processes, autocorrelation and power spectral density of WSS processes and their properties,	3 Hrs
3.3	Poisson process-distribution of inter-arrival times, combination of independent Poisson processes(merging) and subdivision (splitting) of Poisson processes (results without proof)	3 Hrs
4	MODULE 4	9 hours
4.1	Introduction - Measures of System Performance, Characteristics of Queueing Systems, Little's Law, Some General Results.	2 Hrs
4.2	Stochastic Processes - Poisson Process, Exponential Distribution, Discrete Time Markov Chains, Continuous Time Markov Chains.	3 Hr
4.3	Simple Markovian Queueing Models - Birth-Death Processes - Single-Server Queues (M/M/1) – Multi server Queues (M/M/c) -	2 Hrs
4.4	Choosing the Number of Servers, Queues with truncation (M/M/c/K), Erlang's loss formula (M/M/c/c), Queues with unlimited service	2 Hrs
5	MODULE 5	8 hours
5.1	Finite Source Queues, State Dependent Service	2 Hr
5.2	Queues with Impatience, Transient Period, Busy Period Analysis	3 Hr
5.3	M/G/1 Queue, Series Queues, Open Jackson Networks, Closed Jackson Networks, Cyclic Queues	3 Hrs



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT294	NUMBER THEORY	VAC	3	1	0	4

Preamble:

Number theory doesn't suffer too much abstraction and the consequent difficulty in conceptual understanding. Hence it is an ideal topic which acts like an essential bridge or tool from Mathematics to Information Technology. Important topics such as congruence, divisibility, Chinese remainder theorem, Classical results in Number theory, Application to ciphers are included in this course. Enthusiastic students will be able to acquire knowledge to read and enjoy their own more applications of Number theory.

Prerequisite: Linear Algebra and Calculus

Course Outcomes: After the completion of the course the student will be able to

CO No	Course Outcome(CO)	Bloom's Category
CO 1	Examine results involving divisibility, greatest common divisor, Least Common multiple and a few applications	Apply
CO 2	Demonstrate theory and methods to solve Linear Difference Equations	Understand
CO 3	Summarize theory of congruence	Understand
CO 4	Solve linear congruent equations	Apply
CO 5	Illustrate three classical theorems of Number theory and Apply number theory to ciphers.	Apply

Mapping of course outcomes with program outcomes

COs \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	3	-	1	-	-	-	-	1	2
CO 2	3	3	2	2	-	1	2	-	-	-	1	2
CO 3	3	3	2	2	-	-	2	-	-	-	1	2
CO 4	2	2	2	2	-	1	-	-	-	-	1	2
CO 5	2	2	1	2	2	1	-	-	1	-	1	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	50
Apply	20	20	40

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Continuous Assessment Test (2 numbers) : 25 marks
 Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. State Division algorithm.
2. List the first 4 Catalan numbers.
3. Distinguish between Fibonacci and Fermat numbers.

Course Outcome 2 (CO2)

1. State Fundamental theorem of Arithmetic
2. What is 73 congruent modulo 8.
3. State Chinese Remainder Theorem

Course Outcome 3(CO3):

1. State Fermat's little theorem
2. List first 3 Mersenne primes
3. Define Euler's Phi function

Course Outcome 4 (CO4):

1. Describe any two primality tests
2. Find primitive roots of 23.
3. State Lagrange's theorem

Course Outcome 5 (CO5):

1. Define Affine cipher
2. Define Hill ciphers
3. What is RSA crypto system.

Model Question paper

Course Code: IIT294

Course Name: NUMBER THEORY

Max.Marks:100

Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks

1. Define polygonal numbers with examples using recurrence relation.
2. Express 3ABCsixteen in base ten.
3. Prove that any two consecutive Fibonacci numbers are relatively prime.
4. Evaluate (2076; 1776).
5. State Fermat's Little theorem.
6. Compute $\sum_{d|n} \varphi(d)$ for $n = 12$.
7. Verify that 2 is a primitive root modulo 9.
8. Explain perfect numbers and Mersenne primes with example
9. Using the exponentiation modulus $p = 3037$ and the enciphering key $e = 31$, encipher the message 'ALL IS WELL '.
10. Briefly explain RSA-crypto system.

PART B

Answer one full question from each module. Each full question carries 14 marks

MODULE 1

11. (a) Find the number of positive integer less than 3076 which are
 (i) Divisible by 19 (ii) Not divisible by 24 (iii) Divisible by 17
 (b) Prove that there are infinitely many primes

12. (a) Find a formula for $\sum_{i=1}^n F_i$
 (b) Show that $641 \mid f_5$

MODULE 2

13. (a) Find the number of trailing zeros in 234!
 (b) Solve $12x \equiv 18 \pmod{15}$
 14. (a) Solve for x such that $x \equiv 1 \pmod{3}$; $x \equiv 4 \pmod{5}$; $x \equiv 6 \pmod{7}$
 (b) Find the canonical decomposition and positive factors of 2520

MODULE 3

15. (a) State and prove Wilson's theorem
 (b) Determine if there exist a positive integer f(m) such that $a^{f(m)} \equiv 1 \pmod{m}$ for $m = 12$.
 16. (a) Find the number of positive integers less than 500 and relative prime to 500. Also find the number and sum of positive divisors of 500.
 (b) Find the remainder when 24^{1947} is divided by 17.

MODULE 4

17. (a) Compute $\text{ord}_{21} 5$
 (b) Find the incongruent primitive roots modulo 19.
 18. (a) State Lucas' theorem and verify that 823 is a prime using Lucas' theorem. (Take x= 2)
 (b) Solve $8x^5 \equiv 3 \pmod{13}$

MODULE 5

19. (a) Using the matrix $A = \begin{bmatrix} 3 & 2 & 6 \\ 5 & 7 & 11 \\ 13 & 4 & 11 \end{bmatrix}$, encrypt the English proverb "A PROVERB IS

THE CHILD OF EXPERIENCE".

- (b) Using the RSA enciphering modulus $n = 2773$ and the enciphering key $e = 21$, encrypt the message "SILENCE IS GOLDEN".

20. (a) Decrypt the cipher text message 0010 0325 2015 2693 2113 2398 2031 1857 that was created using the RSA enciphering key $(e; n) = (21; 2773)$.

(b) Draw a block diagram for conventional cryptosystem and explain the terms.

Syllabus

Module 1 (9 hours)
Polygonal numbers – Pyramidal numbers – Catalan numbers – Division algorithm – Base b representations – Number patterns – Prime and composite numbers – Fibonacci and Lucas numbers – Fermat numbers
Module 2 (9 hours)
Greatest common divisor – Euclidean algorithm – Fundamental theorem of arithmetic – Least common multiple – Linear Diophantine Equations – Congruences – Linear congruences – divisibility tests – Modular designs – Check digits – Chinese remainder theorem – General Linear systems - 2×2 Linear systems
Module 3 (11 hours)
Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi function – Tau and Sigma function – Perfect numbers – Mersenne Primes
Module 4 (8 hours)
Order of a positive integer – Primality tests – Primitive roots of primes – Composites with primitive roots – The algebra of indices
Module 5 (8 hours)
Affine ciphers - Hill ciphers - Exponentiation ciphers – RSA Crypto system

Text Book

1. Thomas Koshy , “Elementary Number Theory with Applications (2/e)”, Elsever Academic Press, 2007, ISBN: 978-0-12-372487-8.

Reference Books

1. David M Burton, “Elementary Number Theory (7/e)”, McGraw Hill, 2011, ISBN : 978-0-07-338314-9

2. Gareth A Jones and J Mary Jones , “Elementary Number Theory”, Springer Undergraduate Mathematics series, 1998, ISBN : 978-3-540-76197-6

3. Kenneth H Rosen, “Elementary Number Theory” (6/e)”, Pearson Education, 2018, ISBN: 9780134310053

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Module 1	9 Hours
1.1	Polygonal numbers – Pyramidal numbers	1
1.2	Catalan numbers	1
1.3	Division algorithm	1
1.4	Base b representations – Number patterns	1
1.5	Prime and composite numbers	1
1.6	Fibonacci and Lucas numbers	3
1.7	Fermat numbers	1
2	Module 2	9 Hours
2.1	Greatest common divisor – Euclidean algorithm	1
2.2	Fundamental theorem of arithmetic - Least common multiple	1
2.3	Linear Diophantine Equations	1
2.4	Congruences – Linear congruences	2
2.5	divisibility tests – Modular designs – Check digits	1
2.6	Chinese remainder theorem	2
2.7	General Linear systems - 2×2 Linear systems	1
3	Module 3	11 Hours
3.1	Wilson's theorem – Fermat's little theorem	4
3.2	Euler's theorem – Euler's Phi function	4
3.3	Tau and Sigma function	2
3.4	Perfect numbers – Mersenne Primes	1
4	Module 4	8 Hours
4.1	Order of a positive integer	2
4.2	Primality tests	3
4.3	Primitive roots of primes – Composites with primitive roots	2
4.4	The algebra of indices	1
5	Module 5	8 Hours
5.1	Affine ciphers	2
5.2	Hill ciphers	2
5.3	Exponentiation ciphers	2
5.4	RSA Crypto system	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT296	MICROPROCESSOR AND MICROCONTROLLER PROGRAMMING	VAC	2	1	1	4

Preamble: Microprocessor and Micro controller programming course is intended to deliver students the concepts of Microprocessors and Micro-controllers. It also helps them to learn how to write an 8051 program assembly language and also in C programming language. Introduction to Interfacing of micro-controllers, its use and applications are also covered in the syllabus.

Prerequisite: C programming

Course Outcomes: After the completion of the course the student will be able to

CO No	Course Outcome(CO)	Bloom's Category
-CO 1	Describe the basic architectures of microprocessor based systems	Understand
CO 2	Develop a simple assembly program for a 8086 microprocessor	Apply
CO 3	Design a basic 8051 program in Assembly language	Apply
CO 4	Simulate assembly programs using simulation tools and design 8051 programs in C programming language	Apply
CO 5	Utilize various interfacing techniques of micro-controllers	Apply

Mapping of course outcomes with program outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	-	2	-	-	-	-	-	1	3
CO3	3	3	3	-	2	-	-	-	-	-	1	3
CO4	3	3	3	-	3	-	-	-	-	-	1	3
CO5	3	-	-	-	3	3	-	-	3	2	3	3

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Test		End Examination
	1	2	
Remember	15	15	30
Understand	15	15	30
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Differentiate CISC and RISC processors
2. With the help of an example show the set and reset conditions of CY, AC and P flag of 8051 micro controller

Course Outcome 2 (CO2):

1. Write an 8086 program to sort N numbers.

2. Write an 8086 program to find the sum of N numbers

Course Outcome 3 (CO3):

1. Write an 8051 program to find the factorial of a given number.
2. Write an 8051 assembly code to generate look up table for Fibonacci numbers.

Course Outcome 4 (CO4):

1. Write an 8051 C program to toggle bits of P1 ports continuously with 250 ms.
2. Write an 8051 C program to convert 11111101(FDH) to decimal and display the digits on port p0, p1 and p2.

Course Outcome 5 (CO5):

1. Explain the function of pins of 9 pin RS 232 connector
2. Illustrate different modes of operations of 8255 with respect to control words.

Model Question Paper

PART A
(Each question carries 3 Marks)

(10*3=30)

1. Compare microprocessor, microcomputer and micro-controller
2. Differentiate PIC and AVR Micro-controllers
3. List the instructions which are used for memory operation in 8088 microprocessor.
4. Explain the purpose of the following signals in 8086
(i) READY (ii) HOLD
5. Write a program to do data conversions from HEX to ASCII in 8051 assembly code.
6. Explain MOV, MOVC, MOVX instructions of 8051 Micro-controller.
7. Discuss any three data types of 8051 C.
8. Illustrate with an example how arrays are used in 8051 C programs.
9. Describe different modes of operation of the following peripheral ICs:
i) 8255 ii) 8257
10. Write the Control Word Format in 8255.

PART B

(5*14=70)

(Each full question carries 14 marks)

11. a) Explain Van Neumann and Harvard Architecture. (6 marks)
b) Draw the memory map and briefly explain the memory organization for 128 byte internal RAM of 8051 micro-controller. (8 marks)

OR

- 12.a) Explain the functions of ports in 8051 micro-controller. How can P1 be used as both output and input port? (5 marks)
- b) Draw the pin diagram of 8051 micro-controller and explain the function of each pin.(9 marks)

13. a) Compare the architectural features of 8086 and 8088 processors. (7 marks)
- b) An array of 10 numbers is stored in the internal data RAM starting from location 30 H. Write an assembly language program to sort the array in ascending order starting from location 40 H. (7 marks)

OR

14. a) Draw the architectural diagram of 8086 microprocessor and explain. (9 marks)
- b) Write an assembly program to add N numbers. (5 marks)
15. a) Assuming crystal frequency of 11.0592 MHz, write an 8051 assembly program to generate a square wave of 50Hz frequency on pin P2.0 of 8051 Micro-controller. [Hint: Interfacing is not to be considered here for generating square wave] (6 marks)
- b) Discuss the addressing modes of 8051 Instruction set. (8 marks)

OR

16. a) Write an 8051 based assembly language program to perform addition of two 2x2 matrices. (7 marks)
- b) Write an 8051 based assembly language program to convert a hexadecimal number to a BCD. Number. (7 marks)
17. a) Write an 8051 C program to generate the 500us time delay using T1M2(timer1 and mode2). (7 marks)
- b) Write an 8051 C program to read the P1.0 and P1.1 bits and then issue an ASCII character to P0 based on the following conditions. That is if the data from P1.1 and P1.0 is 00, send '0' if 01 send '1', if 10 send '2' . (7 marks)

OR

18. a) Write an 8051 C to get a byte of data from port P0. If the data is greater than 100 send it to P1 otherwise send it to P2. (7 marks)
- b) Write an 8051 C program to toggle all the bits of P0, P1, and P2 continuously with a 250 ms delay.' Use the sfr keyword to declare the port addresses. (7 marks)

19. a) Explain the architecture of programmable interrupt controller 8259. (7 marks)
 b) Explain the interfacing of 8 bit ADC using 8051 micro-controller. (7 marks)

OR

20. a) Explain Keyboard Display controller 8279. (5 marks)
 b) Give the advantage of using 8279 for keyboard/display interface? What are scan lines used for? Explain (i) Encoded Scan Mode and (ii) Decoded scan mode. (9 marks)

Syllabus

Module 1:(8 hours)
Microprocessor Based Systems: Digital Computer, Microprocessor, Microcomputer, Micro-controller, Von Neumann and Harvard Architecture, CISC and RISC Processors; Micro-controllers: Historical background; organization and architectural features of micro-controller 8051 ,Introduction to AVR and PIC micro-controllers
Module 2:(10 hours)
Organization and architectural features of microprocessor 8086,Introduction to 8088 microprocessors, Introduction of assembly language program -Complete 8086 instruction set and Basic programs in assembly language for 8086 should be covered & asked in the exam.
Module 3:(9 hours)
8051 programming in Assembly language : Introduction to instruction set: instruction format, addressing modes of 8051, Data transfer instructions, I/O Port programming, Arithmetic and Logical instructions, Bit level instructions, Branching instructions , Concept of stack, subroutine and related instructions, writing programs (like time delay using loop, data conversions HEX to ASCII, BCD to ASCII, use of look up table etc) in assembly language 8051
Module 4:(10 hours)
Introduction to Program Development Environment (IDE)Tools: Introduction to a simulator: Edge Simulator- Edsim - Programming &Testing using IDE. 8051 Programming in C: Data types, programming for time delay, I/O programming, Logic operations, Control statements and loops, Functions and Arrays in embedded C, Data conversion programs in 8051 C, Accessing code of ROM space & Data serialization using 8051 C.
Module 5:(8 hours)

Interfacing of micro-controllers: Interfacing of memory devices - data transfer techniques and I/O ports (8255); keyboard and display devices(8279) - programmable interrupt and DMA controllers (8257) - sensors, transducers, actuators, A/D and D/A Converters - standard interfaces - RS232, USB, Simple interfacing programs using 8051- (Group Mini projects can be given. Can be evaluated as Assignments. Interfacing programs need not be asked for exams)

Text Books

1. R. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 6/e, Penram International Publishers.
2. A. Pal, Microprocessors: Principles and Applications, 1990, Tata McGraw-Hill.
3. K. J. Ayala, The 8051 Microcontroller Architecture, Programming and Applications, 2/e, Penram International Publishers.
4. Mazidi, Mazidi, McKinlay, Microcontroller and Embedded Systems, 2/e, Pearson Education.
5. R. Kapadia, 8051 Microcontroller and Embedded Systems, 1/e, Jaico Publishing House.
6. Abubeker K M, 80C51 μ C - Embedded C & ALP Programming-ISBN-978-1648921216, Notionpress publications, Singapore, 2020, first edition.

Course Content and Course Schedule

Module 1: Microprocessor Based Systems and Micro controllers		8 hours
1.1	Introduction to Digital Computer and Microprocessor	1 hour
1.2	Introduction to Microcomputer, Micro-controller	1 hour
1.3	Introduction to Van Neumann and Harvard Architecture	1 hour
1.4	Introduction to CISC and RISC Processors,	1 hour
1.5	Micro-controllers: Historical background	1 hour
1.6	Architecture of micro-controller 8051	1 hour
1.7	Register and memory organization of 8051	1 hour

1.8	Introduction to AVR, PIC and ARM micro controllers	1 hour
Module 2: Architecture of 8086 & Introduction of assembly language program		10 hours
2.1	Architecture of microprocessor 8086	1 hour
2.2	Memory Organization of 8086	1 hour
2.3	Introduction to 8088 microprocessor	1 hour
2.4	Introduction of assembly language program	1 hour
2.5	Instruction Types and Addressing modes	1 hour
2.6	Data transfer instructions, I/O Port programming, Arithmetic instructions	1 hour
2.7	Logical and Bit level instructions, Branching instructions	1 hour
2.8	Introducing Sample assembly language programs for 8086 (Square, Square Root & Cube Root of a Number, Factorial of an 8-bit Number, Generation of Fibonacci Series, HCF and LCM of Two Numbers, Bubble Sorting, Largest and Smallest Number of an Array, Code conversion – HEX to Decimal & ASCII to HEX, HEX to ASCII, BCD to ASCII and Matrix Addition. These programs can be done during tutorial/practical)	1 hour
2.9	Writing/Doing the above set of programs in assembly language for 8086 - Tutorial/Practical	1 hour
2.10	Writing/Doing the above set of programs in assembly language for 8086 - Tutorial/Practical	1 hour
Module 3: 8051 programming in Assembly language		9 hours
3.1	Introduction to instruction types and instruction format	1 hour
3.2	Introduction to Instruction sets and addressing modes of 8051	1 hour
3.3	Data transfer instructions, I/O Port programming, Arithmetic instructions	1 hour
3.4	Logical and Bit level instructions	1 hour
3.5	Branching instructions (Jump and loop Jump and call)	1 hour
3.6	Writing /Doing Programs in 8051-Tutorial/Practical	1 hour
3.7	Concept of stack, subroutine and related instructions	1 hour

3.8	Writing programs (like time delay using loop, data conversions HEX to ASCII, BCD to ASCII, use of look up table etc)in assembly language 8051	1 hour
3.9	Writing /Doing Programs in 8051-Tutorial/Practical	1 hour
Module 4: Introduction to Tools & 8051 Programming in C		10 hours
4.1	Introduction to Program Development Tools (IDE): Concept of IDE, Editor, Assembler, Compiler, Linker, Simulator, Debugger and assembler directives.	1 hour
4.2	Introduction to a simulator: Edge Simulator- Edsim - Programming using Simulator-Testing programs using IDE	1 hour
4.3	Writing /Doing Programs in 8051 using Tools -Practical in Lab	1 hour
4.4	8051 Programming in C: Data types in 8051 C	1 hour
4.5	Programming for time delay, I/O programming in 8051 C	1 hour
4.6	Logic operations in 8051 C, Control statements and loops in embedded C	1 hour
4.7	Doing Programs in 8051 using Tools - Practical in lab	1 hour
4.8	Functions and Arrays in embedded C, Data conversion programs in 8051 C	1 hour
4.9	Accessing code ROM space using 8051 C, Data serialization using 8051 C	1 hour
4.10	Doing Programs in 8051in C -Practical in lab	1 hour
Module 5: Interfacing of micro-controllers		8 hours
5.1	Introduction to Interfacing of micro-controllers: Use and Applications	1 hour
5.2	Interfacing of memory devices; data transfer techniques and I/O ports (8255)	1 hour
5.3	Interfacing of keyboard and display devices(8279)	1 hour
5.4	Programmable interrupt and DMA controllers (8257)	1 hour
5.5	Doing Interfacing programs in 8051 using Tools - Practical in lab	1 hour
5.6	Interfacing of sensors, transducers, actuators	1 hour
5.7	A/D and D/A Converters - standard interfaces - RS232, USB	1 hour
5.8	Doing Interfacing programs in 8051 using Tools - Practical in lab	1 hour

MATHEMATICS – (4th semester)

(For Information Technology)

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MAT 208	PROBABILITY, STATISTICS AND ADVANCED GRAPH THEORY	BASIC SCIENCE COURSE	3	1	0	4

Preamble: This course introduces students to the modern theory of probability and statistics, covering important models of random variables and techniques of parameter estimation and hypothesis testing. This course introduces fundamental concepts in Graph Theory, including properties and characterisation of Graph/Trees and Graph theoretic algorithms, which are widely used in Mathematical modelling and has got applications across **Information Technology**

Prerequisite: A basic course in one-variable and multi-variable calculus, knowledge of elementary set theory, matrices

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the concept, properties and important models of discrete random variables and, using them, analyse suitable random phenomena.
CO 2	Understand the concept, properties and important models of continuous random variables and, using them, analyse suitable random phenomena.
CO 3	Perform statistical inferences concerning characteristics of a population based on attributes of samples drawn from the population
CO 4	Understand the basic concept in Graph theory, Understand planar graphs and its properties. Demonstrate the knowledge of fundamental concepts of matrix representation of graphs, Apply fundamental theorems on Eulerian graphs and Hamiltonian graphs.
CO 5	Understand the basic concept in Trees, coloring of graphs. Apply coloring of graphs, Apply algorithm to find the minimum spanning tree

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	2					2		1
CO 2	3	2	2	2	2					2		1
CO 3	3	2	2	2	2					2		1
CO 4	3	2	2	2	2					2		1
CO 5	3	2	2	2	2					2		1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests(%)		End Semester Examination(%)
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	30	30	30
Analyse	20	20	20
Evaluate	10	10	10
Create			

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Let X denote the number that shows up when an unfair die is tossed. Faces 1 to 5 of the die are equally likely, while face 6 is twice as likely as any other. Find the probability distribution, mean and variance of X .
2. An equipment consists of 5 components each of which may fail independently with probability 0.15. If the equipment is able to function properly when at least 3 of the components are operational, what is the probability that it functions properly?
3. X is a binomial random variable $B(n, p)$ with $n = 100$ and $p = 0.1$. How would you approximate it by a Poisson random variable?
4. Three balls are drawn at random without replacement from a box containing 2 white, 3 red and 4 black balls. If X denotes the number of white balls drawn and Y denotes the number of red balls drawn, find the joint probability distribution of (X, Y) .

Course Outcome 2 (CO2)

1. What can you say about $P(X = a)$ for any real number a when X is a (i) discrete random variable? (ii) continuous random variable?
2. A string, 1 meter long, is cut into two pieces at a random point between its ends. What is the probability that the length of one piece is at least twice the length of the other?

3. A random variable has a normal distribution with standard deviation 10. If the probability that it will take on a value less than 82.5 is 0.82, what is the probability that it will take on a value more than 58.3?
4. X and Y are independent random variables with X following an exponential distribution with parameter μ and Y following an exponential distribution with parameter λ . Find $P(X + Y \leq 1)$

Course Outcome 3(CO3):

1. In a random sample of 500 people selected from the population of a city 60 were found to be left-handed. Find a 95% confidence interval for the proportion of left-handed people in the city population.
2. What are the types of errors involved in statistical hypothesis testing? Explain the level of risks associated with each type of error.
3. A soft drink maker claims that a majority of adults prefer its leading beverage over that of its main competitor's. To test this claim 500 randomly selected people were given the two beverages in random order to taste. Among them, 270 preferred the soft drink maker's brand, 211 preferred the competitor's brand, and 19 could not make up their minds. Determine whether there is sufficient evidence, at the 5% level of significance, to support the soft drink maker's claim against the default that the population is evenly split in its preference.
4. A nutritionist is interested in whether two proposed diets, *diet A* and *diet B* work equally well in providing weight-loss for customers. In order to assess a difference between the two diets, she puts 50 customers on diet A and 60 other customers on diet B for two weeks. Those on the former had weight losses with an average of 11 pounds and a standard deviation of 3 pounds, while those on the latter lost an average of 8 pounds with a standard deviation of 2 pounds. Do the diets differ in terms of their weight loss?

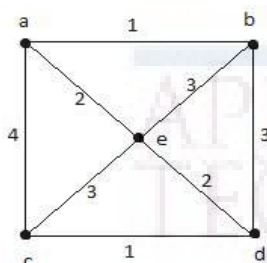
Course Outcome 4(CO4):

1. How many edges are there in a graph with ten vertices each of degree six?
2. Prove that a simple graph with n vertices must be connected, if it has more than $\frac{(n-1)(n-2)}{2}$ edges
3. Prove that a connected graph G is an Euler graph if all vertices of G are of even degree.
4. Use Kuratowski's theorem to determine whether $K_{4,4}$ is planar.

Course Outcome 5 (CO5):

1. Prove that a tree with n vertices has $n - 1$ edges.
2. Find the chromatic number of $K_{m,n}$

3. Using graph model, how can the final exam at a university be scheduled so that no student has two exams at the same time?
4. Explain Prim's algorithm and use it to find the minimum spanning tree for the graph given below



Syllabus

Module 1 (Discrete probability distributions)

9 hours

(Text-1: *Relevant topics* from sections-3.1-3.4, 3.6, 5.1)

Discrete random variables and their probability distributions, Expectation, mean and variance, Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Discrete bivariate distributions, marginal distributions, Independent random variables, Expectation -multiple random variables.

Module 2 (Continuous probability distributions)

9 hours

(Text-1: *Relevant topics* from sections-4.1-4.4, 3.6, 5.1)

Continuous random variables and their probability distributions, Expectation, mean and variance, Uniform, exponential and normal distributions, Continuous bivariate distributions, marginal distributions, Independent random variables, Expectation-multiple random variables, i.i.d random variables and Central limit theorem (**without proof**).

Module 3 (Statistical inference)

9 hours

(Text-1: *Relevant topics* from sections-5.4, 3.6, 5.1, 7.2, 8.1, 8.3, 9.1-9.2, 9.4)

Population and samples, Sampling distribution of the mean and proportion (for large samples only), Confidence interval for single mean and single proportions (for large samples only). Test of hypotheses: Large sample test for single mean and single proportion, equality of means and equality of proportions of two populations, small sample t-tests for single mean of normal population, equality of means (**only pooled t-test, for independent samples from two normal populations with equal variance**)

Module 4 (Advanced Graph theory -I)

9 hours

(Text-2: *Relevant topics* of sections -10.1, 10.2, 10.3, 10.4, 10.5, 10.7)

Introduction- Basic definitions, Directed graphs, pseudo graph, multigraph, Graph models, Graph terminology-vertex degree, simple graph, Complete graphs, cycles, bipartite graph,

new graphs from old-union, complement, Representing graph-Adjacency matrix, Incidence Matrix , Isomorphism, Connectivity, path , cut vertices , cut edges ,connectedness in directed and undirected graphs, Counting paths between vertices-Euler paths and circuits , Fleury's algorithm(**proof of algorithm omitted**) , Hamiltonian paths and circuits. Ore's theorem, Planar graph, -Euler's formula on planar graphs, Kuratowski's theorem (**Proof of theorem omitted**)

Module 5 (Advanced Graph theory -II) (9 hours)

(Text-2: Relevant topics of sections –(10.8,11.1, 11.4, 11.5)

Graph colouring, dual graph, chromatic number, chromatic number of complete graph K_n , chromatic number of complete bipartite graph $K_{m,n}$, chromatic number of cycle C_n , Four color theorem, applications of graph colouring-scheduling and assignments

Trees-rooted trees, Properties of trees-level, height, balanced rooted tree, Spanning tree- basic theorems on spanning tree (**DFS, BFS algorithms and it's applications omitted**), Minimum spanning tree, Prim's algorithm and Kruskal's algorithm(**proofs of algorithms omitted**)

(9 hours)

Text Books

1. (Text-1) Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, 8th edition, Cengage, 2012
2. (Text-2) Kenneth H Rosen, *Discrete Mathematics and it's applications*, Tata Mc Graw Hill, 8th Edition,

Reference Books

1. Hossein Pishro-Nik, *Introduction to Probability, Statistics and Random Processes*, Kappa Research, 2014 (Also available online at www.probabilitycourse.com)
2. Sheldon M. Ross, *Introduction to probability and statistics for engineers and scientists*, 4th edition, Elsevier, 2009.
3. T.Veera Rajan, *Probability, Statistics and Random processes*, Tata McGraw-Hill, 2008
4. Ralph P Grimaldi, *Discrete and Combinatorial Mathematics, An applied Introduction*, 4th edition, Pearson
5. C L Liu, *Elements of Discrete Mathematics*, Tata McGraw Hill, 4th edition, 2017
6. NarasinghDeo, *Graph theory*, PHI, 1979
7. John Clark , Derek Allan Holton, *A first look at Graph Theory*.

Assignments

Assignments should include specific problems highlighting the applications of the methods introduced in this course in physical sciences and engineering.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Discrete Probability distributions	9 hours
1.1	Discrete random variables and probability distributions, expected value, mean and variance (discrete)	3
1.2	Binomial distribution-mean, variance, Poisson distribution-mean, variance, Poisson approximation to binomial	3
1.3	Discrete bivariate distributions, marginal distributions, Independence of random variables (discrete), Expected values	3
2	Continuous Probability distributions	9 hours
2.1	Continuous random variables and probability distributions, expected value, mean and variance (continuous)	2
2.2	Uniform, exponential and normal distributions, mean and variance of these distributions	4
2.3	Continuous bivariate distributions, marginal distributions, Independent random variables, Expected values, Central limit theorem.	3
3	Statistical inference	9 hours
3.1	Population and samples, Sampling distribution of single mean and single proportion(large samples)	1
3.2	Confidence interval for single mean and single proportions (large samples)	2
3.3	Hypothesis testing basics, large sample test for single mean, single proportion	2
3.4	Large sample test for equality of means and equality of proportions of two populations	2
3.5	t-distribution and small sample t-test for single mean and pooled t-test for equality of means	2
4	Advanced Graph Theory -I	9 hours
4.1	Introduction- Basic definition – Application of graphs Incidence	1

	and Degree – Isolated vertex, pendent vertex and Null graph	
4.2	Theorems connecting vertex degree and edges, bipartite graphs.	1
4.3	Adjacency matrix, incidence matrix, Isomorphism	1
4.4	Path, cut set, cut edges, Connectedness of directed and undirected graphs ,path isomorphism	2
4.5	Euler paths and circuits , Fleury's algorithm(proof of algorithm omitted) , Hamiltonian paths and circuits. Ore's theorem(proof omitted)	3
4.6	Planar graph, - Euler's theorem on planar graph , applications of Kuratowski's theorem	1
5	Advanced Graph Theory -II	9 hours
5.1	Graph colouring, dual graph	1
5.2	Chromatic number, chromatic number of K_n , $K_{m,n}$, C_n ,	2
5.3	Four colour theorem, applications of graph colouring-scheduling and assignments,	2
5.4	Trees-spanning trees-definition and example, minimum spanning tree,	2
5.5	Prim's algorithm and Kruskal's algorithm(proofs of algorithms omitted)	2

MODEL QUESTION PAPER (2019 Scheme)

Reg. No: Total Pages: 4

Name :

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**FOURTH SEMESTER B.TECH DEGREE EXAMINATION (Month & year)****Course Code: MAT208****Course Name: PROBABILITY, STATISTICS AND ADVANCED GRAPH THEORY****(For Information Technology)****Max Marks:100Duration : 3 Hours****PART A (Answer all questions. Each question carries 3 marks)**

1. Suppose X is a Poisson random variable find $P(X = 1) = P(X = 2)$. Find the mean and variance. (3)
2. The diameter of a circular metallic discs produced by a machine is a random variable with mean 6cm and variance 2cm. Find the mean area of the discs. (3)
3. If the cumulative distribution of a continuous random variable is given by

$$F(x) = \begin{cases} 0 & x \leq 1 \\ 0.5 & 1 < x < 3, \\ 1 & x \geq 3 \end{cases}$$

find $P(X \leq 2)$ (3)

4. The random variable X is exponentially distributed with mean 3. Find $P(X > t + 3 | X > t)$ where t is any positive real number. (3)
5. The 95% confidence interval for the mean mass (in grams) of tablets produced by a machine is $[0.56, 0.57]$, as calculated from a random sample of 50 tablets. What do you understand from this statement? (3)
6. The mean volume of liquid in bottles of lemonade should be at least 2 litres. A sample of bottles is taken in order to test whether the mean volume has fallen below 2 litres. Give a null and alternate hypothesis for this test and specify whether the test would be one-tailed or two-tailed. (3)
7. Draw the graph represented by the following adjacency matrix

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 0 & 0 \\ 0 & 2 & 2 \end{bmatrix} \quad (3)$$

8. Give an example of a graph which has a circuit that is (i) Eulerian but not Hamiltonian (ii) Hamiltonian but not Eulerian (iii) neither Eulerian nor Hamiltonian (3)
9. Find the value of $\chi^2(K_3)$ (3)

10. How many non isomorphic spanning tree does K_3 have ?. Justify your answer
(3)

PART B (Answer one question from each module)

MODULE 1

11. (a) Verify that $p(x) = \binom{8}{x} \left(\frac{1}{2}\right)^x$, $x = 1, 2, 3$ is a probability distribution. Find (i) $P(X \leq 2)$ (ii) $E[X]$ and (iii) $var(X)$. (7)
(b) Find the mean and variance of a binomial random variable (7)

OR

12. (a) Accidents occur at an intersection at a Poisson rate of 2 per day. What is the probability that there would be no accidents on a given day? What is the probability that in January there are at least 3 days (not necessarily consecutive) without any accidents? (7)
(b) Two fair dice are rolled. Let X denote the number on the first die and $Y = 0$ or 1 , according as the first die shows an even number or odd number. Find (i) the joint probability distribution of X and Y , (ii) the marginal distributions. (iii) Are X and Y independent? (7)

MODULE 2

13. (a) The IQ of an individual randomly selected from a population is a normal distribution with mean 100 and standard deviation 15. Find the probability that an individual has IQ (i) above 140 (ii) between 120 and 130. (7)
(b) A continuous random variable X is uniformly distributed with mean 1 and variance $4/3$. Find $P(X < 0)$ (7)

OR

14. (a) Determine the value of c so that $f(x, y) = cxy$ for $0 < x < 3$, $0 < y < 3$ and $f(x, y) = 0$ otherwise satisfies the properties of a joint density function of random variables X and Y . Also find $P(X + Y \leq 1)$. Are X and Y independent? Justify your answer (7)
(b) The lifetime of a certain type of electric bulb may be considered as an exponential random variable with mean 50 hours. Using central limit theorem, find the approximate probability that 100 of these electric bulbs will provide a total of more than 6000 hours of burning time. (7)

MODULE 3

15. (a) The mean blood pressure of 100 randomly selected persons from a target population is 127.3 units. Find a 95% confidence interval for the mean blood pressure of the population. (7)

(b) The CEO of a large electric utility claims that 80 percent of his 1,000,000 customers are very satisfied with the service they receive. To test this claim, the local newspaper surveyed 100 customers, using simple random sampling. Among the sampled customers, 73 percent say they are very satisfied. Based on these findings, do you think that the CEO is making a false claim of high satisfaction levels among his customers? Use a 0.05 level of significance. (7)

OR

16. (a) A magazine reported the results of a telephone poll of 800 adult citizens of a country. The question posed was: "Should the tax on cigarettes be raised to pay for health care reform?" The results of the survey were: Out of the 800 persons surveyed, 605 were non-smokers out of which 351 answered "yes" and the rest "no". Out of the remaining 195, who were smokers, 41 answered "yes" and the remaining "no". Is there sufficient evidence, at the 0.05 significance level, to conclude that the two populations smokers and non-smokers differ significantly with respect to their opinions? (7)

(b) Two types of cars are compared for acceleration rate. 40 test runs are recorded for each car and the results for the mean elapsed time recorded below:

	Sample mean	Sample Standard Deviation
Car A	7.4	1.5
Car B	7.1	1.8

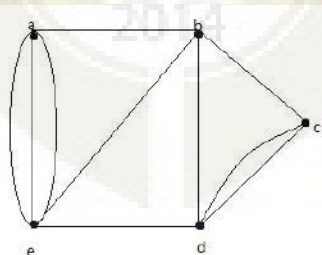
Determine if there is a difference in the mean elapsed times of the two car models at 95% confidence level. (7)

MODULE 4

17. (a) Prove that an undirected graph has an even number of odd degree vertices (7)
 (b) Show that a bipartite graph with an odd number of vertices does not have a Hamilton circuit (7)

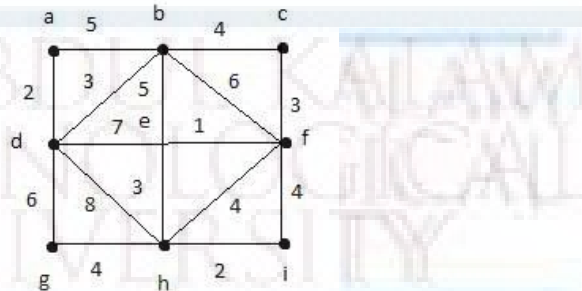
OR

18. (a) Show that an edge in a simple graph is a cut edge if and only if this edge is not part of any simple circuit in the graph. (7)
 (b) Use Fleury's algorithm to find an Euler circuit in the following graph (7)



MODULE 5

19. (a) Prove that a simple graph is a tree if and only if it is connected, but the deletion of any of its edges produces a graph that is not connected (7)
 (b) Find the minimal spanning tree for the following graph by Prim's algorithm (7)



OR

20. (a) Show that a connected bipartite graph has a chromatic number of 2. (7)
 (b) Prove that a full m -ary tree with l leaves has $n = \frac{ml-1}{m-1}$ vertices and $i = \frac{l-1}{m-1}$ internal vertices (7)



CODE		CATEGORY	L	T	P	CREDIT
MCN201	SUSTAINABLE ENGINEERING		2	0	0	NIL

Preamble: Objective of this course is to inculcate in students an awareness of environmental issues and the global initiatives towards attaining sustainability. The student should realize the potential of technology in bringing in sustainable practices.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the relevance and the concept of sustainability and the global initiatives in this direction
CO 2	Explain the different types of environmental pollution problems and their sustainable solutions
CO 3	Discuss the environmental regulations and standards
CO 4	Outline the concepts related to conventional and non-conventional energy
CO 5	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	3					2
CO 2						2	3					2
CO 3						2	3					2
CO 4						2	3					2
CO 5						2	3					2

Assessment Pattern

Mark distribution

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	40
Understand	20	20	40
Apply	10	10	20
Analyse			
Evaluate			
Create			

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Continuous Assessment Test (2 numbers) : 25 marks
 Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Course Level Assessment Questions

Course Outcome 1 (CO1): Understand the relevance and the concept of sustainability and the global initiatives in this direction

1. Explain with an example a technology that has contributed positively to sustainable development.
2. Write a note on Millennium Development Goals.

Course Outcome 2 (CO2): Explain the different types of environmental pollution problems and their sustainable solutions

1. Explain the 3R concept in solid waste management?
2. Write a note on any one environmental pollution problem and suggest a sustainable solution.
3. In the absence of green house effect the surface temperature of earth would not have been suitable for survival of life on earth. Comment on this statement.

Course Outcome 3 (CO3): Discuss the environmental regulations and standards

1. Illustrate Life Cycle Analysis with an example of your choice.
2. “Nature is the most successful designer and the most brilliant engineer that has ever evolved”. Discuss.

Course Outcome 4 (CO4): Outline the concepts related to conventional and non-conventional energy

1. Suggest a sustainable system to generate hot water in a residential building in tropical climate.
2. Enumerate the impacts of biomass energy on the environment.

Course Outcome 5 (CO5): Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

1. Suggest suitable measures to make the conveyance facilities used by your institution sustainable.

Model Question paper

Part A

(Answer all questions. Each question carries 3 marks each)

1. Define sustainable development.
2. Write a short note on Millennium Development Goals.
3. Describe carbon credit.
4. Give an account of climate change and its effect on environment.
5. Describe biomimicry? Give two examples.
6. Explain the basic concept of Life Cycle Assessment.
7. Name three renewable energy sources.

8. Mention some of the disadvantages of wind energy.
9. Enlist some of the features of sustainable habitat.
10. Explain green engineering.

Part B

(Answer one question from each module. Each question carries 14 marks)

11. Discuss the evolution of the concept of sustainability. Comment on its relevance in the modern world.
OR
12. Explain Clean Development Mechanism.
13. Explain the common sources of water pollution and its harmful effects.
OR
14. Give an account of solid waste management in cities.
15. Explain the different steps involved in the conduct of Environmental Impact Assessment.
OR
16. Suggest some methods to create public awareness on environmental issues.
17. Comment on the statement, "Almost all energy that man uses comes from the Sun".
OR
18. Write notes on:
 - a. Land degradation due to water logging.
 - b. Over exploitation of water.
19. Discuss the elements related to sustainable urbanisation.
OR
20. Discuss any three methods by which you can increase energy efficiency in buildings.

Syllabus

Sustainability- need and concept, technology and sustainable development-Natural resources and their pollution, Carbon credits, Zero waste concept. Life Cycle Analysis, Environmental Impact Assessment studies, Sustainable habitat, Green buildings, green materials, Energy, Conventional and renewable sources, Sustainable urbanization, Industrial Ecology.

Module 1

Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).

Module 2

Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.

Module 3

Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.

Module 4

Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.

Module 5

Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.

Reference Books

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
3. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
5. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
6. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
7. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
8. Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Sustainability	
1.1	Introduction, concept, evolution of the concept	1
1.2	Social, environmental and economic sustainability concepts	1
1.3	Sustainable development, Nexus between Technology and Sustainable development	1
1.4	Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)	1
1.5	Clean Development Mechanism (CDM)	1
2	Environmental Pollution	
2.1	Air Pollution and its effects	1
2.2	Water pollution and its sources	1
2.3	Zero waste concept and 3 R concepts in solid waste management	1
2.4	Greenhouse effect, Global warming, Climate change, Ozone layer depletion	1
2.5	Carbon credits, carbon trading and carbon foot print.	1
2.6	Legal provisions for environmental protection.	1
3	Environmental management standards	
3.1	Environmental management standards	1
3.2	ISO 14001:2015 frame work and benefits	1
3.3	Scope and Goal of Life Cycle Analysis (LCA)	1
3.4	Circular economy, Bio-mimicking	1
3.5	Environment Impact Assessment (EIA)	1
3.6	Industrial Ecology, Industrial Symbiosis	1
4	Resources and its utilisation	
4.1	Basic concepts of Conventional and non-conventional energy	1
4.2	General idea about solar energy, Fuel cells	1
4.3	Wind energy, Small hydro plants, bio-fuels	1
4.4	Energy derived from oceans and Geothermal energy	1
5	Sustainability Practices	
5.1	Basic concept of sustainable habitat	1
5.2	Methods for increasing energy efficiency of buildings	1
5.3	Green Engineering	1
5.4	Sustainable Urbanisation, Sustainable cities, Sustainable transport	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
			2	0	0	2
EST 200	DESIGN AND ENGINEERING					

Preamble:

The purpose of this course is to

- i) introduce the undergraduate engineering students the fundamental principles of design engineering,
- ii) make them understand the steps involved in the design process and
- iii) familiarize them with the basic tools used and approaches in design.

Students are expected to apply design thinking in learning as well as while practicing engineering, which is very important and relevant for today. Case studies from various practical situations will help the students realize that design is not only concerned about the function but also many other factors like customer requirements, economics, reliability, etc. along with a variety of life cycle issues.

The course will help students to consider aesthetics, ergonomics and sustainability factors in designs and also to practice professional ethics while designing.

Prerequisite:

Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.

Course Outcomes:

After the completion of the course the student will be able to

CO 1	Explain the different concepts and principles involved in design engineering.
CO 2	Apply design thinking while learning and practicing engineering.
CO 3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1					1			1		
CO 2		2				1		1				2
CO 3			2			1	1		2	2		1

Assessment Pattern**Continuous Internal Evaluation (CIE) Pattern:**

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination (ESE) Pattern: There will be two parts; Part A and Part B.

Part A : 30 marks

part B : 70 marks

Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions.

Part B contains 2 case study questions from each module of which student should answer any one. Each question carry 14 marks and can have maximum 2 sub questions.

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	10	10	20
Apply	35	35	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1): Appreciate the different concepts and principles involved in design engineering.

1. State how engineering design is different from other kinds of design
2. List the different stages in a design process.
3. Describe design thinking.
4. State the function of prototyping and proofing in engineering design.
5. Write notes on the following concepts in connection with design engineering 1) Modular Design, 2) Life Cycle Design, 3) Value Engineering, 4) Concurrent Engineering, and 5) Reverse Engineering
6. State design rights.

Course Outcome 2 (CO2) Apply design thinking while learning and practicing engineering.

1. Construct the iterative process for design thinking in developing simple products like a pen, umbrella, bag, etc.
2. Show with an example how divergent-convergent thinking helps in generating alternative designs and then how to narrow down to the best design.
3. Describe how a problem-based learning helps in creating better design engineering solutions.
4. Discuss as an engineer, how ethics play a decisive role in your designs

Course Outcome 3 (CO3): Develop innovative, reliable, sustainable and economically viable designs incorporating different segments of knowledge in engineering.

1. Illustrate the development of any simple product by passing through the different stages of design process
2. Show the graphical design communication with the help of detailed 2D or 3D drawings for any simple product.
3. Describe how to develop new designs for simple products through bio-mimicry.

Model Question paper

Page 1 of 2

Reg No.: _____ Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION****Course Code: EST 200****Course Name: DESIGN AND ENGINEERING****Max. Marks: 100 Duration: 3 Hours****PART A****Answer all questions, each question carries 3 marks****Use only hand sketches**

- (1) Write about the basic design process.
 - (2) Describe how to finalize the design objectives.
 - (3) State the role of divergent-convergent questioning in design thinking.
 - (4) Discuss how to perform design thinking in a team managing the conflicts.
 - (5) Show how engineering sketches and drawings convey designs.
 - (6) Explain the role of mathematics and physics in design engineering process.
 - (7) Distinguish between project-based learning and problem-based learning in design engineering.
 - (8) Describe how concepts like value engineering, concurrent engineering and reverse engineering influence engineering designs?
 - (9) Show how designs are varied based on the aspects of production methods, life span, reliability and environment?
 - (10) Explain how economics influence the engineering designs?
- (10x3 marks =30 marks)**

Part B**Answer any ONE question from each module. Each question carry 14 marks****Module 1**

- (11) Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.
- or**
- (12) Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Module 2

- (13) Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

or

- (14) Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Module 3

- (15) Graphically communicate the design of a thermo flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.

or

- (16) Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.

Module 4

- (17) Show the development of a nature inspired design for a solar powered bus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.

or

- (18) Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

Module 5

- (19) Examine the changes in the design of a foot wear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.

or

- (20) Describe how to estimate the cost of a particular design using ANY of the following: i) a website, ii) the layout of a plant, iii) the elevation of a building, iv) an electrical or electronic system or device and v) a car.

Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

(5x14 marks =70 marks)

Syllabus

Module 1

Design Process:- Introduction to Design and Engineering Design, Defining a Design Process:-Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.

Module 2

Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.

Module 3

Design Communication (Languages of Engineering Design):-Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.

Module 4

Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design.Modular Design and Life Cycle Design Approaches. Application of Biomimicry,Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.

Module 5

Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design

Text Books

- 1) YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285,
- 2) Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

Reference Books

- 1.Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.
2. Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5
3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
4. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	<u>Module 1: Design Process</u>	
1.1	Introduction to Design and Engineering Design. <i>What does it mean to design something? How Is engineering design different from other kinds of design? Where and when do engineers design? What are the basic vocabulary in engineering design? How to learn and do engineering design.</i>	1
1.2	Defining a Design Process:- Detailing Customer Requirements. <i>How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?</i>	1
1.3	Defining a Design Process:- Setting Design Objectives, Identifying Constraints, Establishing Functions. <i>How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?</i>	1
1.4	Defining a Design Process:- Generating Design Alternatives and Choosing a Design. <i>How to generate or create feasible design alternatives? How to identify the "best possible design"?</i>	1
1.5	Case Studies:- Stages of Design Process. <i>Conduct exercises for designing simple products going through the different stages of design process.</i>	1
2	<u>Module 2: Design Thinking Approach</u>	
2.1	Introduction to Design Thinking <i>How does the design thinking approach help engineers in creating innovative and efficient designs?</i>	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. <i>How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?</i>	1
2.3	Design Thinking as Divergent-Convergent Questioning. <i>Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'.</i>	1
2.4	Design Thinking in a Team Environment. <i>How to perform design thinking as a team managing the conflicts ?</i>	1
2.5	Case Studies: Design Thinking Approach. <i>Conduct exercises using the design thinking approach for</i>	1

	<i>designing any simple products within a limited time and budget</i>	
3	<u>Module 3: Design Communication (Languages of Engineering Design)</u>	
3.1	Communicating Designs Graphically. <i>How do engineering sketches and drawings convey designs?</i>	1
3.2	Communicating Designs Orally and in Writing. <i>How can a design be communicated through oral presentation or technical reports efficiently?</i>	1
First Series Examination		
3.3	Mathematical Modelling in Design. <i>How do mathematics and physics become a part of the design process?</i>	1
3.4	Prototyping and Proofing the Design. <i>How to predict whether the design will function well or not?</i>	1
3.5	Case Studies: Communicating Designs Graphically. <i>Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.</i>	1
4	<u>Module 4: Design Engineering Concepts</u>	
4.1	Project-based Learning and Problem-based Learning in Design. <i>How engineering students can learn design engineering through projects?</i> <i>How students can take up problems to learn design engineering?</i>	1
4.2	Modular Design and Life Cycle Design Approaches. <i>What is modular approach in design engineering? How it helps?</i> <i>How the life cycle design approach influences design decisions?</i>	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. <i>How do aesthetics and ergonomics change engineering designs?</i> <i>How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?</i>	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. <i>How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?</i>	1
4.5	Case Studies: Bio-mimicry based Designs. <i>Conduct exercises to develop new designs for simple</i>	1

	<i>products using bio-mimicry and train students to bring out new nature inspired designs.</i>	
5	<u>Module 5: Expediency, Economics and Environment in Design Engineering</u>	
5.1	Design for Production, Use, and Sustainability. <i>How designs are finalized based on the aspects of production methods, life span, reliability and environment?</i>	1
5.2	Engineering Economics in Design. <i>How to estimate the cost of a particular design and how will economics influence the engineering designs?</i>	1
5.3	Design Rights. <i>What are design rights and how can an engineer put it into practice?</i>	1
5.4	Ethics in Design. <i>How do ethics play a decisive role in engineering design?</i>	1
5.5	Case Studies: Design for Production, Use, and Sustainability. <i>Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors.</i>	1
Second Series Examination		



Code.	Course Name	L	T	P	Hrs	Credit
HUT 200	Professional Ethics	2	0	0	2	2

Preamble: To enable students to create awareness on ethics and human values.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the core values that shape the ethical behaviour of a professional.
CO 2	Adopt a good character and follow an ethical life.
CO 3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.
CO 5	Apply the knowledge of human values and social values to contemporary ethical values and global issues.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1								2			2	
CO 2								2			2	
CO 3								3			2	
CO 4								3			2	
CO 5								3			2	

Assessment Pattern

Bloom's category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understood	20	20	40
Apply	15	15	30

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Tests (2 Nos)	: 25 marks
Assignments/Quiz	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Define integrity and point out ethical values.
2. Describe the qualities required to live a peaceful life.
3. Explain the role of engineers in modern society.

Course Outcome 2 (CO2)

1. Derive the codes of ethics.
2. Differentiate consensus and controversy.
3. Discuss in detail about character and confidence.

Course Outcome 3(CO3):

1. Explain the role of professional's ethics in technological development.
2. Distinguish between self interest and conflicts of interest.
3. Review on industrial standards and legal ethics.

Course Outcome 4 (CO4):

1. Illustrate the role of engineers as experimenters.
2. Interpret the terms safety and risk.
3. Show how the occupational crimes are resolved by keeping the rights of employees.

Course Outcome 5 (CO5):

1. Exemplify the engineers as managers.
2. Investigate the causes and effects of acid rain with a case study.
3. Explore the need of environmental ethics in technological development.

Model Question paper**QP CODE:****Reg No:** _____**PAGES:3****Name :** _____**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD/FOURTH SEMESTER
B.TECH DEGREE EXAMINATION, MONTH & YEAR****Course Code: HUT 200****Course Name: PROFESSIONAL ETHICS****Max. Marks: 100****Duration: 3 Hours****(2019-Scheme)****PART A****(Answer all questions, each question carries 3 marks)**

1. Define empathy and honesty.
2. Briefly explain about morals, values and ethics.
3. Interpret the two forms of self-respect.
4. List out the models of professional roles.
5. Indicate the advantages of using standards.
6. Point out the conditions required to define a valid consent?
7. Identify the conflicts of interests with an example?
8. Recall confidentiality.
9. Conclude the features of biometric ethics.
10. Name any three professional societies and their role relevant to engineers.

(10x3 = 30 marks)**PART B****(Answer one full question from each module, each question carries 14 marks)****MODULE I**

- 11. a)** Classify the relationship between ethical values and law?

b) Compare between caring and sharing.

(10+4 = 14 marks)**Or**

- 12. a)** Exemplify a comprehensive review about integrity and respect for others.

b) Discuss about co-operation and commitment.

(8+6 = 14 marks)

MODULE II

13.a) Explain the three main levels of moral developments, devised by Kohlberg.

b) Differentiate moral codes and optimal codes.

(10+4 = 14 marks)

Or

14. a) Extrapolate the duty ethics and right ethics.

b) Discuss in detail the three types of inquiries in engineering ethics

(8+6 = 14 marks)

MODULE III

15.a) Summarize the following features of morally responsible engineers.

(i) Moral autonomy

(ii) Accountability

b) Explain the rights of employees

(8+6 = 14 marks)

Or

16. a) Explain the reasons for Chernobyl mishap ?

b) Describe the methods to improve collegiality and loyalty.

(8+6 = 14 marks)

MODULE IV

17.a) Execute collegiality with respect to commitment, respect and connectedness.

b) Identify conflicts of interests with an example.

(8+6 = 14 marks)

Or

18. a) Explain in detail about professional rights and employee rights.

b) Exemplify engineers as managers.

MODULE V

19.a) Evaluate the technology transfer and appropriate technology.

b) Explain about computer and internet ethics.

(8+6 = 14 marks)

Or

20. a) Investigate the causes and effects of acid rain with a case study.

b) Conclude the features of ecocentric and biocentric ethics.

(8+6 = 14 marks)

Syllabus

Module 1 – Human Values.

Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment- Empathy-Self Confidence -Social Expectations.

Module 2 - Engineering Ethics & Professionalism.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional roles-Theories about right action –Self interest-Customs and Religion- Uses of Ethical Theories.

Module 3- Engineering as social Experimentation.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Module 4- Responsibilities and Rights.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.

Module 5- Global Ethical Issues.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors-Moral leadership.

Text Book

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

Reference Books

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4. <http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics>.

Course Contents and Lecture Schedule

SL.No	Topic	No. of Lectures 25
1	Module 1 – Human Values.	
1.1	Morals, values and Ethics, Integrity, Academic Integrity, Work Ethics	1
1.2	Service Learning, Civic Virtue, Respect for others, Living peacefully	1
1.3	Caring and Sharing, Honesty, Courage, Co-operation commitment	2
1.4	Empathy, Self Confidence, Social Expectations	1
2	Module 2- Engineering Ethics & Professionalism.	
2.1	Senses of Engineering Ethics, Variety of moral issues, Types of inquiry	1
2.2	Moral dilemmas, Moral Autonomy, Kohlberg's theory	1
2.3	Gilligan's theory, Consensus and Controversy, Profession & Professionalism, Models of professional roles, Theories about right action	2
2.4	Self interest-Customs and Religion, Uses of Ethical Theories	1
3	Module 3- Engineering as social Experimentation.	
3.1	Engineering as Experimentation, Engineers as responsible Experimenters	1
3.2	Codes of Ethics, Plagiarism, A balanced outlook on law	2
3.3	Challenger case study, Bhopal gas tragedy	2
4	Module 4- Responsibilities and Rights.	
4.1	Collegiality and loyalty, Managing conflict, Respect for authority	1
4.2	Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest	2
4.3	Occupational crime, Professional rights, Employee right, IPR Discrimination	2
5	Module 5- Global Ethical Issues.	
5.1	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics	2
5.2	Role in Technological Development, Moral leadership	1
5.3	Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	2



SEMESTER -4

CODE MCN202	COURSE NAME CONSTITUTION OF INDIA	CATEGORY	L	T	P	CREDIT
			2	0	0	NIL

Preamble:

The study of their own country constitution and studying the importance environment as well as understanding their own human rights help the students to concentrate on their day to day discipline. It also gives the knowledge and strength to face the society and people.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the background of the present constitution of India and features.
CO 2	Utilize the fundamental rights and duties.
CO 3	Understand the working of the union executive, parliament and judiciary.
CO 4	Understand the working of the state executive, legislature and judiciary.
CO 5	Utilize the special provisions and statutory institutions.
CO 6	Show national and patriotic spirit as responsible citizens of the country

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	2	2		2		
CO 2						3	3	3		3		
CO 3						3	2	3		3		
CO 4						3	2	3		3		
CO 5						3	2	3		3		
CO 6						3	3	3		2		

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	40
Understand	20	20	40
Apply	10	10	20
Analyse			

Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

- 1 Discuss the historical background of the Indian constitution.
- 2 Explain the salient features of the Indian constitution.
- 3 Discuss the importance of preamble in the implementation of constitution.

Course Outcome 2 (CO2)

- 1 What are fundamental rights ? Examine each of them.
- 2 Examine the scope of freedom of speech and expression underlying the constitution.
- 3 The thumb impression of an accused is taken by the police against his will. He contends that this is a violation of his rights under Art 20(3) of the constitution. Decide.

Course Outcome 3(CO3):

- 1 Explain the powers of the President to suspend the fundamental rights during emergency.

- 2 Explain the salient features of appeal by special leave.
3. List the constitutional powers of President.

Course Outcome 4 (CO4):

- 1 Discuss the constitutional powers of Governor.
- 2 Examine the writ jurisdiction of High court.
- 3 Discuss the qualification and disqualification of membership of state legislature.

Course Outcome 5 (CO5):

- 1 Discuss the duties and powers of comptroller of auditor general.
- 2 Discuss the proclamation of emergency.
- 3 A state levies tax on motor vehicles used in the state, for the purpose of maintaining roads in the state. X challenges the levy of the tax on the ground that it violates the freedom of interstate commerce guaranteed under Art 301. Decide.

Course Outcome 6 (CO6):

- 1 Explain the advantages of citizenship.
- 2 List the important principles contained in the directive principles of state policy.
- 3 Discuss the various aspects contained in the preamble of the constitution

Model Question paper

PART A

(Answer all questions. Each question carries 3 marks)

- 1 Define and explain the term constitution.
- 2 Explain the need and importance of Preamble.
- 3 What is directive principle of state policy?
- 4 Define the State.
- 5 List the functions of Attorney general of India.

- 6 Explain the review power of Supreme court.
- 7 List the qualifications of Governor.
- 8 Explain the term and removal of Judges in High court.
- 9 Explain the powers of public service commission.
- 10 List three types of emergency under Indian constitution.

(10X3=30marks)

PART B

(Answer on question from each module. Each question carries 14 marks)

Module 1

- 11 Discuss the various methods of acquiring Indian citizenship.
- 12 Examine the salient features of the Indian constitution.

Module 2

- 13 A high court passes a judgement against X. X desires to file a writ petition in the supreme court under Art32, on the ground that the judgement violates his fundamental rights.

Advise him whether he can do so.

- 14 What is meant by directive principles of State policy? List the directives.

Module3

- 15 Describe the procedure of election and removal of the President of India.
- 16 Supreme court may in its discretion grant special leave to appeal. Examine the situation.

Module 4

- 17 Discuss the powers of Governor.
- 18 X filed a writ petition under Art 226 which was dismissed. Subsequently, he filed a writ petition under Art 32 of the constitution, seeking the same remedy. The Government argued that the writ petition should be dismissed, on the ground of res judicata. Decide.

Module 5

19 Examine the scope of the financial relations between the union and the states.

20 Discuss the effects of proclamation of emergency.

(14X5=70marks)

Syllabus

Module 1 Definition, historical back ground, features, preamble, territory, citizenship.

Module 2 State, fundamental rights, directive principles, duties.

Module 3 The machinery of the union government.

Module 4 Government machinery in the states

Module 5 The federal system, Statutory Institutions, miscellaneous provisions.

Text Books

1 D D Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi, 24e, 2019

2 PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

Reference Books

1 Ministry of law and justice, The constitution of India, Govt of India, New Delhi, 2019.

2 JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019

3 MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Module 1	
1.1	Definition of constitution, historical back ground, salient features of the constitution.	1
1.2	Preamble of the constitution, union and its territory.	1
1.3	Meaning of citizenship, types, termination of citizenship.	2
2	Module 2	
2.1	Definition of state, fundamental rights, general nature, classification, right to equality ,right to freedom , right against exploitation	2

2.2	Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences.	2
2.3	Directive principles of state policy, classification of directives, fundamental duties.	2
3	Module 3	
3.1	The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions.	2
3.2	The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament.	2
3.3	Union judiciary, the supreme court, jurisdiction, appeal by special leave.	1
4	Module 4	
4.1	The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories.	2
4.2	The State Legislature, composition, qualification and disqualification of membership, functions.	2
4.3	The state judiciary, the high court, jurisdiction, writs jurisdiction.	1
5	Module 5	
5.1	Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission.	1
5.2	Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals.	2
5.3	Official language, elections, special provisions relating to certain classes, amendment of the Constitution.	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
			2	0	0	2
EST 200	DESIGN AND ENGINEERING					

Preamble:

The purpose of this course is to

- i) introduce the undergraduate engineering students the fundamental principles of design engineering,
- ii) make them understand the steps involved in the design process and
- iii) familiarize them with the basic tools used and approaches in design.

Students are expected to apply design thinking in learning as well as while practicing engineering, which is very important and relevant for today. Case studies from various practical situations will help the students realize that design is not only concerned about the function but also many other factors like customer requirements, economics, reliability, etc. along with a variety of life cycle issues.

The course will help students to consider aesthetics, ergonomics and sustainability factors in designs and also to practice professional ethics while designing.

Prerequisite:

Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.

Course Outcomes:

After the completion of the course the student will be able to

CO 1	Explain the different concepts and principles involved in design engineering.
CO 2	Apply design thinking while learning and practicing engineering.
CO 3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1					1			1		
CO 2		2				1		1				2
CO 3			2			1	1		2	2		1

Assessment Pattern**Continuous Internal Evaluation (CIE) Pattern:**

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination (ESE) Pattern: There will be two parts; Part A and Part B.

Part A : 30 marks

part B : 70 marks

Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions.

Part B contains 2 case study questions from each module of which student should answer any one. Each question carry 14 marks and can have maximum 2 sub questions.

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	10	10	20
Apply	35	35	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1): Appreciate the different concepts and principles involved in design engineering.

1. State how engineering design is different from other kinds of design
2. List the different stages in a design process.
3. Describe design thinking.
4. State the function of prototyping and proofing in engineering design.
5. Write notes on the following concepts in connection with design engineering 1) Modular Design, 2) Life Cycle Design, 3) Value Engineering, 4) Concurrent Engineering, and 5) Reverse Engineering
6. State design rights.

Course Outcome 2 (CO2) Apply design thinking while learning and practicing engineering.

1. Construct the iterative process for design thinking in developing simple products like a pen, umbrella, bag, etc.
2. Show with an example how divergent-convergent thinking helps in generating alternative designs and then how to narrow down to the best design.
3. Describe how a problem-based learning helps in creating better design engineering solutions.
4. Discuss as an engineer, how ethics play a decisive role in your designs

Course Outcome 3 (CO3): Develop innovative, reliable, sustainable and economically viable designs incorporating different segments of knowledge in engineering.

1. Illustrate the development of any simple product by passing through the different stages of design process
2. Show the graphical design communication with the help of detailed 2D or 3D drawings for any simple product.
3. Describe how to develop new designs for simple products through bio-mimicry.

Model Question paper

Page 1 of 2

Reg No.: _____ Name: _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION****Course Code: EST 200****Course Name: DESIGN AND ENGINEERING****Max. Marks: 100 Duration: 3 Hours****PART A****Answer all questions, each question carries 3 marks****Use only hand sketches**

- (1) Write about the basic design process.
 - (2) Describe how to finalize the design objectives.
 - (3) State the role of divergent-convergent questioning in design thinking.
 - (4) Discuss how to perform design thinking in a team managing the conflicts.
 - (5) Show how engineering sketches and drawings convey designs.
 - (6) Explain the role of mathematics and physics in design engineering process.
 - (7) Distinguish between project-based learning and problem-based learning in design engineering.
 - (8) Describe how concepts like value engineering, concurrent engineering and reverse engineering influence engineering designs?
 - (9) Show how designs are varied based on the aspects of production methods, life span, reliability and environment?
 - (10) Explain how economics influence the engineering designs?
- (10x3 marks =30 marks)**

Part B**Answer any ONE question from each module. Each question carry 14 marks****Module 1**

- (11) Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.
- or**
- (12) Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Module 2

(13) Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

or

(14) Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Module 3

(15) Graphically communicate the design of a thermo flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.

or

(16) Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.

Module 4

(17) Show the development of a nature inspired design for a solar powered bus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.

or

(18) Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

Module 5

(19) Examine the changes in the design of a foot wear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.

or

(20) Describe how to estimate the cost of a particular design using ANY of the following: i) a website, ii) the layout of a plant, iii) the elevation of a building, iv) an electrical or electronic system or device and v) a car.

Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

(5x14 marks =70 marks)

Syllabus**Module 1**

Design Process:- Introduction to Design and Engineering Design, Defining a Design Process:-Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.

Module 2

Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.

Module 3

Design Communication (Languages of Engineering Design):-Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.

Module 4

Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design.Modular Design and Life Cycle Design Approaches. Application of Biomimicry,Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.

Module 5

Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design

Text Books

- 1) YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285,
- 2) Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

Reference Books

- 1.Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.
2. Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5
3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
4. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	<u>Module 1: Design Process</u>	
1.1	Introduction to Design and Engineering Design. <i>What does it mean to design something? How Is engineering design different from other kinds of design? Where and when do engineers design? What are the basic vocabulary in engineering design? How to learn and do engineering design.</i>	1
1.2	<i>Defining a Design Process:-</i> Detailing Customer Requirements. <i>How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?</i>	1
1.3	<i>Defining a Design Process:-</i> Setting Design Objectives, Identifying Constraints, Establishing Functions. <i>How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?</i>	1
1.4	<i>Defining a Design Process:-</i> Generating Design Alternatives and Choosing a Design. <i>How to generate or create feasible design alternatives? How to identify the "best possible design"?</i>	1
1.5	Case Studies:- Stages of Design Process. <i>Conduct exercises for designing simple products going through the different stages of design process.</i>	1
2	<u>Module 2: Design Thinking Approach</u>	
2.1	Introduction to Design Thinking <i>How does the design thinking approach help engineers in creating innovative and efficient designs?</i>	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. <i>How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?</i>	1
2.3	Design Thinking as Divergent-Convergent Questioning. <i>Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'.</i>	1
2.4	Design Thinking in a Team Environment. <i>How to perform design thinking as a team managing the conflicts ?</i>	1
2.5	Case Studies: Design Thinking Approach. <i>Conduct exercises using the design thinking approach for</i>	1

	<i>designing any simple products within a limited time and budget</i>	
3	<u>Module 3: Design Communication (Languages of Engineering Design)</u>	
3.1	Communicating Designs Graphically. <i>How do engineering sketches and drawings convey designs?</i>	1
3.2	Communicating Designs Orally and in Writing. <i>How can a design be communicated through oral presentation or technical reports efficiently?</i>	1
First Series Examination		
3.3	Mathematical Modelling in Design. <i>How do mathematics and physics become a part of the design process?</i>	1
3.4	Prototyping and Proofing the Design. <i>How to predict whether the design will function well or not?</i>	1
3.5	Case Studies: Communicating Designs Graphically. <i>Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.</i>	1
4	<u>Module 4: Design Engineering Concepts</u>	
4.1	Project-based Learning and Problem-based Learning in Design. <i>How engineering students can learn design engineering through projects?</i> <i>How students can take up problems to learn design engineering?</i>	1
4.2	Modular Design and Life Cycle Design Approaches. <i>What is modular approach in design engineering? How it helps?</i> <i>How the life cycle design approach influences design decisions?</i>	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. <i>How do aesthetics and ergonomics change engineering designs?</i> <i>How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?</i>	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. <i>How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?</i>	1
4.5	Case Studies: Bio-mimicry based Designs. <i>Conduct exercises to develop new designs for simple</i>	1

	<i>products using bio-mimicry and train students to bring out new nature inspired designs.</i>	
5	<u>Module 5: Expediency, Economics and Environment in Design Engineering</u>	
5.1	Design for Production, Use, and Sustainability. <i>How designs are finalized based on the aspects of production methods, life span, reliability and environment?</i>	1
5.2	Engineering Economics in Design. <i>How to estimate the cost of a particular design and how will economics influence the engineering designs?</i>	1
5.3	Design Rights. <i>What are design rights and how can an engineer put it into practice?</i>	1
5.4	Ethics in Design. <i>How do ethics play a decisive role in engineering design?</i>	1
5.5	Case Studies: Design for Production, Use, and Sustainability. <i>Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors.</i>	1
Second Series Examination		



Code.	Course Name	L	T	P	Hrs	Credit
HUT 200	Professional Ethics	2	0	0	2	2

Preamble: To enable students to create awareness on ethics and human values.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the core values that shape the ethical behaviour of a professional.
CO 2	Adopt a good character and follow an ethical life.
CO 3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.
CO 5	Apply the knowledge of human values and social values to contemporary ethical values and global issues.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1								2			2	
CO 2								2			2	
CO 3								3			2	
CO 4								3			2	
CO 5								3			2	

Assessment Pattern

Bloom's category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understood	20	20	40
Apply	15	15	30

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Tests (2 Nos)	: 25 marks
Assignments/Quiz	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Define integrity and point out ethical values.
2. Describe the qualities required to live a peaceful life.
3. Explain the role of engineers in modern society.

Course Outcome 2 (CO2)

1. Derive the codes of ethics.
2. Differentiate consensus and controversy.
3. Discuss in detail about character and confidence.

Course Outcome 3(CO3):

1. Explain the role of professional's ethics in technological development.
2. Distinguish between self interest and conflicts of interest.
3. Review on industrial standards and legal ethics.

Course Outcome 4 (CO4):

1. Illustrate the role of engineers as experimenters.
2. Interpret the terms safety and risk.
3. Show how the occupational crimes are resolved by keeping the rights of employees.

Course Outcome 5 (CO5):

1. Exemplify the engineers as managers.
2. Investigate the causes and effects of acid rain with a case study.
3. Explore the need of environmental ethics in technological development.

Model Question paper**QP CODE:****Reg No:** _____**PAGES:3****Name :** _____**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD/FOURTH SEMESTER
B.TECH DEGREE EXAMINATION, MONTH & YEAR****Course Code: HUT 200****Course Name: PROFESSIONAL ETHICS****Max. Marks: 100****Duration: 3 Hours****(2019-Scheme)****PART A****(Answer all questions, each question carries 3 marks)**

1. Define empathy and honesty.
2. Briefly explain about morals, values and ethics.
3. Interpret the two forms of self-respect.
4. List out the models of professional roles.
5. Indicate the advantages of using standards.
6. Point out the conditions required to define a valid consent?
7. Identify the conflicts of interests with an example?
8. Recall confidentiality.
9. Conclude the features of biometric ethics.
10. Name any three professional societies and their role relevant to engineers.

(10x3 = 30 marks)**PART B****(Answer one full question from each module, each question carries 14 marks)****MODULE I**

- 11. a)** Classify the relationship between ethical values and law?

b) Compare between caring and sharing.

(10+4 = 14 marks)**Or**

- 12. a)** Exemplify a comprehensive review about integrity and respect for others.

b) Discuss about co-operation and commitment.

(8+6 = 14 marks)

MODULE II

13.a) Explain the three main levels of moral developments, devised by Kohlberg.

b) Differentiate moral codes and optimal codes.

(10+4 = 14 marks)

Or

14. a) Extrapolate the duty ethics and right ethics.

b) Discuss in detail the three types of inquiries in engineering ethics

(8+6 = 14 marks)

MODULE III

15.a) Summarize the following features of morally responsible engineers.

(i) Moral autonomy

(ii) Accountability

b) Explain the rights of employees

(8+6 = 14 marks)

Or

16. a) Explain the reasons for Chernobyl mishap ?

b) Describe the methods to improve collegiality and loyalty.

(8+6 = 14 marks)

MODULE IV

17.a) Execute collegiality with respect to commitment, respect and connectedness.

b) Identify conflicts of interests with an example.

(8+6 = 14 marks)

Or

18. a) Explain in detail about professional rights and employee rights.

b) Exemplify engineers as managers.

MODULE V

19.a) Evaluate the technology transfer and appropriate technology.

b) Explain about computer and internet ethics.

(8+6 = 14 marks)

Or

20. a) Investigate the causes and effects of acid rain with a case study.

b) Conclude the features of ecocentric and biocentric ethics.

(8+6 = 14 marks)

Syllabus

Module 1 – Human Values.

Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment- Empathy-Self Confidence -Social Expectations.

Module 2 - Engineering Ethics & Professionalism.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional roles-Theories about right action –Self interest-Customs and Religion- Uses of Ethical Theories.

Module 3- Engineering as social Experimentation.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Module 4- Responsibilities and Rights.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.

Module 5- Global Ethical Issues.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors-Moral leadership.

Text Book

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

Reference Books

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4. <http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics>.

Course Contents and Lecture Schedule

SL.No	Topic	No. of Lectures 25
1	Module 1 – Human Values.	
1.1	Morals, values and Ethics, Integrity, Academic Integrity, Work Ethics	1
1.2	Service Learning, Civic Virtue, Respect for others, Living peacefully	1
1.3	Caring and Sharing, Honesty, Courage, Co-operation commitment	2
1.4	Empathy, Self Confidence, Social Expectations	1
2	Module 2- Engineering Ethics & Professionalism.	
2.1	Senses of Engineering Ethics, Variety of moral issues, Types of inquiry	1
2.2	Moral dilemmas, Moral Autonomy, Kohlberg's theory	1
2.3	Gilligan's theory, Consensus and Controversy, Profession & Professionalism, Models of professional roles, Theories about right action	2
2.4	Self interest-Customs and Religion, Uses of Ethical Theories	1
3	Module 3- Engineering as social Experimentation.	
3.1	Engineering as Experimentation, Engineers as responsible Experimenters	1
3.2	Codes of Ethics, Plagiarism, A balanced outlook on law	2
3.3	Challenger case study, Bhopal gas tragedy	2
4	Module 4- Responsibilities and Rights.	
4.1	Collegiality and loyalty, Managing conflict, Respect for authority	1
4.2	Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest	2
4.3	Occupational crime, Professional rights, Employee right, IPR Discrimination	2
5	Module 5- Global Ethical Issues.	
5.1	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics	2
5.2	Role in Technological Development, Moral leadership	1
5.3	Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	2

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER V

KTU



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT301	WEB APPLICATION DEVELOPMENT	PCC	3	1	0	4

Preamble: Web Application Development course is intended to deliver the elementary concepts of Web Application Development with HTML, CSS, JavaScript, JQuery, Node JS and MongoDB thereby equipping them to develop real time web applications.

Prerequisite: Basics of programming

Course Outcome (CO): After completion of the course, the student will be able to

CO No.	Course Outcomes	Bloom's Category
CO1	Identify HTML5 elements in webpages	Level 2: Understand
CO2	Implement Cascading Stylesheet to add style in HTML pages	Level 3: Apply
CO3	Apply JavaScript to add functionality to web pages	Level 3: Apply
CO4	Use Ajax & JQuery to enhance the functioning of web pages	Level 3: Apply
CO5	Develop web applications with HTML, CSS, JavaScript, Node JS and MongoDB	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

3/2/1: High/Medium/Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2		2							
CO2	1	2	2		2							
CO3	2	2	1		2							
CO4	2	2	1		3							1
CO5	2	3	1	1	3							2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	1	2	
Remember			
Understand	30	20	40
Apply	20	30	60
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

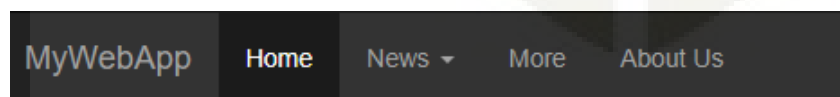
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

CO1: Differentiate ordered list and unordered list with example.

CO2: Create a navigation bar in the format shown below using Cascading Stylesheet and HTML:



CO3: Demonstrate insertion of new list item in an HTML page utilizing DOM methods.

CO4: Use Ajax & JQuery to enhance the functioning of web pages

CO5: Create a web application for library with HTML, CSS, JavaScript and Node.

The features needed in the website are:

1.	Insert Book
2.	Delete Book
3.	Checkout Book

Model Question Paper

Course Code: ITT301

Course Name: WEB APPLICATION DEVELOPMENT

Max.Marks:100

Duration: 3 Hours

PART A

(10*3=30)

(Each question carries 3 marks)

1. What is the use of href? Give example.
2. Illustrate the usage of alt attribute in an image tag.
3. What are Cascading Style Sheets?
4. Differentiate block and inline elements.
5. What is Document Object Model?
6. Illustrate how JavaScript makes webpages more interactive.
7. Differentiate let, var and const in JavaScript.
8. Illustrate how ajax works?
9. What are the different operations involved in accessing a web page?
10. Explain different features of node.js.

PART B

(5*14=70)

11. Explain table tag and create the following table using table tag in HTML:

Branch	CGPA/Percentage		Salary
	UG	PG	
IT	105	12	500000
Others	200	225	400000

OR

12. Explain various concerns and operations involved in web design starting from ideation to hosting of a website.
13. Differentiate the concepts of inline, internal and external style sheets with examples.

OR

14. Illustrate layout and positioning elements in CSS with example.
15. Explain JavaScript: Objects: Math, String, Date, and document Object with example.

OR

16. What is events and explain event handling with example.

17. Explain callbacks, promise and async/await with example.

OR

18. What is Ajax, and explain loading JSON with Ajax.

19. Discuss CRUD operation with node express.

OR

20. Explain steps involved in building a node express app with MongoDB.

Syllabus

MODULE 1: INTRODUCTION TO WEB DESIGNING	8 Hrs
Web Design Basics: Who is the Site For?, Why People Visit your Website?, What Information Your Visitors Need?, Site maps, wireframes, Getting your message across using design, Visual hierarchy, grouping and similarity, Designing Navigation, Search Engine Optimization (SEO), Analytics, Domain Names & Hosting, Ftp & Third party tools HTML5: Introduction to HTML5, Basic Structure for HTML, Basic HTML tags-Headings, Linking, Images, Special Characters and Horizontal Rules, Lists, Tables, Forms, Internal Linking, meta elements, New HTML5 Form input Types, input and data list elements, autocomplete Attribute, Page-Structure Elements	
MODULE 2: STYLE WITH CSS	9 Hrs
Introduction to CSS: Introduction to CSS, Block and Inline Elements, Inline Styles, using internal CSS, using external CSS, How CSS rules cascade, inheritance, why use external style sheets? CSS3 Basics: CSS selectors, <i>color</i>: foreground color, background color, contrast, opacity; <i>text</i>: Typeface terminology, Specifying Typefaces, font-size, font-weight, font-style, text-transform, text-decoration, line-height, letter-spacing, word-spacing, text-align, vertical-align, text-indent, text-shadow; responding to users; <i>box</i>: box dimensions, limiting width, limiting height, overflow; <i>border margin and padding</i>, centering content, change inline/blocks, hiding boxes, box shadows, rounded corners; <i>list tables and forms</i>: list-style, table properties, styling forms, styling text input Layout and positioning: <i>layout</i>: key concepts in positioning elements, <i>controlling the position of elements</i>: relative positioning, absolute positioning, fixed positioning, z-index, float, clear, creating multi column layout with float, fixed width layout, liquid layout, layout grids, <i>Images</i>: controlling size of images in CSS, aligning images using CSS, centering	

images using CSS, background images, gradients, Media Queries

MODULE 3: INTRODUCTION TO JAVASCRIPT

9 Hrs

JavaScript: How JavaScript makes the webpages more interactive, examples of JavaScript in browser, *Basic JavaScript instructions:* statements, comments, variable, data types, arrays, expressions, operators; *functions methods and objects:* function, anonymous function, variable scope, object, this, arrays are objects, browser object model, document object model, *Global objects:* string, number, math, date.

Decision making and Loops: *decision making:* if statement, if...else statement, switch statement, *loops:* key loop concepts, for loops, while loops, do while loops;

DOM: Document Object Model (DOM), the DOM tree as a model of a web page, working with DOM tree, accessing elements, nodelists, selecting elements: using class attribute, tag name, CSS selectors; repeating actions for an entire nodelist, looping through a nodelist, traversing the DOM, adding or removing html content, update text and markup, adding/removing elements

Event handling: different event types and ways to bind an event to an element: using DOM event handlers, using event listeners, using parameters with event listeners; the event object, event delegation, user interface events, event bubbling

Module 4: JAVASCRIPT ADVANCED

10 Hrs

ECMA Script: ECMA Script versions, ES5 Features, ES6 introduction, Var Declarations and Hoisting, let declaration, Constant declaration, function with default parameter values, default parameter expressions, unnamed parameters, the spread operator, arrow functions, object destructuring, array destructuring, sets and maps, Array.find(), Array.findIndex(), template strings, Javascript classes, callbacks, promises, async/await

AJAX: What is Ajax? , Why use Ajax?, How Ajax works?, Handling Ajax request and response, data formats: XML, JSON; Working with JSON data, Loading HTML with Ajax, Loading XML with Ajax, Loading JSON with Ajax, working with data from other servers

JQuery : What is JQuery ?, A basic JQuery example, Why use JQuery ?, finding elements, JQuery selection, getting element content, updating elements, changing content, inserting elements, adding new content, getting and setting attributes, getting and setting CSS properties, using .each(), events, event object, effects, animating CSS properties, using animation, traversing the DOM, working with forms, JavaScript libraries, JQuery and

Ajax

Module 5: BACK END DEVELOPMENT**9 Hrs**

Web Servers: Introduction, HTTP Transactions, Multitier Application Architecture, Client-Side Scripting versus Server-Side Scripting, Accessing Web Servers.

Server Side Scripting with Node.js: Getting to know node, node.js changed JavaScript forever, features of node, when to use and not use node, asynchronous callbacks, the NoSql movement, node and MongoDB in the wild, Hello World in Node, package.json, modules, *Built-in Modules:* FS Module, HTTP Module, Events; Node Package Manager(npm), web server using http, node.js with express, middleware, routing in express, CRUD operations in express, web server using express, making it live on Heroku

Node.js with MongoDB: basics of MongoDB, MongoDB CRUD Operations, Building a data model with MongoDB and Mongoose, Defining simple mongoose schemas, build node express app with MongoDB

Text Books

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet and World Wide Web How To Program”, 5/E, Pearson Education, 2012.
2. Jon Duckett , “HTML and CSS: Design and Build Websites”, Wiley
3. Jon Duckett , “JavaScript and JQuery : Interactive Front–End Web Development”, Wiley
4. Nicholas C. Zakas, “Understanding ECMAScript 6: The Definitive Guide for JavaScript Developers”

Reference Books

1. Alex Young, Marc Harter, “Node js in practice”, Manning.
2. Jason Krol , “Web Development with MongoDB and node js”, Packt
3. Krishna Rungta , “Node JS: learn in one day

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures (in hours)
1	Introduction to web designing	8
1.1	Web Design Basics: Who is the Site For?, Why People Visit your Website, What Information Your Visitors Need?, Site maps, wireframes, Getting your message across using design, Visual hierarchy, grouping and similarity, Designing Navigation, Search Engine Optimization (SEO), Analytics, Domain Names & Hosting, Ftp & Third party tools	2
1.2	HTML5: Introduction to HTML5, Basic Structure for HTML, Basic HTML tags-Headings, Linking, Images, Special Characters and Horizontal Rules	2
1.3	Lists, Tables, Forms, Internal Linking, meta elements, New HTML5 Form input Types	2
1.4	input and data list elements, autocomplete Attribute, Page-Structure Elements	2
2	Style with CSS	9
2.1	Introduction To CSS: Introduction to CSS, Block and Inline Elements, Inline Styles, Using internal CSS, Using external CSS, How CSS rules cascade, inheritance, why use external style sheets?	2
2.2	CSS3 Basics: CSS selectors, <i>color</i> : foreground color, background color, contrast, opacity; <i>text</i> : Typeface terminology, Specifying Typefaces, font-size, font-weight, font-style, text-transform, text-decoration, line-height, letter-spacing, word-spacing, text-align, vertical-align, text-indent, text-shadow; responding to users; <i>box</i> : box dimensions, limiting width, limiting height, overflow; <i>border margin and padding</i> , centering content, change inline/blocks, hiding boxes, box shadows, rounded corners	2
2.3	<i>list tables and forms</i> : list-style, table properties, styling forms, styling text input	1
2.4	Layout and positioning: <i>layout</i> : key concepts in positioning elements, <i>controlling the position of elements</i> : relative positioning, absolute positioning, fixed positioning, z-index, float, clear, creating multi column layout with float, fixed width layout, liquid layout, layout grids,	2

2.5	<i>Images:</i> controlling size of images in CSS, aligning images using CSS, centering images using CSS, background images, gradients, Media Queries	2
3	Introduction To JavaScript	9
3.1	JavaScript: How JavaScript makes the webpages more interactive, examples of JavaScript in browser, <i>Basic JavaScript instructions:</i> statements, comments, variable, data types, arrays, expressions, operators; <i>functions methods and objects:</i> function, anonymous function, variable scope, object, this, arrays are objects, browser object model, document object model, <i>Global objects:</i> string, number, math, date;	2
3.2	Decision making and Loops: <i>decision making:</i> if statement, if...else statement, switch statement, <i>loops:</i> key loop concepts, for loops, while loops, do while loops;	2
3.3	DOM: Document Object Model (DOM), the DOM tree as a model of a web page, working with DOM tree, accessing elements, nodelists, selecting elements: using class attribute, tag name, CSS selectors; repeating actions for an entire nodelist, looping through a nodelist,	2
3.4	traversing the DOM, adding or removing html content, update text and markup, adding/removing elements	1
3.5	Event handling: different event types, three ways to bind an event to an element, using DOM event handlers, using event listeners, using parameters with event listeners, the event object, event delegation, user interface events, event bubbling	2
4	JavaScript Advanced	10
4.1	ECMA Script: ECMA Script versions, ES5 Features, ES6 introduction, Var Declarations and Hoisting, let declaration, Constant declaration, function with default parameter values, default parameter expressions, unnamed parameters, the spread operator, arrow functions, object destructuring, array destructuring, sets and maps, Array.find, Array.findIndex, template strings	2
4.2	JavaScript classes, callbacks, promises, async/await	1
4.2	AJAX: What is Ajax?, Why use Ajax?, How Ajax works?, Handling Ajax request and response, data formats: XML, JSON; Working with JSON data, Loading HTML with Ajax,	2

4.3	Loading XML with Ajax, Loading JSON with Ajax, working with data from other servers	1
4.4	JQUERY : What is JQuery ?, A basic JQuery example, Why use JQuery ?, finding elements, JQuery selection, getting element content, updating elements, changing content, inserting elements, adding new content, getting and setting attributes	2
4.5	getting and setting CSS properties, using .each(), events, event object, effects, animating CSS properties, using animation, traversing the DOM, working with forms, JavaScript libraries, JQuery and Ajax	2
5	Back End Development	9
5.1	Web Servers: Introduction, HTTP Transactions, Multitier Application Architecture, Client-Side Scripting versus Server-Side Scripting, Accessing Web Servers.	2
5.2	Server Side Scripting with Node.js: Getting to know node, node.js changed JavaScript forever, features of node, when to use and not use node, asynchronous callbacks, the NoSql movement, node and MongoDB in the wild, Hello World in Node, package.json, modules,	2
5.3	<i>Built-in Modules:</i> FS Module, HTTP Module, Events; Node Package Manager(npm), web server using http, node.js with express, middleware, routing in express, CRUD operations in express, web server using express, making it live on Heroku	2
5.4	Node.js with MongoDB: basics of MongoDB, MongoDB CRUD Operations, Building a data model with MongoDB and Mongoose	2
5.5	Defining simple mongoose schemas, build node express app with MongoDB	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT303	OPERATING SYSTEM CONCEPTS	PCC	3	1	0	4

Preamble: Operating System Concepts is a graduate-level introductory course in operating systems. This course teaches the basic operating system functions, abstractions, mechanisms, and their implementations. The course is split into five modules: (1) Introduction to OS, (2) Process Management, (3) Process Synchronization, (4) Memory Management and (5) Storage Management.

Prerequisite: ITT204 Computer Organization

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO 1	Explain the concepts and functionality of operating systems.	Level 2: Understand
CO 2	Describe the concepts of process management and process synchronization and apply them to solve problems.	Level 3: Apply
CO 3	Illustrate deadlock and deadlock – prevention and avoidance techniques.	Level 3: Apply
CO 4	Illustrate the memory management techniques.	Level 3: Apply
CO 5	Explain the file system and its implementation	Level 2: Understand
CO 6	Use the disk scheduling algorithms to solve problems.	Level 3: Apply

Mapping of course outcomes with program outcomes

3/2/1: High/Medium/Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	1									2
CO 2	3	3	3	2	1							2
CO 3	3	3	3	2	1							2
CO 4	3	3	3	2	1							2
CO 5	3	2	2	1								2
CO 6	3	3	3	2	1							2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	20	20	40
Apply	25	25	50
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Describe the basic functions of operating system.
2. Illustrate the various types of operating system.
3. Explain the types of System Calls.

Course Outcome 2 (CO2):

1. Describe the process state with suitable diagram.
2. Consider the following set of processes with CPU burst given in seconds.

Process	CPU Burst
P1	20
P2	4
P3	6
P4	4

- i. Draw the Gantt chart for FCFS and Round Robin (Time quantum=4s).
 - ii. What is the average waiting time for each of the scheduling algorithm?
3. Explain the fields in a process control block. What is the use of PCB in context switching?

Course Outcome 3 (CO3):

1. Explain deadlocks detection techniques.
2. Describe deadlock and necessary conditions for deadlocks.
3. Develop the program for Banker's algorithm.
4. Does a cycle in a resource allocation graph indicate a deadlock situation? Justify your answer.
5. Demonstrate the use of Peterson's solution to the critical section problem.

Course Outcome 4 (CO4):

1. Explain internal fragmentation and external fragmentation with suitable diagrams.
2. Illustrate paging and segmentation with suitable diagram.
3. Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults would occur for the following replacement algorithms, assuming three frames? What happens when four frames are used? All frames are initially empty, so your first pages will all cost one fault each (i) LRU replacement (ii) FIFO.

Course Outcome 5 (CO5):

1. Illustrate the File Attributes & File Operations.
2. Identify the different File Access methods.
3. Illustrate the various Directory structures.

Course Outcome 6 (CO6):

1. Explain the various Disk scheduling algorithms.
2. Consider a disk containing 200 cylinders. At a certain point of time the disk head is at cylinder 55 and the disk queue contains request for I/O to blocks on cylinders 58, 39, 150, 180, 65, 75, 88, 110, 100, 130. Find out the total head movement with respect to FCFS, SSTF, SCAN, C-SCAN and LOOK scheduling.
3. How would you select a disk scheduling algorithm?

Model Question paper**Course Code: ITT303****Course Name: Operating System Concepts****Max.Marks:100****Duration: 3 Hours****PART A****Answer all Questions. Each question carries 3 Marks**

1. What is an operating system? State and explain the basic functions of operating system?
2. Differentiate between hard real-time systems and soft real-time systems. Give 2 examples of each.
3. Explain five state process models with a neat diagram.
4. Compare long term scheduling and short term scheduling.
5. What is a deadlock? What are the necessary conditions for a deadlock to occur?

6. Explain the concept of safe and unsafe state in the context of deadlock avoidance.
7. Differentiate between external fragmentation and internal fragmentation.
8. What is Translation Look Aside Buffer (Associative Memory)? What is the need for TLB?
9. List out the different operations that can be performed by a file system.
10. What is Direct memory access technique and how it is advantageous in performing I/O?

(10x3=30)

Part B**Answer any one Question from each module. Each question carries 14 Marks**

11. (a) Explain the various types of system calls with an example for each. (10)
(b) Explain the execution of a system call. (4)
- OR
12. (a) Explain in detail about the OS structure. (10)
(b) What are shells? Give examples. (4)
13. (a) What is context switching? What are all the factors affecting context switching time? (6)
(b) Explain any two preemptive CPU scheduling algorithms with example. (8)
- OR
14. (a) What are the functions of a dispatcher? (6)
(b) Explain the structure of PCB. (8)
15. (a) What are the strategies for recovering from deadlock? Write the merits and demerits of each. (10)
(b) Explain how dead lock can be prevented in a system. (4)

OR

16. (a) Explain how resource allocation graphs can be used to detect deadlock. (6)
- (b) Explain Bankers algorithm for dead lock avoidance with multiple resources of each type. (8)
17. (a) Describe the following memory allocation algorithms. (6)
- i) First-fit
 - ii) Best-fit
 - iii) Worst-fit
- (b) Explain paging memory management techniques. (8)
- OR
18. (a) Explain how segmentation with paging is implemented. (8)
- (b) What is virtual memory? How is it implemented? (6)
19. (a) How directories are implemented? (6)
- (b) Explain the different types of directory structures. (8)
- OR
20. (a) Describe various file access methods. (4)
- (b) Illustrate the disk scheduling algorithms. (10)

(14x5=70)

Estd.



2014

Syllabus

Module 1 (7 hours)
Operating Systems: Introduction, Functions of OS, Types of OS (Batch, Multi programmed, Time-sharing and Real time systems) –System calls – System Programs — System structure (Simple structure, Layered approach, Microkernel system structure, Modules)– Kernel, Shell.
Module 2 (11 hours)
Process Management: Process concept, Process State, PCB, Operations on processes, Multithreading-Benefits. Process Scheduling: Basic concepts, Preemptive Scheduling, Dispatcher, Scheduling criteria, Scheduling Algorithms (FCFS, SJF, Priority scheduling, Round Robin Scheduling, Multi level queue scheduling, Multi level feedback queue scheduling). Inter process communication (Shared memory, message passing, pipes and socket).
Module 3 (11 hours)
Process Synchronization: Race Conditions - Critical Sections – Mutual Exclusion - Busy Waiting - Sleep and Wakeup - Semaphores – Monitors (Introduction). Deadlocks: Deadlock characteristics - conditions for deadlock - prevention – avoidance (Safe state, Resource –Allocation Graph, Banker’s algorithm) - deadlock detection – recovery from dead lock.
Module 4 (10 hours)
Memory Management: Basics - Swapping -Memory Allocation (fixed partitions, variable partitions) Fragmentation - Paging - Segmentation - Virtual memory concepts – Demand paging - Page replacement algorithms (FIFO, Optimal, LRU) – Allocation of frames - Thrashing.
Module 5 (6 hours)
Storage Management: File System: Introduction, File concept – File Attributes, File Operations, File Types, File structure- File access methods (Sequential Access, Direct Access, Indexed Access)– File allocation methods (Contiguous, linked and indexed allocation), Directory structure (Single-Level, Two-Level, Tree-Structured, Acyclic Graph, General Graph)– Directory implementation (Linear list, Hash table). Disk Management: Introduction, Disk Scheduling algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK)

Text Books

1. Andrew S. Tanenbaum and Herbert Bos, Modern Operating Systems, 4th edition, Pearson, 2015
2. A. Silberschatz, G.Gagne and P.Galvin, Operating System Concepts, 7th edition, AddisonWesley, 2004.

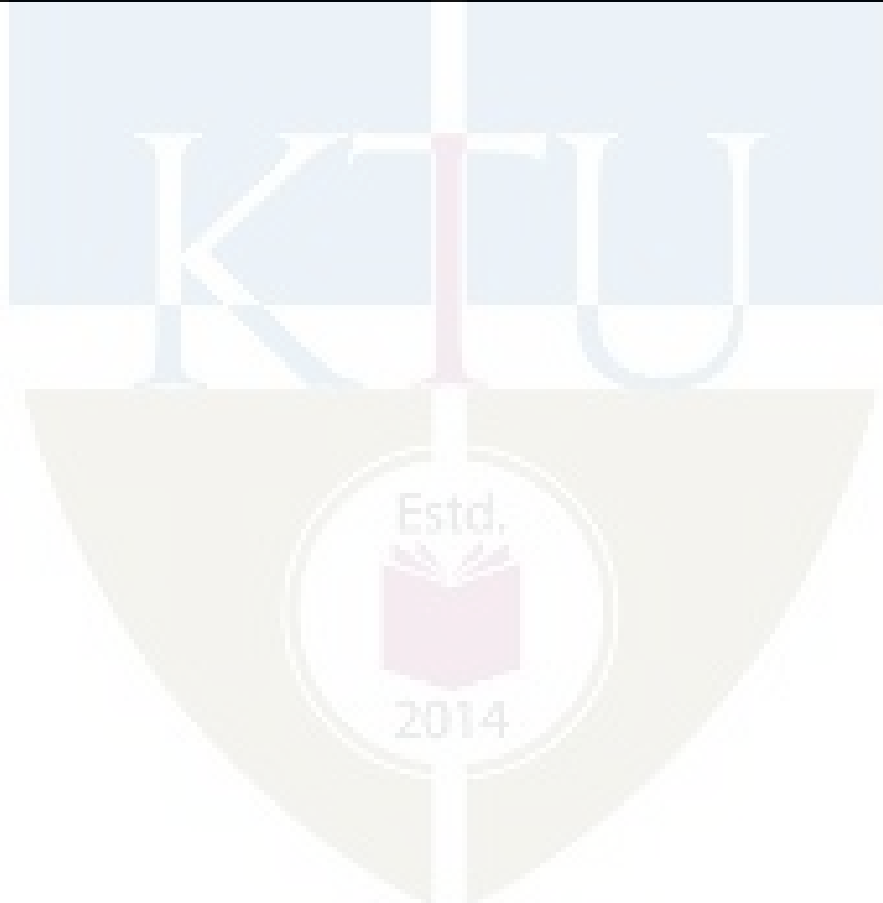
Reference Books

1. D M Dhamdhare, “*Operating Systems A Concept-based Approach*”, Tata McGraw Hill, New Delhi, 2nd Edition, 2010.
2. William Stallings, Operating Systems, 6th Edition, Pearson, 2009.
3. Garry Nutt, “Operating Systems – A Modern perspective”, Third Edition, Pearson Education

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Operating Systems	(7 hours)
1.1	Introduction, Functions of OS	1 hour
1.2	Types of OS	2 hours
1.3	System calls	1 hour
1.4	System Programs	1 hour
1.5	System structure	1 hour
1.6	Kernel & Shell.	1 hour
2	Process Management	(11 hours)
2.1	Process concept, Process State, PCB	2 hours
2.2	Operations on processes	1 hour
2.3	Multithreading-Benefits.	1 hour
2.4	Process Scheduling: Basic concepts	1 hour
2.5	Pre-emptive Scheduling, Dispatcher	1 hour
2.6	Scheduling criteria	1 hour
2.7	Scheduling Algorithms	3 hours
2.8	Inter process Communication	1 hours
3	Process Synchronization	(11 hours)
3.1	Race Conditions - Critical Sections	1 hour
3.2	Mutual exclusion with busy waiting	2 hours
3.3	Sleep and Wakeup	1 hour
3.4	Semaphores, Monitors(introduction)	2 hours
3.5	Deadlocks: Deadlock characteristics, conditions for deadlock	1 hour
3.6	Deadlock prevention	1 hour
3.7	Deadlock avoidance	2 hours

3.8	Deadlock detection & recovery from dead lock.	1 hour
4	Memory Management	(10 hours)
4.1	Basics - swapping	1 hour
4.2	Memory Allocation (fixed partitions, variable partitions), Fragmentation	1 hour
4.3	Paging	2 hours
4.4	Segmentation	1 hour
4.5	Virtual memory concepts & demand paging	1 hour
4.6	Page replacement algorithms (FIFO, Optimal, LRU).	2 hours
4.7	Allocation of frames, Thrashing	2 hours
5	Storage Management	(6 hours)
5.1	Introduction , File concept – File Attributes– File Operations, File Types, File structure	1 hours
5.2	File access methods, File allocation methods	1 hour
5.3	Directory structure, Directory implementation	2 hours
5.4	Disk management: Introduction, Disk scheduling algorithms	2 hours



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT305	DATA COMMUNICATION AND NETWORKING	PCC	3	1	0	4

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in data communication and computer networking, and to fine-tune performance parameters used in data transmission.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basic concepts used in data communication and computer networking	Level 2 :Understand
CO 2	Identify the concepts of data transmission and apply signal encoding techniques in data transmission.	Level 3 : Apply
CO 3	Compare different transmission mode, multiplexing, and Spread Spectrum techniques.	Level 2 :Understand
CO 4	Describe the design issues and protocols in data link layer.	Level 2 :Understand
CO 5	Summarize the routing algorithms and congestion control techniques in network layer.	Level 2 :Understand

Mapping of Course Outcomes with Program Outcomes 3/2/1: High/Medium/Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	-	-	-	-	-	-	-	-	2
CO 2	3	3	2	1	2	-	-	-	-	-	-	2
CO 3	2	3	1	2	2	-	-	-	-	-	-	2
CO 4	2	3	3	2	1	-	-	-	-	-	-	2
CO 5	2	2	2	1	1	-	-	-	-	-	-	2

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
BL 2: Understand	30	30	60
BL 3: Apply	20	20	40
BL 4: Analyse			
BL 5: Evaluate			
BL 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. List the various layers of the OSI reference model.
2. What are the types of topologies used in a network?
3. Mention the various devices used in different layers of the TCP/IP reference model.
4. Define a Protocol Data Unit (PDU).
5. Compare the features of different guided media used in data transmission.
6. Give a comparative analysis of different kinds of satellite communication.
7. Compare and contrast the functionalities of hubs, bridges and switches.

Course Outcome 2 (CO 2):

1. Explain the impairments in data transmission.
2. What is Nyquist criteria for channel bandwidth?
3. Differentiate between analog and digital signals used in transmission.
4. Explain the process of Delta Modulation?

Course Outcome 3 (CO 3):

1. Explain Spread Spectrum Techniques used in networks.
2. Compare and contrast FDM and WDM.
3. Explain CDMA with the help of an example
4. Differentiate statistical TDM and synchronous TDM
5. Discuss synchronous transmission. How is synchronization provided for synchronous transmission?

Course Outcome 4 (CO 4):

1. Assess the suitability of various error correcting codes to deal with single-bit and burst errors in data transmission.
2. Derive a Hamming code for single bit error correction (For a data of length 7 Bit).
3. How are errors detected using parity checking? What are the limitations of parity checking?
4. What are the services offered by the Data Link Layer? Mention the protocols also.
5. With the help of a diagram, explain the format of an Ethernet frame.

Course Outcome 5 (CO 5):

1. What are the functionalities of network layer?
2. Compare distance vector routing and link state routing?
3. What is count-to-infinity problem? How can it be solved?
4. Explain how congestion control is performed in network layer
5. Explain congestion control in virtual circuit subnet

Model Question Paper

Course Code: ITT305

Course Name: Data Communication and Networking

Max.Marks:100
Hours

Duration: 3

Part A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. What are the features of WAN.
2. Explain the role of routers in Networks.
3. Explain Data rate, Noise and Bandwidth with respect to a channel.
4. If a periodic signal is decomposed into five sine waves with frequencies of 100, 300, 500, 700, and 900 Hz, what is its bandwidth? Draw the spectrum, assuming all components have a maximum amplitude of 10 V.
5. Draw the constellation diagrams for ASK, BPSK, and QPSK signals.
6. Define scrambling and give its purpose.
7. Using an example, explain two-dimensional parity checks.
8. Write a short note on CDMA.
9. Explain the significance of QoS in communication
10. Explain the importance of the age field in link state messages

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11	List and explain the main features of all the seven layers of the ISO/OSI reference model and compare it with TCP/IP Model.	14

OR

12	a. Explain the features of any two guided transmission media	9
	b. Describe the use of satellites in communication	5

- 13 a. Explain the features of NRZ, AMI, and Manchester encoding schemes. Encode the given digital data 10110010 using NRZ-L, NRZ-I, AMI, Manchester and differential Manchester encoding schemes? 10
- b. A telephone line normally has a bandwidth of 3000 Hz (300 to 3300 Hz) assigned for data communications. The signal-to-noise ratio is usually 3162. Find the channel capacity. 4

OR

- 14 a. What are the transmission impairments happening in data communication? 10
- b. Consider a channel with a 1-MHz bandwidth. The SNR for this channel is 63. What are the appropriate bit rate and signal level? 4
- 15 a. Explain Multiplexing in detail. 10
- b. List the features of frequency hopping spread spectrum. 4

OR

- 16 a. Describe direct sequence spread spectrum in detail 10
- b. Explain in detail about synchronous communication 4
- 17 a. List and explain the sliding window protocols used in data link layer 10
- b. Derive the saturation throughput of pure ALOHA 4

OR

- 18 a. Describe about CRC encoding and decoding with data word 1010 with $G(x) = x^3 + x + 1$ 10
- b. What is CSMA/CA? 4
- 19 a. Explain distance vector routing in detail 10
- b. What is flooding? 4

OR

- 20 a. Explain in detail about the congestion control mechanisms used by datagram subnets 10
- b. What are the services provided by the transport layer? 4

Syllabus

Module 1: Overview of Data Communication and Networks (8 Hours)
Introduction: - Types of Computer Networks, Network Software - Protocol Hierarchies, Connection oriented and Connection less hierarchies, Reference Models - ISO-OSI Reference Model, TCP/IP Reference Model – Comparison of OSI and TCP/IP reference models. Physical Layer: - Guided Transmission Media– Twisted Pair, Coaxial and Fiber Optics, Wireless Transmission- Radio and Microwave transmission, Communication Satellites – GEO, MEO, LEO. Comparison of Network hardware - Repeaters, Routers, Bridges, Gateways, and Hub.
Module 2: Data Transmission and Encoding Techniques (10 Hours)
Data and signals, Analog Signals, Digital Signals - Transmission Impairments, Data Rate Limits: Channel Capacity, Nyquist Bit Rate, Shannon Capacity, Performance parameters - Bandwidth, Throughput, Delay & Jitter. Digital-To-Digital Conversion: Line Coding Schemes: Unipolar, Polar, Bipolar - Block Coding, Scrambling, Analog-To-Digital Conversion: Pulse Code Modulation, Delta Modulation - Digital-To-Analog Conversion: ASK, FSK, PSK.
Module 3: Digital Transmission (7 Hours)
Transmission Modes: Parallel and Serial Transmission, Asynchronous, Synchronous, Isochronous Transmission Multiplexing - TDM, FDM, WDM - Spread spectrum-The concept of spread spectrum – frequency hopping spread spectrum – direct sequence spread spectrum – code division multiple access
Module 4: Link Layer Communication (10 Hours)
Data Link Layer – design issues - Error Detection: Parity Check, Checksum, CRC, Error Correction: Hamming code - Flow Control: Stop-and-Wait, Go-Back-N, and Selective-Repeat - Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access: Reservation, Polling, Token Passing, Ethernet- Ethernet Cabling, Encoding, Frame Format, Binary Exponential Back Off Algorithm.
Module 5: Network Layer (10 Hours)
Network Layer Design Issues, Routing Algorithm – Optimality principle - Flooding - Distance vector routing – Link state routing –Multicast Routing - Congestion Control Algorithms – General principles – Congestion prevention policies – Choke packets – Random Early Detection- Quality of Service requirements- Buffering, Traffic shaping – Leaky bucket algorithm. Basic functions of Transport layer and Application layer (Basic understanding only).

Text Books

1. Andrew S. Tanenbaum, Computer Networks, Prentice Hall, 4th Edition, 2003
2. Behrouz A. Forouzan, Data Communications and Networking, 5/e, Tata McGraw Hill, 2017.
3. William Stallings, 'Data and Computer Communications', 8/e Pearson, 2007.

Reference Books

1. William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.
2. Fred Halsall, Computer Networking and the Internet, 5/e.
3. F. Kurose and K. W. Ross, Computer Networking: A Top-Down Approach Featuring Internet, 6/e, Pearson Education, 2012.
4. L. L. Peterson and B. S. Davie, Computer Networks, A systems approach, 5/e, Morgan Kaufmann, 2011.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Overview of Data Communication and Networks	8 Hours
1.1	Introduction: - Types of Computer Networks, Network Software - Protocol Hierarchies, Connection oriented and Connection less hierarchies	2
1.2	Reference Models - ISO-OSI Reference Model, TCP/IP Reference Model – Comparison of OSI and TCP/IP reference models	3
1.3	Physical Layer: - Guided Transmission Media– Twisted Pair, Coaxial and Fiber Optics, Wireless Transmission- Radio and Microwave transmission, Communication Satellites – GEO, MEO, LEO. Comparison of Network hardware - Repeaters, Routers, Bridges, Gateways, and Hub.	3
2	Data Transmission and Encoding Techniques	10 Hours
2.1	Data and signals, Analog Signals, Digital Signals - Transmission Impairments, Data Rate Limits: Channel Capacity, Nyquist Bit Rate, Shannon Capacity, Performance parameters - Bandwidth, Throughput, Delay & Jitter.	4
2.2	Digital-To-Digital Conversion: Line Coding Schemes: Unipolar, Polar, Bipolar - Block Coding, Scrambling,	3
2.3	Analog-To-Digital Conversion: Pulse Code Modulation, Delta Modulation - Digital-To-Analog Conversion: ASK, FSK, PSK.	3
3	Digital Transmission	7 Hours
3.1	Transmission Modes: Parallel and Serial Transmission, Asynchronous, Synchronous, Isochronous Transmission	2
3.2	Multiplexing - TDM, FDM, WDM	2
3.3	Spread spectrum-The concept of spread spectrum – frequency hopping spread spectrum – direct sequence spread spectrum – code division multiple access	3
4	Link Layer Communication	10 Hours
4.1	Data Link Layer – design issues	2
4.2	Error Detection: Parity Check, Checksum, CRC, Error Correction: Hamming code	3

4.3	Flow Control: Stop-and-Wait, Go-Back-N, and Selective-Repeat	2
4.4	Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access: Reservation, Polling, Token Passing,	3
	Ethernet- Ethernet Cabling, Encoding, Frame Format, Binary Exponential Back Off Algorithm.	
5	Network Layer	10 Hours
5.1	Network Layer Design Issues, Routing Algorithm – Optimality principle - Flooding	2
5.2	Distance vector routing, Link state routing	2
5.3	Multicast Routing	1
5.4	Congestion Control Algorithms – General principles	1
5.5	Congestion prevention policies – Choke packets – Random Early Detection	2
5.6	Quality of Service requirements- Buffering, Traffic shaping – Leaky bucket algorithm.	1
5.7	Basic functions of Transport layer and Application layer	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT307	FORMAL LANGUAGES AND AUTOMATA THEORY	PCC	3	1	0	4

Preamble: The course is considered as a core subject in the area of computer science. This course introduces the formal languages and automata theory which includes various formal languages, strings, finite automaton, grammar, regular expression, pushdown automaton; Linear bounded automata and variants of Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, NLP, Program verification, Complexity theory. The properties of various automata will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.

Prerequisite: The students are expected to have basic knowledge in Set theory, Functions and Relations.

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcomes (CO)	Bloom's Category Level
CO 1	Understand the formal language hierarchy and its applications in the field of computation.	Level 2: Understand
CO 2	Construct automaton for any given regular language and find its equivalent regular expressions.	Level 3: Apply
CO 3	Design a context free grammar for any given context free language.	Level 3: Apply
CO 4	Construct Turing machines and understand their capability.	Level 3: Apply
CO 5	Analyze P,NP class and various undecidable problems.	Level 4: Analyze

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2										2
CO 2	3	1										3
CO 3	1		3		2							1
CO 4	3	2			1							2
CO 5	3	3										3

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
BL 1: Remember	10	10	20
BL 2: Understand	30	30	60
BL 3: Apply	10	5	15
BL 4: Analyse		5	5
BL 5: Evaluate			
BL 6: Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Define grammar. How can we represent grammar in terms of an expression?
2. Check whether the given grammar is ambiguous or not.
3. Give a brief note on chomsky hierarchy for language classification

Course Outcome 2 (CO2):

1. Construct a DFA for the given regular language.
2. Consider the language for the NFA, strings ending with 'ab' over $\Sigma = \{a, b\}$. Convert the NFA into equivalent DFA.
3. Prove that the following languages are regular or not (Ex: $L = \{a^n \mid n \geq 0\}$)

Course Outcome 3(CO3):

1. Construct context free grammar for the regular expression:

$$L = (a + b)^* (aa + bb) (a+b)^*$$

2. Which Normal form representation of CFG will you prefer in converting CFG to NPDA? Why?
3. Can we construct a deterministic PDA for the language ww^R . Justify your answer and also design a NPDA machine for the above language.

Course Outcome 4 (CO4):

1. Write a note on recursively enumerable language.
2. “For every language in the universe, there exists a TM”. Justify your answer with a suitable example.
3. Discuss briefly about the halting problem of TM.

Course Outcome 5 (CO5):

1. Discuss on tractable problems.
2. Give a brief note on Universal Turing Machine(UTM).
3. Compare and contrast decidable problems and undecidable problems.

Model Question paper

Course Code: ITT307

Course Name: Formal Languages and Automata Theory

Max.Marks:100

Duration: 3 Hours

PART A

(10*3=30)

(Each Question carries 3 Marks)

1. Explain a) Language of DFA b) Extended transition function.
2. Design a DFA, which accepts the strings with even number of 0's and even number of 1's over $\{0,1\}$.
3. Construct the finite automaton equivalent to the regular expression i) $R.S$, ii) R^* .
4. Design a Moore machine that takes a set of all strings over $\{a,b\}$ as input and prints 1 as output for every occurrence of baa as a substring.
5. If a DFA D constructed from NFA N by the subset construction, then $L(D) = L(N)$. Prove it.

6. Design ϵ -NFA for the set of strings consisting of zero or more a's followed by zero or more b's followed by zero or more c's. Try to use ϵ transitions to simplify your design.
7. Show that the language $L = \{ 0^i 1^i \mid i \text{ is an integer and } i \geq 1 \}$ is not regular using Pumping Lemma.
8. Explain Closure properties of CFL.
9. Define CFG. Give CFG generating the set of palindromes over alphabet $\{a, b\}$.
10. Define PushDown Automata.

PART B

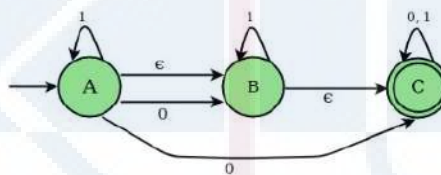
(5*14=70)

11. State and prove the equivalence theorem between DFA and NFA.

OR

12. Construct a Moore machine that takes a set of all strings over $\{a, b\}$ as input and prints '1' as output for every occurrence of 'ab' as a substring.

13. Convert the following NFA- ϵ to its equivalent DFA.



OR

14. State and prove myhill nerode theorem. Also minimize a dfa for any regular language.
15. Obtain CFG for the language " Set of all palindromes". Discuss it.

OR

16. Can we construct a deterministic PDA for the language ww^R . Justify your answer. Also design a NPDA machine for the above language.
17. Simplify the following grammar:

$S \rightarrow AB / a$

$A \rightarrow BC / b$

$B \rightarrow aC / B$

$C \rightarrow aB / C$

OR

18. Discuss about Turing Machine Halting Problem with a suitable example.

19. With a neat sketch explain about Universal Turing Machine.

OR

20. Design a Turing Machine, which can compute the second complement of a given binary number.

Syllabus

Module 1 – Finite automata (9 hours)
Family of formal languages - Finite automata – Type 3 formalism - Deterministic finite automata (DFA) – Language acceptance - Non-deterministic finite automata (NFA) – Finite automata with epsilon transitions – Applications - Finite automata with output - NFA to DFA conversions - Equivalence theorem between DFA and NFA - Minimization of DFA.
Module 2 - Regular languages & Regular expressions (10 hours)
Regular languages and Regular expressions: Myhill-Nerode theorem - Conversion of DFA's to Regular expressions by eliminating states - Conversion of Regular expressions to Automata – Closure properties of Regular languages – Pumping lemma for Regular languages - Applications of the Pumping lemma.
Module 3 – Type 2 formalism & Push Down Automata (10 hours)
Type 2 formalism: Context free grammars (CFG) and languages – Parse trees – Ambiguity in grammars – Pushdown automata (PDA) – Acceptance by final state and empty stack – Equivalence of PDA's and CFG's – Deterministic push down automata (DPDA) – Simplification of CFG - Pumping lemma for CFG's – Chomsky normal form – Greibach normal form.
Module 4 – Type 1 formalism(9 hours)
Closure properties of context free languages – Decision properties of CFL's - Type 1 formalism: Context sensitive grammar – Linear bounded automata .Type 0 formalism: Turing machine (TM) - Recursively enumerable language (REL) – Multitape TM – Non-deterministic TM – Properties of TM.
Module 5 - Undecidability and Universal Turing Machine (7 hours)
Halting problem of TM – Recursive languages - Unrestricted grammars - Universal Turing Machine (UTM) – Tractability - Undecidable problems - Introduction to P and NP class problems.

Text Books

1. J.E.Hopcroft, R.Motwani and J.D.Ullman , "Introduction to Automata Theory Languages and computation", 3rd edition Pearson, 2008.
2. Michael Sipser, "Introduction to the Theory of Computation", 3rd edition (or 1st edition), Course Technology Inc, 2013.

Reference Books

1. Harry R. Lewis, Christos H. Papadimitriou, "Elements of the Theory of Computation", Prentice-hall Publisher, 2nd edition, 1998.
2. K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation ,Pearson Education, 2009.
3. John C . Martin, "Introduction to Languages and the Theory of Computation", McGraw-Hill Publisher, 4th edition, 2010.
4. Dexter C. Kozen, "Automata and Computability", Springer.1997.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Finite automata (9 hours)	
1.1	Family of formal languages	1
1.2	Deterministic finite automata	2
1.3	Non-deterministic finite automata	2
1.4	Finite automata with epsilon transitions	1
1.5	Finite automata with output	1
1.6	Equivalence between DFA and NFA	1
1.7	Minimization of DFA	1
2	Regular languages & Regular expressions (10 hours)	
2.1	Regular languages	1
2.2	Regular expressions	1
2.3	Myhill-Nerode theorem	1
2.4	Conversion of DFA's to Regular expressions by state elimination	2
2.5	Conversion of Regular expressions to Automata	1
2.6	Closure properties of Regular languages	1
2.7	Pumping lemma for Regular languages	2
2.8	Applications of the Pumping lemma.	1
3	Type 2 formalism & Push Down Automata (10 hours)	
3.1	Context free grammars	1
3.2	Ambiguity in grammars	1
3.3	Push down automata(PDA)	2
3.4	String Acceptance by final state and empty stack	1
3.5	Equivalence of PDA's and CFG's	1
3.6	Deterministic push down automata (DPDA)	1

3.7	Simplification of CFG	1
3.8	Pumping lemma for CFG's	1
3.9	CNF and GNF	1
4	Type 1 formalism(9 hours)	
4.1	Closure properties of context free languages	1
4.2	Context sensitive grammar	1
4.3	Linear bounded automata	1
4.4	Turing machine	2
4.5	Recursively enumerable languages , Properties	1
4.6	Non-deterministic TM	2
4.7	Properties of TM	1
5	Undecidability and Universal Turing Machine (7 hours)	
5.1	Halting problem of TM	1
5.2	Recursive languages	1
5.3	Unrestricted grammars	1
5.4	Universal Turing machine	1
5.5	Tractability,Undecidable problems	1
5.6	P, NP class problems	2

Estd.

2014

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT309	MANAGEMENT FOR SOFTWARE ENGINEERS	PCC	3	0	0	3

Preamble: This course aims on providing the concepts of Software Engineering, Software Development Life Cycle and the key aspects of managing a software project like project evaluation, planning, monitoring along with management of people and quality.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO 1	Understand about the basics of software process, software development life cycle and process models.	Level 2 : Understand
CO 2	Interpret the concepts of managing software projects.	Level 2 : Understand
CO 3	Make use of project evaluation techniques and choose software estimation approaches for effort and cost.	Level 3: Apply
CO 4	Explain on planning the project activities and describe the concepts of risk management and resource allocation.	Level 2 : Understand
CO 5	Understand project monitoring and control, organize people and teams and describe the techniques for ensuring software quality.	Level 2 : Understand

Mapping of course outcomes with program outcomes

COs \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2								1	1	2
CO 2	2	2								1	1	2
CO 3	2	1								1	1	2
CO 4	2	1								1	1	2
CO 5	2	2						1	2	1	2	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	80
Apply	20	20	10
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. What is Software Engineering?
2. Explain about Software Process.
3. Explain about any one process model.

Course Outcome 2 (CO2)

1. Explain any one aspect of software project management spectrum.
2. Explain the importance of software project management over other types of projects.

3. What are the activities involved in project management?

Course Outcome 3(CO3):

1. How evaluation of individual projects is done?
2. What are steps in project planning?
3. Explain any one effort estimation technique.
4. Suppose a project was estimated to be 400 KLOC. Calculate the effort and development time for each of the three model i.e., organic, semi-detached & embedded.
5. Explain on cost estimation.

Course Outcome 4 (CO4):

1. Explain any one scheduling technique.
2. Explain on risk assessment.
3. How are resources identified for a project?

Course Outcome 5 (CO5):

1. How data collection is done for project monitoring?
2. What are the factors for selecting a right person for a project?
3. What is a quality plan?

Model Question paper

Course Code: ITT309

Course Name: MANAGEMENT FOR SOFTWARE ENGINEERS

Max Marks:100

Duration: 3hr

PART A

Answer all questions, each carries 3 marks

1. Explain the Generic process framework for Software engineering.
2. Briefly explain about Scrum.
3. How can a Project manager avoid the problems in a project which may lead to project failure?
4. Compare Traditional and Modern project management practices.

5. What is Cost-benefit analysis?
6. Explain the Bottom-up approach of estimation.
7. What are activity-on-arrow networks?
8. How are Risks identified?
9. What are the activities that are carried out as a part of the project termination review process?
10. Explain CMMI. (10*3=30)

PART B

Answer all questions, each carries 14 marks

11. a) What are the advantages and disadvantages of Waterfall model? How can an Agile model overcome the disadvantages of Waterfall model? (8)
 b) What is Agile Modeling? Explain. (6)
- OR
12. a) Explain prototyping model in detail. (9)
 b) What is Pair programming? What are the advantages of Pair Programming? (5)
13. a) Explain about Agile Teams. (5)
 b) How are Software projects categorized? (9)
- OR
14. a) Explain the Product aspect of Software management spectrum. (8)
 b) Explain the major activities carried out by a software project manager and the order in which these are carried out. (6)
15. Explain in detail the Steps in Project planning. (14)
- OR
16. a) What is Benefits management? Explain. (5)
 b) Explain the COCOMO II approach for effort estimation. (9)
17. a) Explain on the Forward pass and Backward pass analysis in CPM. (8)
 b) How are resources scheduled over the duration of the project? (6)
- OR
18. a) What is an Activity? Explain the approaches for identifying the activities that make up a project. (7)

- b) Explain any one techniques used for evaluating risks in the project schedule. (7)
19. a) Explain Software Configuration Management. (9)
- b) What is leadership? What are the various styles of Leadership? (6)

OR

20. a) Explain in detail about Earned Value Analysis. (10)
- b) Explain the difference between Verification and Validation. (4)

Syllabus

Module 1 (8 Hours)
Introduction: Software engineering, Software process, Software engineering practice Process models: Prescriptive process models- Specialised process models, The unified process, Personal and Team process models. Agile development: Agility, Agile process. Extreme programming- XP Values, The XP Process, Industrial XP, The XP Debate. Other Agile development models- Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Crystal, Feature Driven Development (FDD), Lean Software Development (LSD), Agile Modeling (AM), Agile Unified Process (AUP). Selection of an appropriate Project Approach- Choice of process Models.
Module 2 (5 Hours)
Managing software projects: Project Management Concepts –The Management Spectrum- People- Product- Process- Project. Software Project Management - Importance – Software projects VS other types of project – Categorizing Software projects- Stakeholders – Setting Objectives –The Business Case- Project success and failure. Management –Activities- Management Control- Traditional VS modern project management.
Module 3 (8 Hours)
Project Evaluation: Project portfolio management- Evaluation of individual projects- Cost benefit evaluation techniques- Risk evaluation- Programme Management- Creating a Programme- Aids to Programme Management- Benefits Management. Project Planning: Step wise Project Planning Software Estimation: Basis for software estimation- Software Effort estimation techniques- Bottom-up and Top-down estimation- Function Point Analysis- COCOMO II. Cost Estimation- Staffing Pattern- Schedule compression.

Module 4 (7 Hours)

Activity Planning: Objectives- Project Schedules- Projects and Activities- Sequencing and Scheduling Activities- Network Planning Models- Forward Pass- Backward pass- Identifying Critical Path and Critical Activities- Activity-on-arrow networks.

Risk Management: Risk- Categories of Risk- Risk Identification- Risk Assessment- Risk Planning- Risk management- Risk Evaluation- PERT, Monte Carlo Simulation, Critical Chain.

Resource Allocation: Nature of Resources- Identifying and Scheduling Resources- Creating Critical Paths- Cost Schedule- Scheduling sequence.

Module 5 (7 Hours)

Monitoring and Control: Creating the framework- Collecting data- Review- Project Termination Review- Visualizing Progress- Gantt Chart, Slip Chart, Timeline. Cost Monitoring- Earned Value Analysis- Getting the project back to target- Change control- Software Configuration Management- Contract management.

Managing People: Organizational Behaviour- Selecting the right Person- Motivation- Stress- Working in Teams- Becoming a Team- Decision Making- Organization and Team Structures- Communication- Leadership.

Software Quality: Quality Management Systems- Process Capability Models- CMMI, Six Sigma. Techniques for Enhancing Software Quality- Testing- Software Reliability- Quality Plans.

Text Books

1. Roger S Pressman, Software Engineering: A Practitioner's Approach, Seventh edition, Tata McGraw Hill.
2. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill

Reference Books

1. Pankaj Jalote, Software Project Management in Practice, Pearson Education
2. Walker Royce, Software Project Management- Addison-Wesley, 1998.
3. Sunitha E.V, Sarath K.S, Software Project Management, Jyothis Publishers 2019

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction	8 Hours
1.1	Software engineering, Software process, Software engineering practice	1
1.2	Process models: Prescriptive process models- Specialised process models, The unified process, Personal and Team process models.	3
1.3	Agile development: Agility, Agile process. Extreme programming- XP Values, The XP Process, Industrial XP, The XP Debate. Other Agile development models- Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Crystal, Feature Driven Development (FDD), Lean Software Development (LSD), Agile Modeling (AM), Agile Unified Process (AUP). Selection of an appropriate Project Approach- Choice of process Models.	4
2	Managing software projects	5 Hours
2.1	Project Management Concepts –The Management Spectrum- People- Product- Process- Project.	1
2.2	Software Project Management - Importance – Software projects VS other types of project – Categorizing Software projects- Stakeholders – Setting Objectives –The Business Case- Project success and failure.	3
2.3	Management –Activities- Management Control- Traditional VS modern project management.	1
3	Evaluation, Planning and Estimation	8 Hours
3.1	Project Evaluation: Project portfolio management- Evaluation of individual projects- Cost benefit evaluation techniques- Risk evaluation- Programme Management- Creating a Programme- Aids to Programme Management- Benefits Management.	3
3.2	Project Planning: Step wise Project Planning	2
3.3	Software Estimation: Basis for software estimation- Software Effort estimation techniques- Bottom-up and Top-down estimation- Function Point Analysis- COCOMO II. Cost Estimation- Staffing Pattern- Schedule compression.	3
4	Activity Planning, Risk management and Resource allocation	7 Hours
4.1	Activity Planning: Objectives- Project Schedules- Projects and Activities- Sequencing and Scheduling Activities- Network	3

	Planning Models- Forward Pass- Backward pass- Identifying Critical Path and Critical Activities- Activity-on-arrow networks.	
4.2	Risk Management: Risk- Categories of Risk- Risk Identification- Risk Assessment- Risk Planning- Risk management- Risk Evaluation- PERT, Monte Carlo Simulation, Critical Chain.	2
4.3	Resource Allocation: Nature of Resources- Identifying and Scheduling Resources- Creating Critical Paths- Cost Schedule- Scheduling sequence	2
5	Monitoring, People management, Quality	7 Hours
5.1	Monitoring and Control: Creating the framework- Collecting data- Review- Project Termination Review- Visualizing Progress- Gantt Chart, Slip Chart, Timeline. Cost Monitoring- Earned Value Analysis- Getting the project back to target- Change control- Software Configuration Management- Contract management.	3
5.2	Managing People: Organizational Behaviour- Selecting the right Person- Motivation- Stress- Working in Teams- Becoming a Team- Decision Making- Organization and Team Structures- Communication- Leadership.	2
5.3	Software Quality: Quality Management Systems- Process Capability Models- CMMI, Six Sigma. Techniques for Enhancing Software Quality- Testing- Software Reliability- Quality Plans.	2



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL331	OPERATING SYSTEM AND NETWORK PROGRAMMING LAB	PCC	0	0	3	2

Preamble: Operating System and Network Programming Lab aims at giving an in depth idea of operating system and networking concepts. Students will understand the basic commands and the implementation of process scheduling, inter process communication, semaphores etc. and also aim to implement network programming in Java.

Prerequisite: Concepts of Operating Systems and Networking, and Programming knowledge in C and JAVA

Course Outcomes:

After the completion of the course the student will be able to

CO. No.	Course Outcomes	Bloom's Taxonomy
CO 1	Analyse CPU Scheduling Algorithms like FCFS, Round Robin, SJF and Priority.	Level 4: Analyse
CO 2	Implement inter process communication and process synchronization problems.	Level 3: Apply
CO 3	Implement memory management schemes - first fit, best fit and worst fit.	Level 3: Apply
CO 4	Implement client server communication using sockets.	Level 3: Apply
CO 5	Implement MAC protocols.	Level 3: Apply
CO 6	Familiarization of network simulation tool.	Level 2: Understand

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	-	-	-	-	1	-	3
CO 2	3	3	3	2	1	-	-	-	-	1	-	3
CO 3	3	3	3	2	1	-	-	-	-	1	-	3
CO 4	3	3	3	2	2	-	-	-	-	1	-	3
CO 5	3	3	3	2	2	-	-	-	-	1	-	3
CO 6	2	2	2	2	3	-	-	-	-	1	-	3

3/2/1: High/Medium/Low

Assessment Pattern:**Mark distribution**

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
 Continuous Assessment : 30 marks
 Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

- (a) Preliminary work : 15 Marks
- (b) Implementing the work/Conducting the experiment : 10 Marks
- (c) Performance, result and inference (usage of equipments and trouble shooting) : 25 Marks
- (d) Viva voce : 20 marks
- (e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions:**Course Outcome 1 (CO1):**

1. Write a program to implement FCFS and Round Robin process scheduling algorithms for the following scenario.

Processes	Arrival time	Burst time
P0	0	7
P1	2	4
P2	4	1
P3	5	4

Assume quantum time for RR is 2

- (i) What is the Average Turn-around time for each of these scheduling algorithms?

(ii) What is the Total Waiting time for each of these scheduling algorithms?

Course Outcome 2 (CO2):

1. Program to implement Inter Process Communication using shared memory.
2. Program to implement Dining Philosophers problem using semaphores.

Course Outcome 3 (CO3):

1. Implement first fit, best fit and worst fit memory management schemes.

Course Outcome 4 (CO4):

1. Program to implement client server communication using sockets.
2. Program to implement chat application.

Course Outcome 5 (CO5):

1. Program to implement Go Back N protocol.

Course Outcome 6 (CO6):

1. Simulate Bus topology using NS-3.

LIST OF EXPERIMENTS

(All the listed experiments are mandatory)

OPERATING SYSTEM

(Experiments are to be implemented using C programming language)

1. Familiarization of system calls (fork, exec, getpid, exit, wait, close, stat etc) in operating system.
2. Implement process scheduling algorithms (FCFS, SJF, Round-Robin, Priority) and compute average waiting time and average turn-around time.
3. Inter-process communication using mail boxes, pipes, message queues and shared memory.
4. Implementation of dining philosophers problem using threads, semaphores and shared memory.
5. Implementation of banker's algorithm.
6. Implement memory management schemes (first fit, best fit and worst fit).

NETWORK PROGRAMMING

(Experiments are to be implemented using JAVA programming language)

7. Familiarisation of Network Programming API in Java.
8. Implementation of Medium Access Control protocols – 1) Go Back N. 2) Selective Repeat and 3) Sliding Window.
9. Implementation of an echo server.
10. Implement Client-Server communication using sockets.
11. Implementation of chat application
12. Install network simulator NS-3 in Linux operating system and simulate wired and wireless scenarios. (Familiarization only)

References:

1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, Operating System Concepts, 9/e, Wiley India, 2015.
2. Behrouz A Forouzan, Data Communications & Networking –Mc Graw Hill,2008.
3. Herbert Schildt, “The Java 2 : Complete Reference” Tenth Edition - Mc Graw Hill.
4. <https://www.nsnam.org/docs/tutorial/html/>



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL333	WEB APPLICATION DEVELOPMENT LAB	PCC	0	0	3	2

Preamble: Web Application Development Lab is intended to deliver hands-on experience of Web Application Development with HTML, CSS, JavaScript, JQuery, Node JS and Mongo DB thereby equipping them to develop real time web applications.

Prerequisites: Basics of Programming, ITT301 Web Application Development

Course Outcomes: After the completion of the course the student will be able to

CO.No.	Course Outcomes
CO1	Infer the structure of HTML elements in a webpage
CO2	Build Webpages using HTML and CSS
CO3	Utilize JavaScript to add functionality to webpages
CO4	Implement different Ajax & JQuery functionalities in Web development.
CO5	Develop a web applications using Node JS and MongoDB

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	1	2	-	2	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	2	-	2	-	-	-	-	-	-	-	-
CO4	2	2	-	3	-	-	-	-	-	-	-	-
CO5	2	3	1	3	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	:	15 marks
Continuous Assessment	:	30 marks
Internal Test (Immediately before the second series test)	:	30 marks

End Semester Examination Pattern:

The following guidelines should be followed regarding award of marks

(a) Preliminary work	:	15 Marks
(b) Implementing the work/Conducting the experiment	:	10 Marks
(c) Performance, result and inference (usage of equipment and troubleshooting)	:	25 Marks
(d) Viva voce	:	20 Marks
(e) Record	:	5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Develop a website (HTML) for College Library having pages:

- a) Home Page:
 - Navbar
 - Banner image
 - Contents
 - Footer
- b) Books Management
 - Add/Remove Book
 - Book Details
- c) About Us

2. Create a website which demonstrates the usage of following HTML tags:

- Headings
- Paragraphs
- Image
- Lists
- Anchor
- Forms

3. Develop a website for Online Bus Ticket Booking having pages:

- a) Home Page:
 - Navbar

- Banner image
- Contents
- Footer
- b) Ticket Booking
 - Book Ticket
 - Booking Details
- c) About Us

Course Outcome 2 (CO2)

1. Develop a website for College Library having pages:

- a) Home Page:
 - Navbar
 - Banner image
 - Contents
 - Footer
- b) Books Management
 - Add/Remove Book
 - Book Details
- c) About Us

2. Develop a Responsive website for Online Bus Ticket Booking

3. Develop an Online shopping website using HTML and Bootstrap

Course Outcome 3(CO3):

1. Write javascript code to calculate grades of students and average grade of a class(use prompt to get input)
2. Develop “Craps dice game” with javascript.
3. Develop a to do list app with HTML, CSS and Javascript (use AJAX with JSON)

Course Outcome 4 (CO4):

1. Develop Craps dice game with jquery
2. Develop a to do list app with HTML, CSS and JQuery(use AJAX with JSON)
3. Develop an online shopping website with HTML, CSS and JQuery (use JQuery Animations and plugins)

Course Outcome 5 (CO5):

1. Develop a website for College Library using Node JS with MongoDB.
2. Develop a Responsive website for Online Bus Ticket Booking using Node JS with MongoDB
3. Develop an Online shopping website using Node JS with MongoDB

LIST OF EXPERIMENTS

(All the listed experiments are mandatory)

1. Install, setup Integrated Development Environment (IDE) for web development.
2. Create a web page with all possible elements of HTML5
3. Create a web page with all types of Cascading style sheets
4. Create a Responsive Web page with HTML and CSS
5. Create Responsive web page with Bootstrap
6. Programs to demonstrate JavaScript array, object and functions
7. Client Side Scripts for Form Validation using JavaScript
8. Programs to familiarise ES6 concepts
9. Programs to demonstrate DOM and event handling.
10. Programs using AJAX with HTML, XML and JSON data
11. Programs to familiarise JQuery.
12. Create a website with HTML, CSS and Javascript (implement Ajax)
13. Programs to familiarise Server Side Scripting using Node JS
14. Programs using MongoDB database with Node JS
15. Develop a web site with HTML, CSS, Javascript/JQuery, Node JS and MongoDB

Reference Books

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, "Internet and World Wide Web How To Program", 5/E, Pearson Education, 2012.
2. Jon Duckett , "HTML and CSS: Design and Build Websites", Wiley
3. Jon Duckett , "JavaScript and JQuery: Interactive Front–End Web Development", Wiley
4. Nicholas C. Zakas, "Understanding ECMAScript 6: The Definitive Guide for JavaScript Developers"
5. Alex Young, Marc Harter, "Node js in practice", Manning
6. Jon Krol , "Web Development with mongodb and node js", Packt
7. Krishna Rungta , "Node JS: learn in one day"

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER V

MINOR



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT381	WEB APPLICATION DEVELOPMENT	VAC	3	1	0	4

Preamble: This course is intended to make the students capable of understanding the important components of HTML5 documents and use HTML5, CSS to create web pages. The course is intended to help the students to develop dynamic web pages PHP, Java Servlets and Java Server Pages

Prerequisite: ITT281 JAVA programming, ITT282 Database Management

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcomes	Bloom's Category
CO1	Discuss the important components of HTML5 documents and use HTML5 to create web pages	Level 2: Understand
CO2	Apply styles in web pages using cascading style sheets	Level 3: Apply
CO3	Develop dynamic web pages using PHP.	Level 3: Apply
CO4	Develop server based programs using Java Servlets	Level 3: Apply
CO5	Develop dynamic web pages using Java Server Pages	Level 3: Apply

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	-	3	-	2	-	-	-	-	-	-	3
CO 2	2	-	3	-	2	-	-	-	-	-	-	3
CO 3	3	-	3	-	2	-	-	-	-	-	-	3
CO 4	3	-	3	-	2	-	-	-	-	-	-	3
CO 5	3	-	3	-	2	-	-	-	-	-	-	3

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	20	20	30

Apply	25	25	60
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Create an HTML5 document containing an ordered list of three items—ice cream, pizza and soft drinks. Each ordered list should contain a nested, unordered list of your favourite flavours. Provide three flavours in each unordered list.
2. What do you meant by MIME? Explain its uses? Provide any FIVE examples.
3. Create a web page using HTML5 to accomplish a feedback on a cafeteria.

Course Outcome 2 (CO2):

1. Using CSS create a sophisticated drop down menu for a set of web page addresses
2. Explain conflicting styles with examples. What happens when conflicting occurs? How can you remove the conflicts?
3. Write a CSS rule that changes the colour of all elements containing attribute class = "red_colour" to red.

Course Outcome 3(CO3):

1. With a PHP code snippet illustrate the use of “foreach” loop in PHP.
2. Design and Develop a mail registration form using PHP.
3. Develop a student management system using PHP.

Course Outcome 4(CO4):

1. Design and Develop a Servlet based web application to update the basic salary of all employees belonging to the department of sales by 5%, assuming there exists an employee table with field(e_id,e_dept,e_name,b_sal,n_sal)?
2. Explain the methods used to implement the life cycle of Servlets
3. List out the benefits of Servlets

Course Outcome 5(CO5):

1. How to pass control from one JSP page to another?
2. Explain the importance of data sharing among JSP Pages. Design and Develop a JSP based web application to display the values which is being entered by the user in a registration form
3. How does Error handling is done in JSP

Model Question paper

Course Code: ITT381

Course Name: WEB APPLICATION DEVELOPMENT

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. What is Internal Linking? How can it be achieved?
2. List out any 5 page structure elements
3. List any 4 media types available in CSS?
4. How can you insert CSS codes in your HTML page? Provide one example for each methods
5. In PHP how can you search a string using regular expressions
6. Discuss the differences between server side programming and client side programming
7. Compare and Contrast doGet and doPost service methods of Servlets

8. Explain the use of Servlets in MVC architecture
9. How to pass control from one JSP page to another?
10. Explain the role of JSP in MVC design

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. a) Suppose your HTML page contains a text input element for inputting months of a year. How can you provide a drop-down list of pre-defined options of months for that text element? (7Marks)

b) Using HTML5 scripting create the below given table (CO1)

Sl. No	Department	No of Students	
		Boys	Girls
1	IT	110	135
2	ME	220	18
3	EC	160	180
4	CE	200	120

(7 Marks)

12. a) Create an HTML5 document containing an ordered list of animals of three kinds—Carnivorous, Herbivorous and Omnivorous. Each ordered list should contain a nested, unordered list of your favourite animals. Provide atleast three of them in each unordered list (8 Marks)

b) Provide HTML tags for inserting the following:

- i) >
- ii) ©
- iii) ®
- iv) 1/4
- v) Horizontal Rule
- vi) &

(6 Marks)

13. a) Illustrate different flavours of positioning elements available in CSS with examples. (7 Marks)

b) Provide CSS rules to set background image of a page. Make it tiled.

(7 Marks)

14.a) Explain conflicting styles with examples. What happens when conflicting occurs? How can you remove the conflicts?

(8 marks)

b) Which all are the media types available in CSS? Explain the uses of atleast two types with an example. (6 Marks)

15. a) Implement a database based online student management system using PHP. The system should have the following features:
- Provision to input the student details such as stud_name, stud_rollno, stud_age, stud_branch, stud_gender
 - Provision to search a student using stud_rollno
 - Provision to delete a student using stud_rollno
 - Provision to display the details of all students available in the database.
- (10 marks)
- b) List out the methods to access a web server (4 Marks)
16. a) How can you make data type conversions in PHP? (4 marks)
- b) Describe the steps involved in PHP to access a database. (10 Marks)
17. a) Describe the use of Servlet Container with a neat diagram (6 marks)
- b) Develop a Servlets based online student management system with the following features:
- Student registration
 - Student search using stud_ID
 - Student deletion using stud_ID
- (8 Marks)
18. a) With a neat diagram explain the Servlets life cycle. (7 marks)
- b) Implement a simple mail registration application using Java Servlets. (7 Marks)
19. a) With a JSP program explain the method of sharing control among different pages. (8 Marks)
- b) Develop a registration and login form for an e-mail application using JSP and required database. (6 marks)
20. a) With neat diagrams explain the architecture of JSP applications. (8 Marks)
- b) How does error handling done in JSP using Exception objects? Explain with an example. (6 marks)

Syllabus

Module 1	No. of Lectures
Introduction to Computers and the Internet- Web Basics, Introduction to HTML5 - W3C HTML5 Validation Service, Headings, Linking, Images, Special Characters and Horizontal Rules, Lists, Tables, Forms, Internal Linking, meta elements, New HTML5 Form input Types, input and data list elements and auto complete Attribute, Page-Structure Elements.	8 hours
Module 2	
Introduction to Cascading Style Sheets -Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets, Positioning Elements - Absolute Positioning, z-index, Relative Positioning, span, Backgrounds, Element Dimensions, Box Model and Text Flow, Media Types, Drop-Down Menus	8 hours
Module 3	
Web Servers: Introduction, HTTP Transactions, Multitier Application Architecture, Client-Side Scripting versus Server-Side Scripting, Accessing Web Servers. Server Side Programming with PHP - Introduction, converting Between Data Types, Arithmetic Operators, Form Processing and Business Logic, Using PHP to Process HTML5 Forms, Accessing MySQL Database with PHP	10 hours
Module 4	
Servlets: Introduction to Servlets, Benefits of Servlets, servlets as controller in MVC, basic HTTP, servlet container, servlet lifecycle,Servlets with JDBC	9 hours
Module 5	
Java Server Pages: Generating Dynamic Content, Using Scripting Elements, Implicit JSP Objects. Error Handling and Debugging, Passing Control and Data between Pages – Sharing Session and Application Data – Application Models - MVC Design	10 hours

Text Books

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet and World Wide Web How To Program”, 5/E, Pearson Education, 2012.
2. Hans Bergsten , Java Server Pages, O’Reilly, 2003
3. Jason Hunter, William Crawford, Java Servlet Programming, Second Edition, , O’Reilly Media.

Reference Books

1. Robert W. Sebesta, “Programming the World Wide Web”, 8/E, Pearson Education, 2012.
2. Chris Bates, “Web Programming – Building Intranet applications”, Wiley Publications, 3rd Edition, 2009..
3. Joseph J. Bambara, Paul R. Allen, Mark Ashnault, Ziyad Dean, Thomas Garben, Sherry Smith J2EE UNLEASHED — SAMS Techmedia
4. Roman, Scott Ambler, Tyler Jewell (ed.), Mastering EJB(2nd Edition) – Ed– John Wiley Publications, 2003.
5. Stepahnie Bodoff, Dale Green, Kim Hasse, Eric Jendrock, Monica Pawlan, Beth Stearns , The J2EE Tutorial, Pearson Education , Asia.
6. www.w3schools.com

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to Computers and the Internet	8 hours
1.1	Introduction to Computers and the Internet- Web Basics	1 hour
1.2	Introduction to HTML5 - W3C HTML5 Validation Service, Headings, Linking, Images, Special Characters and Horizontal Rules	2 hours
1.3	Lists, Tables	1 hour
1.4	Forms, Internal Linking, meta elements	1 hour
1.5	New HTML5 Form input Types, input and data list elements and auto complete Attribute,	2 hours
1.6	Page-Structure Elements.	1 hour
2	Introduction to Cascading Style Sheets	8 hours
2.1	Inline Styles, Embedded Style Sheets	2 hours
2.2	Conflicting Styles, Linking External Style Sheets	2 hours
2.3	Positioning Elements - Absolute Positioning, z-index, Relative Positioning, span, Backgrounds, Element Dimensions	2 hours
2.4	Box Model and Text Flow, Media Types, Drop-Down Menus	2 hours
3	Web Servers	10 hours
3.1	Introduction, HTTP Transactions, Multitier Application Architecture, Client-Side Scripting versus Server-Side Scripting, Accessing Web Servers.	2 hours
3.2	Server Side Programming with PHP - Introduction, converting	2 hours

	Between Data Types, Arithmetic Operators	
3.3	Form Processing and Business Logic	2 hours
3.4	Using PHP to Process HTML5 Forms	2 hours
3.5	Accessing MySQL Database with PHP	2 hours
4	Java Servlets	9 hours
4.1	Introduction to Java Servlets, Benefits of Servlets, use as controller in MVC,	2 hours
4.2	basic HTTP, servlet container,	2 hours
4.3	Servlet lifecycle	1 hour
4.4	Servlets with JDBC	4 hours
5	Java Server Pages	10 hours
5.1	Generating Dynamic Content, Using Scripting Elements,	2 hours
5.2	Implicit JSP Objects.	1 hour
5.3	Error Handling and Debugging	2 hours
5.4	Passing Control and Data between Pages	2 hours
5.5	Sharing Session and Application Data	2 hours
5.6	Application Models - MVC Design	1 hour



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT383	INTERNET TECHNOLOGY	VAC	3	1	0	4

Preamble: This subject provides an overview on the principles on which the Internet and other distributed systems are based; their architecture, algorithms and design. It covers the important topic of middleware, examining different approaches to supporting distributed applications including distributed objects and components, and web services. The two dominant modern network architectures are cloud computing and the Internet of things (IoT) is also introduced here. The subject then covers the well-established topics of security.

Prerequisite: ITT 283 Data Communication and ITT 284 Computer Networks

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcomes(CO)	Bloom's Category
CO 1	Describe building blocks of distributed systems.	Level2: Understand
CO 2	Explain the functions of remote invocation, operating system and webserver and understand its application on Internet.	Level2:: Understand
CO 3	Familiarize with the basic concepts, cloud services, deployment models, and architecture of cloud computing.	Level2:: Understand
CO 4	Discuss the key foundation and uses of IoT enabled devices and familiarize with the IoT architecture reference model.	Level2:: Understand
CO 5	Describe the modern networking security issues, and their solutions.	Level2:: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	1	-	-	-	-	-	-	-	-	2
CO 3	3	2	1	-	1	-	-	-	-	-	-	2
CO 4	3	2	1	-	-	-	-	-	-	-	-	2
CO 5	3	2	1	-	2	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	20
Understand	40	40	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. What are the features of distributed systems?
2. What is interprocess communication?

Course Outcome 2 (CO2)

1. What is request reply protocol?
2. What are the differences between process and threads?

Course Outcome 3(CO3):

1. What are the features of cloud computing?
2. Explain ITU-T Cloud Computing Functional Reference Architecture

Course Outcome 4 (CO4):

1. Explain in detail about types of sensors
2. Explain the elements of RFID systems

Course Outcome 5 (CO5):

1. Discuss the importance of encryption in communication
2. Explain wireless network security

Model Question Paper

Course Code: ITT383
Course Name: INTERNET TECHNOLOGY

Max. Marks: 100

Duration: 3 Hours

PART A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. Give examples for distributed system
2. What is HTML?
3. What is middleware?
4. What is a thread?
5. What are the characteristics of cloud computing?
6. What is Infrastructure as a service?
7. What is an actuator?
8. What is RFID?
9. What is the difference between HTTP and HTTPS?
10. What is VPN?

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. What is a distributed system? Explain the challenges in distributed system.

OR

12. Explain in detail about overlay networks.

13. Explain in detail about remote procedure call.

OR

14. Explain about web service infrastructure and components.

15. Illustrate NIST cloud computing reference architecture.

OR

16. Describe the three basic cloud services in detail.

17. Explain the different elements in an RFID system in detail.

OR

18. Describe the ITU-T Y.2060 IoT Reference Model.

19. Explain any 5 security scams used to fool users

OR

20. Explain in detail about wireless network security

Syllabus

Module 1: Introduction to Distributed Systems (9Hours)

Characterization of Distributed Systems: Introduction, Examples of distributed systems, Trends in distributed systems, Challenges, Case Study: The World Wide Web. System Models: Introduction, Physical Models, Architectural models. Interprocess Communication: Introduction, The APIs for internet protocols, External data representation and marshalling, Network Virtualization: Overlay networks.

Text Book I – Chapter 1,2, and 4

Module 2: Distributed Middleware Application(9 Hours)

Remote Invocation: Introduction, request-reply protocols, remote procedure call, remote method invocation. Operating system support: Introduction, The operating system layer, Processes and threads, Communication and invocation. Web Services: Introduction, Web Services, Coordination of web services, Application of web services

Text Book I – 5, 7, and 9

Module 3: Cloud Computing (9 Hours)

Basic Concepts, Cloud Computing Elements, Cloud Service Models: SaaS, PaaS, IaaS, Other Cloud Services, Cloud Deployment Models, NIST Cloud Computing Reference Architecture, ITU-T Cloud Computing Reference Architecture, ITU-T Cloud Computing Functional Reference Architecture

Text Book II – Chapter 13

Module 4: Internet of Things (9Hours)

The Internet of Things: Components. Scope of the Internet of Things, Components of IoT-Enabled Things: Sensors, Types of Sensors, Actuators, Embedded System, Microprocessors, Microcontrollers, Transceivers, RFID, IoT Architecture - ITU-T Y.2060 IoT Reference Model, IoT World Forum Reference Model

Text Book II – Chapter 14, 15

Module 5: Network Security(9 Hours)

Introduction, Cybercrime And Cyber Security, Unsecure Internet, Computer Encryption, Confidential Web Browsing, Encryption Keys, Authentication: User IDs And Passwords, Two-Factor Authentication, Wireless Network Security, Network Firewall, Security Scams, Man-In-The-Middle Attacks, Email Addresses And Web Site URLs based attacks, Malware In Email Attachments, Secure Access with VPNs, VPN Technology

Text Book III – Chapter 14, 15

Text Books

1. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, “Distributed Systems – Concepts and Design”. 5/e Addison Wesley, Inc., 2012.
2. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud”. 10/e Pearson Education, Inc., 2016.
3. Douglas E. Comer, “The Internet Book: Everything You Need to Know about Computer Networking and How the Internet Works”, 5th edition, CRC Press, 2019.

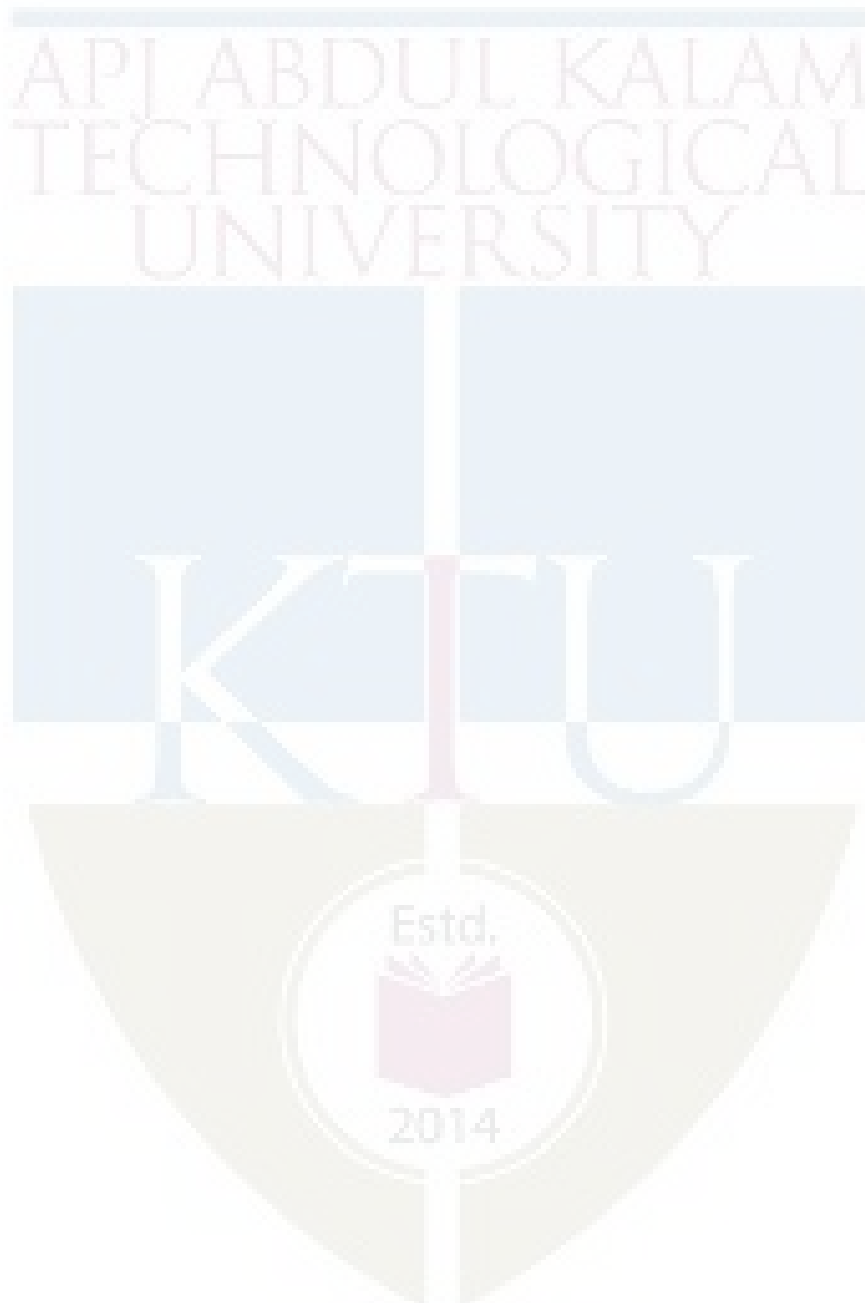
Reference Books

1. William Stallings, “Computer Security: Principles and Practice”, 3/e, Pearson Education Inc, 2015
2. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, Wiley, 2013
3. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach”, McGrawhill, 2009
4. Douglas E. Comer, Computer Networks and Internets, 6/e, Pearson Education Inc, 2018

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Module 1: Introduction to Distributed Systems (9 Hours)	
1.1	Characterization of Distributed Systems: Introduction, Examples of distributed systems	2Hours
1.2	Trends in distributed systems, Challenges, Case Study: The World Wide Web.	2Hours
1.3	System Models: Introduction, Physical Models, Architectural models.	2Hours
1.4	Interprocess Communication: Introduction, The APIs for internet protocols, External data representation and marshalling	2 Hours
1.5	Network Virtualization: Overlay networks	1 Hour
2	Module 2: Distributed Middleware Application(9 Hours)	
2.1	Remote Invocation: Introduction, request-reply protocols	2 Hours
2.2	Remote procedure call, remote method invocation.	2 Hours
2.3	Operating system support: Introduction, The operating system layer, Processes and threads, Communication and invocation.	3 Hours
2.4	Web Services: Introduction, Web Services	1 Hours
2.5	Coordination of web services, Application of web services	1 Hours
3	Module 3: Cloud Computing (9 Hours)	
3.1	Basic Concepts, Cloud Computing Elements, Cloud Service Models: SaaS, PaaS, IaaS, Other Cloud Services	3Hours
3.2	Cloud Deployment Models	2 Hours
3.3	NIST Cloud Computing Reference Architecture, ITU-T Cloud Computing Reference Architecture, ITU-T Cloud Computing Functional Reference Architecture	4Hours
4	Module 4: Internet of Things (9Hours)	
4.1	The Internet of Things: Components. Scope of the Internet of Things	3Hours
4.2	Components of IoT-Enabled Things: Sensors, Types of Sensors, Actuators, Embedded System, Microprocessors, Microcontrollers, Transceivers, RFID	3 Hours
4.3	IoT Architecture - ITU-T Y.2060 IoT Reference Model, IoT World Forum Reference Model	3 Hours
5	Module 5: Security (9Hours)	
5.1	Introduction, Cybercrime And Cyber Security	1Hour
5.2	Unsecure Internet, Computer Encryption, Confidential Web Browsing, Encryption Keys	1Hour
5.3	Authentication: User IDs And Passwords, Two-Factor Authentication	2Hours
5.4	Wireless Network Security, Network Firewall	2Hours

5.5	Security Scams, Man-In-The-Middle Attacks, Email Addresses And Web Site URLs based attacks, Malware In Email Attachments	2 Hours
5.6	Secure Access with VPNs, VPN Technology	1 Hour



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT385	SOFTWARE ARCHITECTURE CONCEPTS	VAC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of understanding essential concept of software architecture.

Prerequisite: Basic programming knowledge

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO1	Summarize role of software architecture and architect	Level 2: Understand
CO2	Discuss Basic Concepts in Software Architecture	Level 2: Understand
CO3	Explain Design Patterns	Level 2: Understand
CO4	Explain the role of Architecture in SDLC	Level 2: Understand
CO5	Identify the role of Architecture in Business	Level 2: Understand
CO6	Illustrate Architecture Techniques	Level 2: Understand

Mapping of course outcomes with program outcomes

COs	PROGRAMME OUTCOMES (PO)											
	K3 PO1	4 PO2	5 PO3	5 PO4	6 PO5	3 PO6	2 PO7	3 PO8	3 PO9	3 PO10	3 PO11	3 PO12
CO1	1	-	-	-	-	-	-	3	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	3	3	-	1	-	-	1	-	-
CO4	2	-	1	-	-	-	-	-	-	-	-	-
CO5	1	-	2	-	-	-	-	1	-	-	-	1
CO6	2	-	-	-	2	-	1	-	-	-	-	-

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	30	30	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. List out the importance of software architecture.
2. Explain the business context of software architecture.
3. Describe the Contexts of Software Architecture.
4. Explain roles of the Software Architect.

Course Outcome 2 (CO2):

1. List out basic concepts in Software Architecture.
2. Explain the relevance of Software Design.
3. Examine the Design principles of software architecture.

Course Outcome 3 (CO3):

1. Summarize structural design patterns.

2. Illustrate Design Patterns.

Course Outcome 4 (CO4):

1. Compare and contrast waterfall model and agile model.
2. Classify architecture evaluation methods.
3. Illustrate documentation of Software Architectures with example.
4. Identify different phases in software development.

Course Outcome 5 (CO5):

1. Identify the basis for economic analysis of architecture.
2. Identify the role of Product Line Architecture.
3. Develop a strategy to improve the Architecture Competence.
4. Select the quality attributes that are relevant for the Software Industry.

Course Outcome 6 (CO6):

1. Differentiate bottom-up and top-down architecture development.
2. Write short note on architectural patterns
3. Describe Architecture Development Techniques.
4. Explain different architecture integration strategies.

Model Question paper

Course Code: ITT385

Course Name: Software Architecture Concepts

Max.Marks:100

Hours

Duration: 3

PART A

(Each Question carries 3 Marks)

(10*3=30)

1. List out the importance of software architecture.
2. Explain the business context of software architecture.
3. List out basic concepts in Software Architecture.
4. Summarize structural design patterns.
5. Compare and contrast waterfall model and agile model.
6. Classify architecture evaluation methods.
7. Identify the basis for economic analysis of architecture.
8. Identify the role of Product Line Architecture.
9. Differentiate bottom-up and top-down architecture development.
10. Write short note on architectural patterns.

PART B
(Each Question carries 14 Marks)

11. Describe the Contexts of Software Architecture.

OR

12. Explain roles of the Software Architect.

13. Analyze the relevance of Software Design.

OR

14. Examine the merits and demerits of each type of Design Patterns.

15. Illustrate documentation of Software Architectures with example.

OR

16. Identify different phases in software development.

17. Develop a strategy to improve the Architecture Competence.

OR

18. Select the quality attributes that are relevant for the Software Industry.

19. Describe Architecture Development Techniques.

OR

20. Explain different architecture integration strategies.

Syllabus

Module 1: Introduction to Software Architecture
Relevance of Software Architecture, Contexts of Software Architecture, Software Architecture Approaches, Software Architect, Roles of the Software Architect
Module 2: Basic Concepts in Software Architecture
Basic Concepts in Software Architecture, Introduction to software design, Design principles, Design Patterns
Module 3: Architecture in SDLC
Software Development Life Cycle (SDLC) Role of Architecture in SDLC -Requirements and Design Documenting Software Architectures, Implementation, and Testing, Architecture Evaluation
Module 4: Architecture & Business
Economic Analysis of Architectures Architecture Competence- Competence of Individuals, Competence of a Software Architecture Organization Architecture and Software Product Lines- working, role, evaluation, and issues Quality Attributes
Module 5: Architecture Techniques

Architecture Development Techniques
 Software Partitioning Strategies
 Software Changeability and Dependency Management
 Using Architectural Patterns
 Integration Strategies
 Bottom-Up Architecture Development, Top-Down Architecture Development

Text Books

1. Software Architecture – A practical Guide using UML, Jeff Garland, Richard Anthony, John Wiley & Sons Ltd, ISBN 0 470 84849 9, 2003
2. Software Architecture in Practice, (3rd Edition) (SEI Series in Software Engineering), by Len Bass, Paul Clements, Rick Kazman, Publisher: Addison-Wesley, 2012.
3. Software Design: From Programming to Architecture, Eric Braude, Wiley, 2004.
4. Software Architecture: Foundations, Theory, and Practice, R. N. Taylor, N. Medvidovic, and E. M. Dashofy. , John Wiley & Sons, 2009.

Reference Books

1. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development (3ed), Craig Larman; Printice Hall PTR (2004). ISBN 13: 978-0131489066
2. Pankaj Jalote, An integrated approach to Software Engineering, 3rd Edition, Springer/Narosa.
3. Ian Sommerville, Software Engineering, 10th Edition, Addison-Wesley

Course Contents and Lecture Schedule

Sl.No	Module 1: Introduction to Software Architecture	10hrs
1.1	Introduction to Software Architecture, importance of Software Architecture	2
1.2	Contexts of Software Architecture – Technical Context, Project Life Cycle Context, Business Context, Professional Context	2
1.3	Software Architecture Approaches - The 4+1 Views, RM-ODP viewpoints, Bass architectural structures, Hofmeister software architecture views.	2
1.4	Software Architect, Roles of the Software Architect - Relationship to other key roles in development organization, Skills and Background for the Architect,	2
1.5	Injecting Architecture Experience, Structuring the Architecture Team, Traps and Pitfalls Associated with the Role of Software Architect.	2

	Module 2: Basic Concepts in Software Architecture	8 hrs
2.1	Basic Concepts in Software Architecture – Architecture, components, connector, configuration, architectural style, architectural patterns, models, processes, stakeholders.	2
2.2	Introduction to software design	1
2.3	Design principles - Correctness and Robustness, Flexibility, Reusability, and Efficiency.	2
2.4	Design Patterns - Creational Design Patterns, Structural Design Patterns, Behavioural Design Patterns.	3
	Module 3: Architecture in SDLC	9 hrs
3.1	Software Development Life Cycle (SDLC) overview – Phases in software development, Different types of SDLC – Waterfall model to Agile model.	2
3.2	Architecture in SDLC - Architecture and Requirements	2
3.3	Architecture in SDLC - Designing an Architecture	2
3.4	Architecture in SDLC - Documenting Software Architectures, Architecture, Implementation, and Testing, Architecture Evaluation.	3
	Module 4: Architecture & Business	9 hrs
4.1	Economic Analysis of Architectures - Decision-Making Context, The Basis for the Economic Analysis, Putting Theory into Practice: The CBAM	2
4.2	Architecture Competence - Competence of Individuals: Duties, Skills, and Knowledge of Architects, Competence of a Software Architecture Organization	2
4.3	Architecture and Software Product Lines - An Example of Product Line Variability, Working of a Software Product Line, Product Line Scope, The Quality Attribute of Variability, The Role of a Product Line Architecture, Variation Mechanisms, Evaluating a Product Line Architecture, Key Software Product Line Issues	2
4.4	Quality Attributes – Availability, Interoperability, Modifiability, Performance, Security, Testability, Usability	3
	Module 5: Architecture Techniques	9 hrs

5.1	Architecture Development Techniques - Commonality and variability analysis, Design for change, Generative programming techniques, Building a skeleton system, Prototyping, Interface development – Design by Contract, Architectural description languages, Architecture evaluation	2
5.2	Software Partitioning Strategies – Separation of Concerns - Functional decomposition, Isolate configuration data, Isolate hardware-specific components, Isolate time-critical components, Separate domain implementation model from human interface, Separate domain implementation model from implementation technology, Separate main function from monitoring, Separate fault recovery processing, Adaptation of external interfaces	2
5.3	Software Changeability and Dependency Management - The stable dependencies principle (SDP), Acyclic dependencies principle, Interface Separation Principle. Using Architectural Patterns	2
5.4	Integration Strategies - Data-only integration, Executable integration, Establishing Architecture to Support Development, Configuration and change management, Build management, Continuous integration, Anticipate multi-language development, Anticipate tactical development (scripting),	2
5.5	Bottom-Up Architecture Development, Top-Down Architecture Development	1

APJ ABDUL KALAM
TECHNOLOGICAL
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SEMESTER V

HONOURS



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT393	WIRELESS COMMUNICATION	VAC	3	1	0	4

Preamble: The course addresses the fundamentals of wireless communications and provides an overview of existing and emerging wireless communication technology and networks.

Prerequisite: ITT292 Mathematical Foundation for Networking

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category
CO 1	Discuss the fundamental concepts wireless communication	Level 2: Understand
CO 2	Illustrate large and small scale fading in mobile wireless communication	Level 3: Apply
CO 3	Familiarize and apply equalization, diversity & channel coding techniques	Level 3: Apply
CO 4	Identify the multiple access techniques in wireless systems	Level 2: Understand
CO 5	Discuss various wireless system models	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1	-	-	-	-	-	-	-	-	3
CO 2	1	2	2	2	-	-	-	-	-	-	-	2
CO 3	1	2	3	2	-	-	-	-	-	-	-	2
CO 4	1	2	2	1	-	-	-	-	-	-	-	2
CO 5	1	2	1	-	2	-	-	-	-	-	-	3

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember			
Understand	30	30	60
Apply	20	20	40
Analyse			
Evaluate			
Create			

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Define Coherence time. How does this parameter decide the behaviour of the wireless channel?
2. If a total of 33MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25KHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses a) 4 cell re-use and b) 7-cell reuse.

Course Outcome 2 (CO2)

1. Distinguish between slow and fast fading. Explain with an example.
2. Describe the free space propagation model and derive the loss in the signal strength.

Course Outcome 3(CO3):

1. Draw and explain a simplified communication system using an adaptive equalizer at the receiver.
2. Write a brief note on categories of space diversity reception methods.

Course Outcome 4 (CO4):

1. How FDMA handles near far problem?
2. Identify the channel capacity of TDMA in cell system.

Course Outcome 5 (CO5):

1. Explain the GSM architecture in detail.
2. What is triangular routing problem? Discuss any solution.

Model Question Paper

Course Code: ITT393

Course Name: WIRELESS COMMUNICATION

Max. Marks: 100

Duration: 3 Hours

PART A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. How is frequency reuse distance measured in cellular system?
2. What is meant by mobile assisted handoff?
3. What is fast fading?
4. List the various path loss models for large scale fading
5. What is time diversity?
6. What is the difference between linear and non linear equalization?
7. What is reverse channel interference?
8. What is SDMA?
9. What is care of address?
10. What are the features of mobile adhoc networks?

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. Explain in detail about the handoff strategies used in cellular system

OR

12. Discuss the impact of interference in a cellular system and system capacity

13. Explain in detail about the three basic propagation mechanisms

OR

14. Explain the different types of small scale fading based on multipath time delay spread

15. Describe any two diversity combining techniques stating their respective merits

OR

16. What are block codes? Explain the features of block codes

17. Compare FDMA and TDMA

OR

18. Describe in detail about CSMA/CD protocol

19. Discuss the system architecture of GSM

OR

20. What is triangular routing? How can it be avoided?

Syllabus

Module 1: INTRODUCTION TO WIRELESS COMMUNICATION	8 hours
Introduction to wireless communication systems: Evolution of mobile radio communications, Mobile radio systems around the world. Example of wireless communication systems. Modern wireless communication systems: 2G, 3G, 4G and 5G. Wireless local loop, Wireless local area networks, Bluetooth and personal area networks. The Cellular Concept: Frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service. Improving coverage and capacity in cellular systems.	
Module 2 :MOBILE RADIO PROPAGATION	9 hours
Large scale path loss: Introduction to radio wave propagation, free space propagation models, Three basic propagation mechanisms, reflection, Two-ray propagation model, Diffraction, Scattering. Small scale fading and multipath: Small scale multipath propagation, Types of small scale fading – flat fading, frequency selective fading, fast fading and slow fading.	
Module 3: EQUALIZATION, DIVERSITY & CHANNEL CODING	9 hours
Introduction, fundamentals of equalization, Survey of equalization techniques, Methods for Channel Diversity – Space Diversity, Polarization Diversity, Frequency Diversity , Multipath diversity, Time Diversity. Diversity Combining – Selection Combining, Scanning Combining, Equal Gain Combining, Maximal Ratio Combining Fundamentals of Channel Coding – BlockCodes, Examples	
Module 4:MULTIPLE ACCESS TECHNIQUES	10 hours
Introduction. Frequency Division Multiple Access (FDMA). Time Division Multiple Access	

(TDMA). Spread Spectrum Multiple Access. Space Division Multiple Access (SDMA). Capture effects in packet Radio, CSMA/CA Capacity of Cellular Systems – fundamentals
Module 5 : WIRELESS SYSTEMS 9 hours
Telecommunication system – GSM, Wireless LAN – IEEE 802.11,Bluetooth. Mobile Network layer – Mobile IP, Mobile ad-hoc networks.

Text Books

1. Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, 2nd edition, Pearson Education India, 2014.
2. Dr Jochen Schiller, “Mobile Communications”, 2nd edition, Pearson Education, 2012.

Reference Books

1. Goldsmith, A. (2005). Wireless Communications. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511841224.
2. Prof. Neal Patwari, ECE 5325/6325: Wireless Communication Systems Lecture Notes, Fall 2011
3. Cory Beard and William Stallings, “Wireless Communication Networks and Systems”, Pearson

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	MODULE 1	8 hours
1.1	Introduction to wireless communication systems: Evolution of mobile radio communications, Mobile radio systems around the world. Example of wireless communication systems.	1 Hr
1.2	Modern wireless communication systems: 2G, 3G, 4G and 5G. Wireless local loop, Wireless local area networks, Bluetooth and personal area networks.	1 Hr
1.3	The Cellular Concept: Frequency reuse, channel assignment and handoff strategies,	2 Hrs
1.4	Interference and system capacity, trunking and grade of service.	2 Hrs
1.5	Improving coverage and capacity in cellular systems.	2Hrs
2	MODULE 2	9 hours
2.1	LARGE SCALE PATH LOSS: Introduction to radio wave propagation, free space propagation models, Three basic propagation mechanisms, reflection, Two-ray propagation model.	3 Hrs

2.2	Diffraction, Scattering.	2 Hrs
2.3	SMALL SCALE FADING AND MULTIPATH: Small scale multipath propagation	1 Hr
2.3	Types of small scale fading – flat fading, frequency selective fading, fast fading and slow fading.	3 Hrs
3	MODULE 3	9 hours
3.1	Introduction, fundamentals of equalization, Survey of equalization techniques.	2 Hrs
3.2	Methods for Channel Diversity – Space Diversity, Polarization Diversity, Frequency Diversity, Multipath diversity, Time Diversity.	3 Hrs
3.3	Diversity Combining – Selection Combining, Scanning Combining, Equal Gain Combining, Maximal Ratio Combining	2 Hrs
3.4	Fundamentals of Channel Coding – BlockCodes, Examples	2 Hrs
4	MODULE 4	10 hours
4.1	Introduction. Frequency Division Multiple Access (FDMA).	1 Hrs
4.2	Time Division Multiple Access (TDMA).	1 Hr
4.3	Spread Spectrum Multiple Access.	2 Hrs
4.4	Space Division Multiple Access (SDMA).	2 Hrs
4.5	Capture effects in packet Radio, CSMA/CA	2 Hrs
4.6	Capacity of Cellular Systems - fundamentals	2 Hrs
5	MODULE 5	9 hours
5.1	Telecommunication system – GSM.	2 Hr
5.2	Wireless LAN – IEEE 802.11	2 Hr
5.3	Bluetooth.	1 Hrs
5.4	Mobile Network layer – Mobile IP.	2 Hrs
5.5	Mobile ad-hoc networks.	2 Hrs

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT395	SECURITY IN COMPUTING	VAC	3	1	0	4

Preamble:

The syllabus is designed with the view of preparing the students capable of understanding the principles and concepts of computer security. The students should be able to understand what it means for a system to be secure. Furthermore, the students will get to know about computing systems vulnerabilities, threats, and security controls.

Prerequisite: Basics of Operating systems, Database Systems and Computer Networks

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category
CO 1	Outline the basic concepts and techniques of computer security	Level 2: Understand
CO 2	Explain the various aspects of program security	Level 2: Understand
CO 3	Model secure and trusted operating systems	Level 3: Apply
CO 4	Summarize the requirements and features of database security	Level 2: Understand
CO 5	Identify the security issues in network and the appropriate security measures	Level 3: Apply

Mapping of course outcomes with program outcomes

COs	PROGRAMME OUTCOMES (PO)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1			1						
CO 2	3	2	1			1						
CO 3	2	2	1		2							1
CO 4	2	2	1		2			2				2
CO 5	3	2	2		2	2		2				3

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	30	30	40
Apply	10	10	40
Analyze			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Outline substitution techniques with suitable examples.
2. Distinguish between vulnerability, threat and control
3. Explain DES algorithm.

Course Outcome 2 (CO2):

1. Explain how non malicious program errors become a threat to security.
2. Explain the different methods to control program threats.
3. Explain the limitations on the amount of information leaked per second through a covert channel in multi-access computing system.

Course Outcome 3 (CO3):

1. Model the layered design of a trusted operating system.
2. Compare Simple Security Condition Preliminary version and Star Property Preliminary version in Bell-La-Padula model.
3. Write a set of rules combining the secrecy controls of the Bell-La-PADula model with the integrity controls of Biba model.

Course Outcome 4 (CO4):

1. Outline the models for designing multilevel secure database.
2. Explain two phase update with an example.
3. Explain the factors that determine the sensitivity of data.

Course Outcome 5 (CO5):

1. Compare the different types of firewalls.
2. Explain the two general types of IDS.
3. Identify the security purpose for the fields, such as sequence number of an IPSec packet.

Model Question paper

Course Code: ITT395

Course Name: Security in Computing

Max.Marks:100

Duration: 3 Hours

PART A

(10*3=30)

(Each Question carries 3 Marks)

1. What do you mean when you say that a system is secure?
2. Summarize the uses of encryption.
3. Differentiate the types of program security flaws.
4. Explain about virus signatures.
5. Outline how a fence register is used for relocating a user's program.
6. List few disadvantages of using physical separation in computing system.
7. Interpret the purpose of encryption in multilevel secure database management systems.
8. Explain about commutative filters.
9. Identify a counter measure for traffic flow analysis.
10. Explain the different types of Intrusion Detection Systems.

PART B

(5*14=70)

11. a. Explain the major vulnerabilities that a computer system is subjected to (7)
b. Differentiate substitution ciphers and transposition ciphers with examples (7)

OR

12. a. Explain DES algorithm. (7)
b. Differentiate symmetric and asymmetric encryption. (7)

13. a. Explain about non malicious program errors. (7)
b. Outline the various methods to control different program threats. (7)

OR

14. a. Explain the different kinds of malicious codes. (7)
b. Represent three controls that could be applied to detect or prevent salami attacks. (7)

15. a. According to Bell-La Padula Model, identify the restrictions placed on two active subjects that need to send and receive signals to and from each other. Justify your answer. (7)
b. Compare Simple Security Condition Preliminary version and Star Property Preliminary version in Bell-La-Padula model. (7)

OR

16. a. Model the layered design of a trusted operating system. (9)
b. Explain the factors that determine the sensitivity of data. (5)

17. a. Outline the basic security requirements of database systems. (7)
b. Show the mechanisms to implement 'seperation' in databases. (7)

OR

18. a. Represent the models for designing multilevel secure database. (7)
b. Explain the disadvantages of partitioning as means of implementing multilevel security for database. (7)

19. a. Examine the significance of dual signature in secure electronic transactions? (5)
b. Compare the different types of firewalls. (9)

OR

20. Differentiate between message confidentiality threats and message integrity threats. (7)
21. Make use of a social engineering attack to obtain a user's password and explain the attack in detail. (7)

Syllabus

Module 1: Introduction to Security in Computing (10 Hours)
Introduction: Security Problem in Computing, Elementary Cryptography- Terminology and Background, Introduction - Substitution Ciphers, Transposition Ciphers, Encryption Algorithms, DES, AES, Public Key Encryption, Uses of Encryption.
Module 2: Program Security (9 Hours)
Secure Programs, Nonmalicious Program Errors, Viruses and other Malicious Code, Targeted Malicious Code, Controls against Program Threats.
Module 3 : Protection in General Purpose Operating System (9 Hours)
Protected Objects and Methods of Protection, Memory Address Protection, Control of Access to General Objects, File Protection Mechanisms, User Authentication, Designing Trusted Operating Systems- Security Policies, Models of Security, Trusted Operating System Design, Assurance in Trusted OS.
Module 4 : Database and Data Mining Security (9 Hours)
Introduction to Databases, Security Requirements, Reliability and Integrity, Sensitive Data, Inference, Multilevel Databases, Proposals for Multilevel Security, Data Mining.
Module 5 : Security in Networks (8 Hours)
Security in Networks- Threats in Networks, Network Security Controls, Secure Electronic Transactions, Firewalls, Intrusion Detection Systems.

Text Books

1. Charles P. Pfleeger, Shari Lawrence Pfleeger and Deven N. Shah, Security in Computing, 4th Edition.
2. William Stallings, Cryptography and Network Security Principles and Practice, Pearson Education, 4th Edition.

Reference Books

1. William Stallings, Network Security Essentials, Applications and Standards, Pearson Education.
2. Michael E. Whitman and Herbert J Mattord, Principles of Information Security, 4th Edition.

Course Contents and Lecture Schedule

	Module 1: Introduction to Classical and Modern cryptographic techniques	10 hrs
1.1	Introduction: Security problem in Computing	1
1.2	Elementary Cryptography- terminology and background	1
1.3	Substitution Ciphers	2
1.4	Transposition Ciphers	2
1.5	Encryption Algorithms- DES, AES	3

1.6	Public Key Encryption, Uses of Encryption.	1
	Module 2: Program Security	9 hrs
2.1	Secure Programs	1
2.2	Nonmalicious Program Errors	1
2.3	Viruses and other Malicious Code	2
2.4	Targeted Malicious Code	3
2.5	Controls against Program Threats	2
	Module 3: Protection in General Purpose Operating System	9 hrs
3.1	Protected Objects and Methods of Protection	1
3.2	Memory Address Protection	1
3.3	Control of Access to General Objects	1
3.4	File Protection Mechanisms	1
3.5	User Authentication	1
3.6	Designing Trusted Operating Systems- Security Policies, Models of Security	2
3.7	Trusted Operating System Design, Assurance in Trusted OS	2
	Module 4: Database and Data Mining Security	9 hrs
4.1	Introduction to Databases	1
4.2	Security Requirements	1
4.3	Reliability and Integrity	1
4.4	Sensitive Data, Inference	2
4.5	Multilevel Databases, Proposals for Multilevel Security	3
4.6	Data Mining	1
	Module 5: Security in Networks	8hrs
5.1	Network Concepts	1
5.2	Threats in Networks	2
5.3	Network Security Controls	2
5.4	Secure Electronic Transactions	1
5.5	Firewalls	1
5.6	Intrusion Detection Systems	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT397	ADVANCED COMPUTER ARCHITECTURE	VAC	3	1	0	4

Preamble: Advanced computer architecture course is intended to deliver students the advanced concepts of Computer architecture. It also helps them to learn how computer performance is measured and how memory organisation and memory performance optimization is done. A detailed insight into ILP, TLP and DLP, multicore and shared memory architectures with necessary case studies are also covered in the syllabus.

Prerequisite: ITT204 Computer Organisation

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category
CO 1	Measure performance of a computer by understanding the basic architectures of computers	Level 3: Apply
CO 2	Demonstrate the Memory optimization techniques.	Level 3: Apply
CO 3	Investigate pipelining techniques, ILP, multithreading and to illustrate various methods to overcome the challenges in ILP	Level 3: Apply
CO 4	Write a simple OpenMP program to execute multi threaded programs and to understand the concepts in Shared Multicore Architectures	Level 3: Apply
CO 5	Write a simple CUDA program to exploit DLP and to understand the concepts in DLP	Level 3: Apply

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2								2
CO2	3	2	2	2	3							2
CO3	3	3	2	3	3							2
CO4	3	3	3	3	2							2
CO5	3	3	3	3	2							2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Test		End Semester Examination
	1	2	
Remember	10	10	20
Understand	10	10	20
Apply	30	30	60
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Continuous Assessment Test (2 numbers) : 25 marks
 Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Consider two programs A and B that solves a given problem. A is running on a SPARC machine operating at 500 MHz and B is running on a DEX machine running at 750 MHz. A

contains a total instructions of 4670, out of which 19% are floating point instructions, 33% load store instructions and rest are simple instructions. B is composed of 25% floating point instructions. The number of simple instructions in B is twice the count of load store instructions. Total instruction count of B is 4100. In both DEX and SPARC floating point operation has an average CPI of 5 and simple instruction has an average CPI of 1.2. Both the architectures differ in the CPI of load store instruction. They are 2 and 2.4 for SPARC and DEX respectively.

- a) Given this setup which machine solves the problem faster, and by how much?
- b) Is there any other program to machine mapping that gives a better result ?

2. A new floating-point system is introduced in a system and it speeds up floating point operations by 2 times. In an application $\frac{1}{5}$ th of the instructions are floating-point operations. What is the overall speedup? (Ignore the penalty to any other instructions) The speeding up of the floating-point unit slowed down data cache accesses resulting in a 1.5x slowdown. Data cache accesses consume 10% of the execution time. What is the overall speedup now?

Course Outcome 2 (CO2):

1. Discuss various cache optimisation techniques
2. An 8KB direct-mapped write-back cache is organized as multiple blocks, each of size 32-bytes. The processor generates 32-bit addresses. The cache controller maintains the tag information for each cache block comprising of the following. 1 Valid bit 1 Modified bit As many bits as the minimum needed to identify the memory block mapped in the cache. What is the total size of memory needed at the cache controller to store meta-data (tags) for the cache?

Course Outcome 3 (CO3):

1. Assume a MIPS pipeline with 1 integer unit (EX), 1 FP Adder for the following code.

```

Loop:  L.D F0,(R1) ;F0=array element
        ADD.D F4,F0,F2 ;add scalar in F2
        S.D F4,0(R1) ;store result
        DAADUI R1,R1,#-8 ;decrement pointer 8 bytes(per DW)
        BNE R1,R2,Loop ; branch if R1!=R2
  
```

- (a) What is the execution time of one loop iteration (in cycles) if operand forwarding is permitted?
- (b) What is the execution time of one loop iteration (in cycles) if compiler scheduling is done within an iteration of the loop?
- (c) Unroll the loop fully and then schedule the code for maximum performance. What is the best execution time you can get from this code?

2. Suppose you have the following instruction sequence to be executed

```

lw $1, 0($7)
addi $1, $1, 1
  
```



```

sw $10, 10($7)
lw $2, 0($8)
addi $2, $2, 1
sw $20, 10($8)

```

Rearrange the instruction sequence so that it achieves the same functionality but best performance (shortest execution time). You are only allowed to change the order of the six instructions. Do not modify or add new instructions. Calculate the execution time of the instruction sequence you rearranged.

Course Outcome 4 (CO4):

1. Discuss Cache coherence protocols
2. Create a simple OpenMP program that does the following:
 - A. Creates a parallel region
 - B. Has each thread in the parallel region obtain its thread id
 - C. Has each thread print "Hello World" along with its unique thread id
 - D. Has the master thread only, obtain and then print the total number of threads

Course Outcome 5 (CO5):

1. Assume that the processor runs at 700 MHz and has a maximum vector length of 64. The load/store unit has a start-up overhead of 15 cycles; the multiply unit, 8 cycles; and the add/subtract unit, 5 cycles. Consider the following code, which multiplies two vectors that stores single precision complex numbers in it:

```

for (i=0;i<300;i++){
    c_re[i] = a_re[i] * b_re[i] - a_im[i] * b_im[i];
    c_im[i] = a_re[i] * b_im[i] + a_im[i] * b_re[i]; }

```

- (a) What is the arithmetic intensity of this kernel, if arithmetic intensity is defined as the ratio of floating point operations per byte of memory accessed?
- (b) Assuming chaining and a single memory pipeline, how many clock cycles are required? How many clock cycles are required per complex result value, including start-up overhead? (5)
2. Write a CUDA program for matrix multiplication by exploiting DLP

Model Question Paper**Course Code: ITT397****Course Name: Advanced Computer Architecture**

Max.Marks:100

Duration: 3 Hours

PART A**(10*3=30)****(Each question carries 3 Marks)**

1. Compare SISD and SIMD architectures.
2. Discuss Amdahl's law.
3. For a cache with capacity 32KB, how many blocks does the cache holds for block size=32 bytes, 64 bytes and 128 bytes?
4. Differentiate cache memory and TLB
5. List the limitations of ILP
6. What do you mean by hardware speculation?
7. What is multiprocessor hyperthreading
8. What is the use of Vector Mask Registers Vector architecture.
9. Write any three differences between Vector architecture and GPU.
10. Show that the following loop have a loop-carried dependency or not?

```
for (i=0;i<100;i++){
    A[i] = B[2*i+4];
    B[4*i+5] = A[i];}
```

PART B**(5*14=70)****(Each full question carries 14 marks)**

11. a) Explain Flynn's taxonomy of architectures specifying the application of each. (7 marks)
 b) A single processor has FIT of 100. What is the mean time to failure for this system? If it takes 2 days to get the system running again, what is the availability of the system? Suppose a cluster Lucid has 1000 processors with a FIT of 100, then what is its MTTF? Assume that it experiences a catastrophic failure only if 1/4 of the computers fail. (7 marks)

OR

12. a) Consider a code fragment $A = D * (B + C) - E$ where A, B, C, D and E are memory locations to be executed on a processor TITAN. Write down the instruction sequence generated for this code fragment if TITAN is
 (i) Stack machine
 (ii) Accumulator machine
 (iii) Load Store machine. (6 marks)

b) A new floating-point system is introduced in a system and it speeds up floating point operations by 2 times. In an application 1/5 th of the instructions are floating-point operations. What is the overall speedup? (Ignore the penalty to any other instructions) The speeding up of the floating-point unit slowed down data cache accesses resulting in a 1.5x slowdown. Data cache accesses consume 10% of the execution time. What is the overall speedup now?

(8 marks)

13. a) Explain the memory hierarchy in ARM Cortex- A8 (5 marks)
 b) Discuss the cache optimisation techniques. (9 marks)

OR

14. a) Consider two cache architectures. One has a separate I and D cache of size 16KB and the other one is a unified dual ported of size 32KB. The I & D cache has instruction miss rate 0.5% and data miss rate 5%. The unified cache has aggregate miss rate 1%. Hit time is 1 cycle. Miss penalty is 50 cycles. 30% of instructions are load/store. Which one is better and what is the improvement in CPI. Assume CPI of 1 without cache misses.

(6 marks)

- b) Discuss how address translation is done in Virtual memory (8 marks)

15. a) We have a program of 1000 instructions in the format of “lw, add, lw, add, ...”
 The add instruction depends (and only depends) on the lw instruction right before it. The lw instruction depends (and only depends) on the add instruction right before it. If the program is executed on the pipelined datapath with 5 stages (IF-ID&DR-EXE-MEM-WB).

(1) What would be the actual CPI if operand forwarding is permitted?

(2) Without forwarding, what would be the actual CPI?

Format : LOAD Rdest, #constant(Rx)

ADD Rdest, Rsrc1, Rsrc2

(7 marks)

- b) Perform Tomasulo's algorithm with reservation stations and Reorder Buffer and find out clock cycle in which the last instruction completes execution..

i) Assume the following information about functional units.

Functional unit type	Cycles in Ex
Integer Mul	2
Integer Div	10
Integer Add	1

- ii) Assume the processor can issue into the reservation stations and reorder buffer only one instruction per cycle.
- iii) Assume you have unlimited reservation stations, functional units, reorder buffer entries and CDB .
- iv) The Functional units are not pipelined.
- v) Fill in the cycle numbers in each pipeline stage for each instruction. For each instruction indicate where its source operands' are read from (use RF for register file, CDB for common data bus and ROB for Reorder Buffer).
- vi) Also for simplicity when an operand is waiting for an execution unit's result just indicated as waiting on CDB, instead of the number of the execution unit.
- vii) An instruction waiting for data on CDB can move to its EX stage in the cycle after the CDB broadcast.
- viii) Assume that integer instructions also follow Tomasulo's algorithm so the result from the integer functional unit is also broadcast on CDB and forwarded to dependent instructions through CDB.

(7 marks)

OR

16. a) Discuss dynamic scheduling in Intel core i7 (9 marks)
 b) A non pipelined system takes 50 ns to process a task. The same task can be processed in a six segment pipeline with a clock cycle of 10ns. Determine the speedup ratio of the pipeline for 100 tasks. What is the maximum speed up that can be achieved. ? (5 marks)
17. a) Explain shared memory multiprocessor systems (8 marks)
 b) Write an OpenMP program for matrix multiplication (6 marks)
- OR**
18. a) Discuss Directory based cache coherency protocol (7 marks)
 b) Discuss Intel Skylake processor (7 marks)
- 19 a) Discuss Graphical Processing Units (8 marks)
 b) Write a CUDA program for adding two vectors (6 marks)
- OR**
- 20 a) Discuss Loop level parallelism with examples (8 marks)
 b) Discuss DLP in Nvidia Maxwell (6 marks)

Syllabus

Module 1:(6 hours)
Introduction: Defining Computer Architecture, Flynn's Classification of Computers, Metrics for Performance Measurement-CPU performance, Memory/ Cache performance.
Module 2:(10 hours)
Memory Hierarchy Introduction, Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Virtual Memory and Virtual Machines, The Design of Memory Hierarchy, Simple program analysis using PIN (A binary instrumentation tool) Case Study: Memory Hierarchies in Intel Core i7 and ARM Cortex-A8.
Module 3:(10 hours)
Instruction Level Parallelism and Thread Level Parallelism: Introduction, Concepts and Challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Advanced Branch Prediction, Dynamic Scheduling, Advanced Techniques for Instruction Delivery and Speculation, Limitations of ILP, Multithreading: Exploiting Thread-Level Parallelism to Improve Uniprocessor Throughput, Simple thread programs and synchronization using OpenMP, Case Study: Dynamic Scheduling in Intel Core i7 and ARM Cortex-A8
Module 4:(10 hours)
Multicore systems and Shared Memory Architectures - Introduction, Shared-Memory Multicore Systems, Performance Metrics for Shared-Memory Multicore Systems, Cache Coherence Protocols, Synchronization, Memory Consistency, Multithreaded Programming using OpenMP, Case Study:

Intel Skylake and IBM Power8.

Module 5:(9 hours)

Data Level Parallelism Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, GPU Memory Hierarchy, Detecting and Enhancing Loop-Level Parallelism, Introduction to CUDA programming and simple programs using CUDA, Case Study: Nvidia Maxwell.

Text Books

1. J.L. Hennessy and D.A. Patterson. Computer Architecture: A Quantitative Approach. 5th Edition, Morgan Kauffmann Publishers, 2012.
2. J.P. Shen and M.H. Lipasti. Modern Processor Design: Fundamentals of Superscalar Processors. McGraw-Hill Publishers, 2005.

References

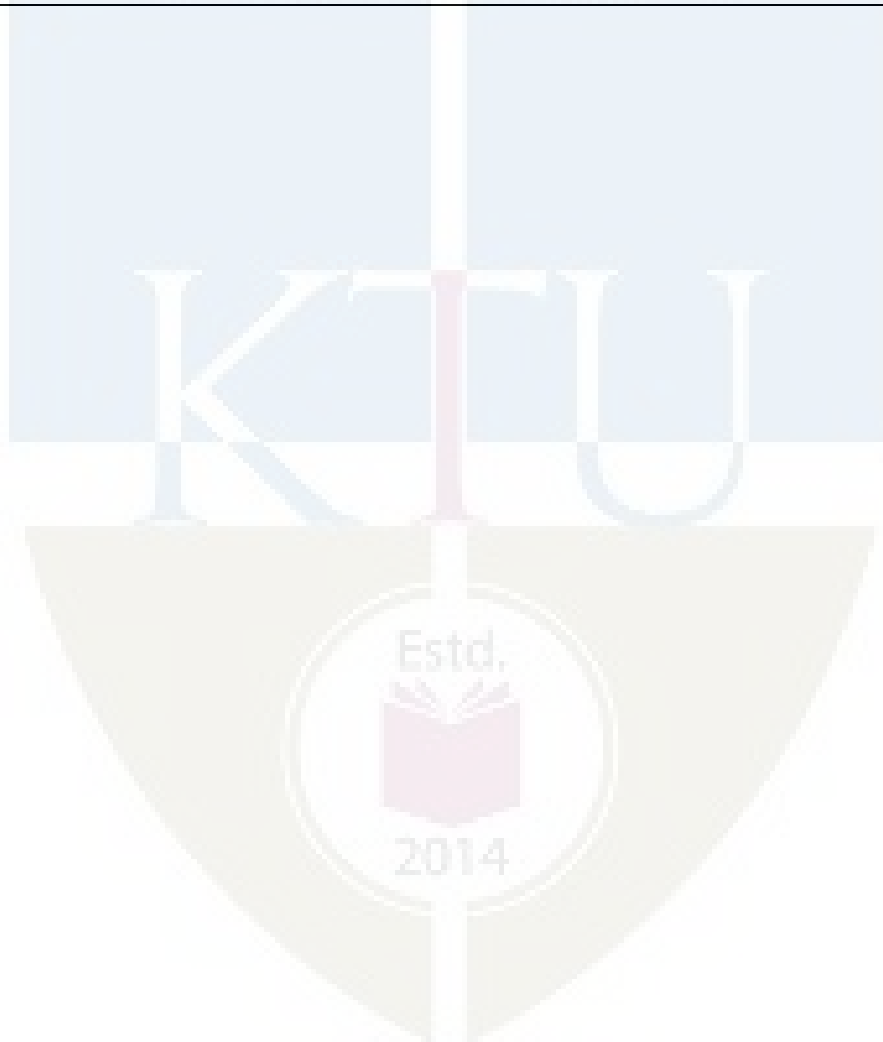
1. D.B. Kirk and W.W. Hwu. Programming Massively Parallel Processors. 2nd Edition, Morgan Kauffmann Publishers, 2012.
2. Pin tool – A Dynamic Binary Instrumentation Tool
<http://software.intel.com/en-us/articles/pin-a-dynamic-binary-instrumentation-tool>
3. OpenMP. <http://www.openmp.org/>
4. CUDA. <https://developer.nvidia.com/cuda-zone>

Course Content and Course Schedule

Module 1:Introduction:		6 hours
1.1	Defining Computer Architecture	2 hours
1.2	Flynn's Classification of Computers	1 hour
1.3	Metrics for Performance Measurement	1 hour
1.4	Processor performance	1 hour
1.5	Memory Performance	1 hour
Module 2: Memory Hierarchy		10 hours
2.1	Introduction to Memory hierarchy	1 hour
2.2	Advanced Optimizations of Cache Performance	2 hours
2.3	Memory Technology and Optimizations	2 hours

2.4	Virtual Memory and Virtual Machines	1 hour
2.5	The Design of Memory Hierarchy	1 hour
2.6	Simple program analysis using PIN (A binary instrumentation tool)	1 hour
2.7	Case Study: Memory Hierarchies in Intel Core i7 and ARM Cortex-A8.	2 hours
Module 3: Instruction Level Parallelism and Thread Level Parallelism		10 hours
3.1	Instruction-level Parallelism: Concepts and Challenges	1 hour
3.2	Basic Compiler Techniques for Exposing ILP	1 hour
3.3	Reducing Branch Costs with Advanced Branch Prediction	1 hour
3.4	Dynamic Scheduling	1 hour
3.5	Advanced Techniques for Instruction Delivery and Speculation	1 hour
3.6	Limitations of ILP	1 hour
3.7	Multithreading, Exploiting Thread-Level Parallelism to Improve Uniprocessor Throughput	1 hour
3.8	Simple thread programs and synchronization using OpenMP	1 hour
3.9	Case Study: Dynamic Scheduling in Intel Core i7 and ARM Cortex-A8	2 hours
Module 4: Multicore systems and Shared Memory Architectures		10 hours
4.1	Introduction to TLP	1 hour
4.2	Shared-Memory Multicore Systems	1 hour
4.3	Performance Metrics for Shared-Memory Multicore Systems	1 hour
4.4	Cache Coherence Protocols	3 hours
4.5	Synchronization, Memory Consistency	1 hour
4.6	Multithreaded Programming using OpenMP	1 hour
4.7	Case Study: Intel Skylake and IBM Power8.	2 hours

Module 5: Data Level Parallelism		9 hours
5.1	Introduction to DLP	1 hour
5.2	Vector Architecture	1 hour
5.3	SIMD Instruction Set Extensions for Multimedia,	1 hour
5.4	Graphics Processing Units, GPU Memory Hierarchy	2 hours
5.5	Detecting and Enhancing Loop- Level Parallelism	1 hour
5.6	Introduction to CUDA programming and simple programs using CUDA	2 hours
5.7	Case Study: Nvidia Maxwell.	1 hour



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VI

KTU



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT302	INTERNETWORKING WITH TCP/IP	PCC	3	1	0	4

Preamble: This subject is about the TCP/IP protocol suite and how it is used on the internet. It begins with a review of the underlying communications technologies needed for the internet. The course provides a detailed examination of IP routing, UDP, TCP, network virtualization, and label switching. Finally, internet applications and Software defined networking are discussed.

Prerequisite: ITT 305 Data Communication and Networking

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcomes (CO)	Bloom's Category Level
CO 1	Discuss internetworking concepts and internet address resolution.	Level2: Understand
CO 2	Illustrate the functions of IPv4, IPv6, and ICMP protocols	Level 3: Apply
CO 3	Explain internet routing architecture and internet multicasting	Level2: Understand
CO 4	Solve the design issues and protocols in transport layer	Level 3: Apply
CO 5	Explain application layer protocols, network virtualization and software defined networking	Level2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	2
CO 3	3	2	-	-	2	-	-	-	-	-	-	2
CO 4	3	2	2	-	-	-	-	-	-	-	-	2
CO 5	3	2	-	-	3	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember			
Understand	40	40	80
Apply	10	10	20

Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain ARP
2. Explain different layers in TCP/IP reference model.

Course Outcome 2 (CO2)

1. Explain IP datagram fragmentation and reassembly. Also explain different header fields affected in these cases.
2. Describe the functions of ICMP

Course Outcome 3(CO3):

1. Explain characteristics and message formats in BGP.
2. Explain RIP in detail. What is slow convergence problem and how it is solved?

Course Outcome 4 (CO4):

1. Draw and explain TCP finite state machine.

2. What is label switching?

Course Outcome 5 (CO5):

1. Explain the difference between persistent and non-persistent HTTP.
2. Explain DNS.

Model Question Paper

Course Code: ITT302
Course Name: INTERNETWORKING WITH TCP/IP

Max. Marks: 100

Duration: 3 Hours

PART A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. What is internetworking?
2. Explain the role of routers in Networks.
3. Explain the header fields in IP that are used for datagram fragmentation and reassembly
4. Explain the importance of ICMP
5. What is an autonomous system?
6. Explain about IPv6 multicast address.
7. What is VPN?
8. What is the purpose of including pseudo header while computing UDP header checksum
9. What is a cookie?
10. What is persistent HTTP?

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

- 11 List and explain the main features of all the seven layers of the ISO/OSI reference model and compare it with TCP/IP Model.

OR

- 12 Explain in detail about ARP.

- 13 Explain the format of IPv4 and IPv6 datagram.

OR

- 14 Explain in detail about ICMP.
- 15 What is BGP? Explain the characteristics and message formats of BGP.

OR

- 16 What is slow convergence problem? How can it be solved?
- 17 Explain in detail about TCP segment format.

OR

- 18 What is congestion? Explain in detail about TCP congestion control.
- 19 Explain the working of DNS.

OR

- 20 Explain in detail about FTP.

Syllabus

Module 1: Introduction to Internetworking (8 Hours)

Introduction & Overview – Motivation for internetworking, TCP/IP internet, Internet Services. Internetworking Concept and Architectural Model – Introduction, Application-Level Interconnection, Network-Level Interconnection, Properties Of The Internet, Internet Architecture, Interconnection Of Multiple Networks With IP Routers.

Protocol Layering- Introduction, The Need For Multiple Protocols, The Conceptual Layers Of Protocol Software, Functionality Of The Layers, ISO 7-Layer Reference Model, The TCP/IP 5-Layer Reference Model, Mapping Internet Addresses To Physical Addresses (ARP)

Module 2: Network Layer (8Hours)

Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) – Introduction, Connectionless Delivery System Characteristics, Purpose And Importance Of The Internet Protocol, The IP Datagram, Datagram Type Of Service And Differentiated Services, Datagram Encapsulation, Datagram Size, Network MTU and Fragmentation, Datagram Reassembly, Header Fields Used For Datagram Reassembly, Time To Live (IPv4) And Hop

Limit (IPv6), Optional IP Items, Options Processing During Fragmentation.

Internet Protocol: Error And Control Messages (ICMP) – Introduction, The Internet Control Message Protocol, Error Reporting Vs. Error Correction, ICMP Message Delivery, 5 Conceptual Layering, ICMP Message Format

Module 3: Routing (9 Hours)

Routing Architecture – Cores, Peers and Algorithms, Routing among Autonomous system – BGP - The Scope Of A Routing Update Protocol, Determining A Practical Limit On Group Size, Autonomous System Concept, Exterior Gateway Protocols And Reachability, BGP Characteristics, BGP Functionality And Message Types, Routing Within An Autonomous System (RIP, RIPng, OSPF, IS-IS)- Introduction, Static Vs. Dynamic Interior Routes, Routing Information Protocol (RIP), Slow Convergence Problem, Solving The Slow Convergence Problem, The Disadvantage Of Using Hop Counts, Delay Metric (HELLO), Delay Metrics, Oscillation, And Route Flapping, The Open SPF Protocol (OSPF).

Internet Multicasting – Introduction, Hardware Broadcast, Hardware Multicast, Ethernet Multicast, The Conceptual Building Blocks Of Internet Multicast, The IP Multicast Scheme, IPv4 And IPv6 Multicast Addresses, Multicast Address Semantics, Mapping IP Multicast To Ethernet Multicast, Hosts And Multicast Delivery, Multicast Scope, Multicast Routing.

Module 4: Transport Layer (10 Hours)

Transport Layer - Transport Service, The services provided to upper layers, Transport Service primitives, UDP- Segment Structure, Remote Procedure Call, RTP, and RTCP. TCP – Service model, TCP Protocol, TCP Segment Header, Connection establishment and Release, TCP finite state machine, TCP Sliding Window, TCP timer management, Congestion Control. Label switching, flows and MPLS. Network Virtualization: VPNs, NATs, And Overlays

Module 5: Application Layer (10Hours)

Application Layer- HTTP- Overview, Persistent and non-persistent Connections, Message formats, Concept of Cookies and Web Cache -FTP - Electronic Mail– SMTP, Mail message formats, POP3, IMAP – DNS- Services provided by DNS, Overview of how DNS works, DNS Caching, Message format, DHCP. Software Defined Networking (SDN, OpenFlow)

Text Books

1. Douglas E Comer, “Internetworking with TCP/IP Principles, Protocol, and Architecture” , Volume I, 6th Edition, Pearson Education, 2013
2. Andrew S. Tanenbaum, “Computer Networks”, Prentice Hall, 5th Edition
3. James F Kurose, Keith W Ross, Computer Networking: A top Down Approach featuring the Internet, Pearson Education, 3rd Edition

Reference Books

1. Behrouz A Forouzan, TCP/IP Protocol Suite, Fourth Edition

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to Internetworking	8 Hours
1.1	Introduction & Overview – Motivation for internetworking, TCP/IP internet, Internet Services. Internetworking Concept And Architectural Model – Introduction, Application-Level Interconnection, Network-Level Interconnection, Properties Of The Internet, Internet Architecture, Interconnection Of Multiple Networks With IP Routers.	2Hours
1.2	Protocol Layering- Introduction, The Need For Multiple Protocols, The Conceptual Layers Of Protocol Software, Functionality Of The Layers, ISO 7-Layer Reference Model.	2Hours
1.3	The TCP/IP 5-Layer Reference Model	2Hours
1.4	Mapping Internet Addresses To Physical Addresses (ARP)	2 Hours
2	Network Layer	8 Hours
2.1	Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) – Introduction, Connectionless Delivery System Characteristics, Purpose And Importance Of The Internet Protocol, The IP Datagram, Datagram Type Of Service And Differentiated Services, Datagram Encapsulation, Datagram Size, Network MTU and Fragmentation, Datagram Reassembly, Header Fields Used For Datagram Reassembly, Time To Live (IPv4) And Hop Limit (IPv6), Optional IP Items, Options Processing During Fragmentation.	5Hours
2.2	Internet Protocol: Error And Control Messages (ICMP) – Introduction, The Internet Control Message Protocol, Error Reporting Vs. Error Correction, ICMP Message Delivery, 5 Conceptual Layering, ICMP Message Format	3 Hours
3	Routing	9 Hours
3.1	Routing Architecture – Cores, Peers and Algorithms, Routing among Autonomous system – BGP - The Scope Of A Routing Update Protocol, Determining A Practical Limit On Group Size, Autonomous System Concept, Exterior Gateway Protocols And Reachability, BGP Characteristics, BGP Functionality And Message Types	2 Hours
3.2	Routing Within An Autonomous System (RIP, RIPng, OSPF, IS-IS)- Introduction, Static Vs. Dynamic Interior Routes, Routing Information Protocol (RIP), Slow Convergence Problem, Solving The Slow Convergence Problem, The Disadvantage Of Using Hop Counts, Delay Metric (HELLO), Delay Metrics, Oscillation, And Route Flapping, The Open SPF Protocol (OSPF).	5Hours
3.3	Internet Multicasting – Introduction, Hardware Broadcast, Hardware Multicast, Ethernet Multicast, The Conceptual Building Blocks Of Internet Multicast, The IP Multicast Scheme, IPv4 And IPv6 Multicast Addresses, Multicast Address Semantics, Mapping	2 Hours

	IP Multicast To Ethernet Multicast, Hosts And Multicast Delivery, Multicast Scope, Multicast Routing.	
4	Transport Layer	10 Hours
4.1	Transport Layer - Transport Service, The services provided to upper layers, Transport Service primitives, UDP- Segment Structure, Remote Procedure Call, RTP, and RTCP.	2 Hours
4.2	TCP – Service model, TCP Protocol, TCP Segment Header, Connection establishment and Release, TCP finite state machine, TCP Sliding Window, TCP timer management, Congestion Control.	4 Hours
4.3	Label switching, flows and MPLS. Network Virtualization: VPNs, NATs, And Overlays	4 Hours
5	Application Layer	10 Hours
5.1	Application Layer: - HTTP- Overview, Persistent and non persistent Connections, Message formats, Concept of Cookies and Web Cache	1 Hour
5.2	FTP - Electronic Mail– SMTP, Mail message formats, POP3, IMAP	2 Hours
5.3	DNS- Services provided by DNS, Overview of how DNS works, DNS Caching, Message format	2 Hours
5.4	DHCP	1 Hour
5.5	Software Defined Networking (SDN, Openflow)	4 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT304	ALGORITHM ANALYSIS AND DESIGN	PCC	3	1	0	4

Preamble: The syllabus is prepared with a view to equip the Engineering Graduatesto learn basic concepts in algorithms, and to instil the confidence to solve non-conventional problems using different problem solving strategies.

Prerequisite:

- ITT201 Data Structures

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain asymptotic notations used in the performance analysis of algorithms and to solve recurrence equations	Level 2: Understand
CO 2	Apply divide and conquer strategy to solve practical problems efficiently	Level 3: Apply
CO 3	Apply greedy and dynamic programming techniques in algorithm design	Level 3: Apply
CO 4	Apply backtracking and branch and bound techniques in algorithm design	Level 3: Apply
CO 5	Interpret sophisticated algorithms such as string matching and approximation algorithms	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	2
CO 2	3	3	3	-	3	-	-	-	-	-	-	2
CO 3	3	3	3	-	3	-	-	-	-	-	-	2
CO 4	3	3	3	-	3	-	-	-	-	-	-	2
CO 5	3	3	-	-	-	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	Test 1 (Marks)	Test 2 (Marks)	Marks
Remember			
Understand	30	30	60
Apply	20	20	40
Analyze			
Evaluate			
Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. What is an asymptotic notation? Give the different notations used to represent the complexity of algorithms.
2. Write the recurrence equation for your algorithm and solve it to estimate the time complexity of the algorithm.

Course Outcome 2 (CO 2):

1. Give the divide and conquer solution for binary search and analyse its complexity.

2. What is the notion behind the divide and conquer method? Apply divide and conquer strategy to perform merge sort on an array of integers.

Course Outcome 3 (CO 3):

1. Why Kruskal's minimum cost spanning tree construction method is considered as a Greedy method for problem solving?
2. State fractional knapsack problem. Give an algorithm for solving the fractional knapsack problem using greedy strategy.

Course Outcome 4 (CO 4):

1. Draw the state space tree corresponding to 4-Queens problem.

Course Outcome 5 (CO 5):

1. Write an algorithm based on Rabin Karp method to find all the occurrences of pattern $P[0..m-1]$ from a given string $str[0..n-1]$, where $n > m$. Compare the time complexity of this algorithm with the naive approach.
2. Suggest an algorithm for finding the vertex cover of a graph.

Model Question Paper

Course Code: ITT304

Course Name: Algorithm Analysis and Design

**Max.Marks:100
Hours**

Duration: 3

Part A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. What are the properties of a good algorithm?
2. Write down the control abstraction of divide and conquer.
3. List and explain the characteristic properties associated with a problem that can be solved using dynamic programming.
4. What is backtracking? Give one problem that can be solved by backtracking.
5. Differentiate Fixed Tuple and Variable Tuple formulation.
6. Define Least Common Sequence Problem.
7. What is principle of optimality?
8. Write an algorithm for matrix multiplication using Divide and conquer method.

9. What are approximation algorithms?
10. Differentiate between deterministic and nondeterministic algorithm.

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

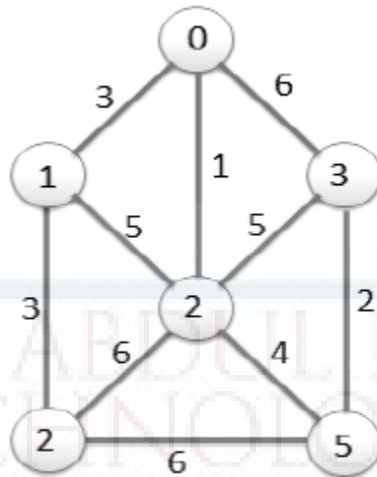
11. (a) Compare asymptotic notations with examples (6 marks)
- (b) What is amortized analysis? Explain any one method to perform amortized analysis with an example. (8 marks)

OR

12. (a) Compare the growth of time complexity for the following set of functions. (6 marks)
- (i) $2n$ and n^2
 ii) $\sqrt{\log n}$ and $\log \log n$
 iii) $n\sqrt{n}$ and $n \log n$
- (b) Solve the recurrence equation using recursive tree method: $T(n) = 2T(n/2) + c$ (8 marks)
13. (a) How we can prove that Strassen's matrix multiplication is advantageous over ordinary matrix multiplication? (8 marks)
- (b) Explain why worst case complexity of Quick sort is $O(n^2)$ and average case complexity is $O(n \log n)$ (6 marks)

OR

14. (a) Write a recursive algorithm for implementing Binary Search. Illustrate the divide and conquer approach through this algorithm. (7 marks)
- (b) Design a recursive algorithm to find the maximum and minimum from a set of n numbers. Illustrate with an example. (7 marks)
15. (a) Explain Kruskal's algorithm. Find the minimum cost spanning tree of the graph whose vertices are $v_1, v_2, v_3, v_4, v_5, v_6$ and v_7 . Cost of graph edges are $(v_1, v_2) = 28$, $(v_1, v_6) = 10$, $(v_6, v_5) = 25$, $(v_5, v_4) = 22$, $(v_7, v_2) = 14$, $(v_2, v_3) = 16$, $(v_3, v_4) = 12$, $(v_4, v_7) = 18$ (8 marks)
- (b) Draw and explain each stages of execution of Prim's algorithm in the following graph. (6 marks)



OR

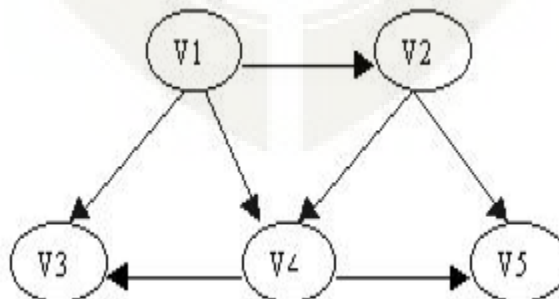
16. (a) Find an optimal solution to the fractional knapsack problem for an instance with number of items 7, Capacity of the sack $W=15$, profit associated with the items $(p_1, p_2, \dots, p_7) = (10, 5, 15, 7, 6, 18, 3)$ and weight associated with each item $(w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)$. (5 marks)
- (b) Define Travelling Salesman Problem (TSP). Explain the basic steps that are to be followed to solve TSP using branch and bound. Illustrate with an example. (9 marks)

17. (a) Define the following tree organization for representing solution spaces.

- (i) Problem state (ii) State space (iii) Solution state (6 marks)
- (b) Describe Branch and Bound technique. Demonstrate a problem that can be solved by branch and bound method. (8 marks)

OR

18. (a) What is 15-puzzle problem? How can it be solved? (8 marks)
- (b) What is the relevance of Least cost search? Give the control abstraction for Least Cost Search. (6 marks)
19. (a) Perform Topological sorting on the given graph. (5 marks)

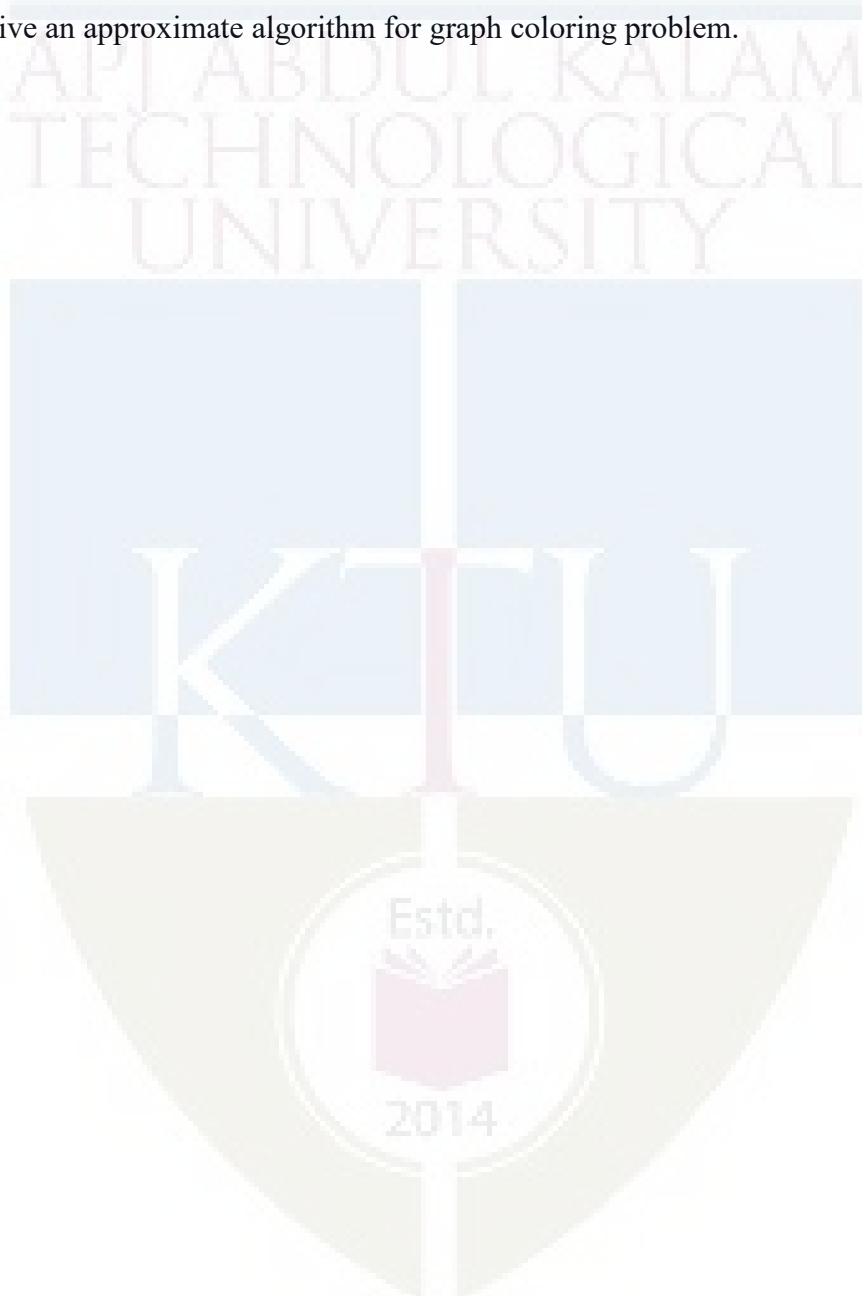


(b) Explain vertex cover problem using an example. Suggest an algorithm for finding vertex cover of a graph. (9 marks)

OR

20. (a) Write an algorithm based on Rabin Karp method to find all the occurrences of the pattern $P[0..m-1]$ from a given string $str[0....n-1]$, where $n > m$. Analyse and Compare the time complexity of this algorithm with the naive approach. (10 marks)

(b) Give an approximate algorithm for graph coloring problem. (4 marks)



Syllabus

Module 1: Introduction to Algorithms (9 Hours)
Properties of a good Algorithm, Development of an Algorithm, Pseudo-code Conventions, Recursive Algorithms Performance Analysis - Space and Time Complexity, Running Time Comparison - Worst, Best and Average Case Complexity, Asymptotic Notations, Common Complexity Functions Recurrence Relations – Solving Recurrences using substitution and recurrence trees Amortized Complexity – aggregate analysis, cost-accounting and potential methods
Module 2: Divide and Conquer (8 Hours)
Divide and Conquer - Control Abstraction, Finding Maximum and Minimum, Binary Search, Strassen's Matrix Multiplication, Quick Sort, Merge Sort
Module 3: Greedy Strategy and Dynamic Programming (9 Hours)
Greedy Strategy- Control Abstraction, Fractional Knapsack Problem, Minimum Cost Spanning Trees – Prim's and Kruskal's Algorithm, Job sequencing with deadlines Dynamic Programming- Principle of Optimality, DP solution for traveling salesman and 0/1 Knapsack problems, Least Common Subsequence problem
Module 4: Backtracking & Branch and Bound (10 Hours)
Backtracking– State Space Tree, Fixed Tuple and Variable Tuple Formulation - Control Abstraction, Monte Carlo Method – N-Queens Problem, Sum of Subsets Branch and Bound Techniques– FIFO, LIFO, and LC Branch and Bound, Control Abstraction, 15-puzzle problem
Module 5: Sophisticated Algorithms (9 Hours)
Topological sort, string matching: KMP algorithm, Rabin-Karp algorithm, Introduction to Computational Complexity – complexity classes, Determinism and Non-determinism, Approximation Algorithms – Planar Graph Colouring, Vertex cover

Text Books

1. Introduction to Algorithms – Cormen, Leiserson, Rivest, Stein – 3/e, PHI
2. Fundamentals of Computer Algorithms – Horowitz and Sahni, 2/e, Universities Press

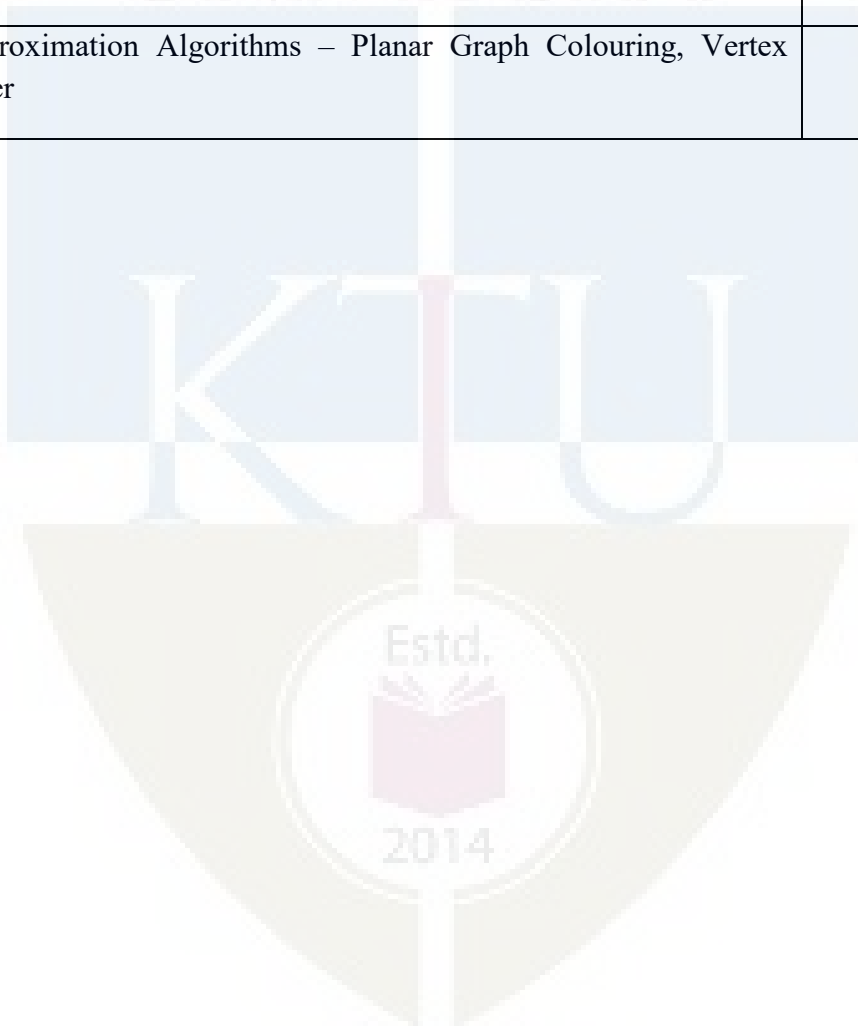
Reference Books

1. Computer Algorithms – Introduction to Design and Analysis – Sara Baase & Allen Van Gelder, 3/e, Pearson Education
2. Introduction to the Design and Analysis of Algorithms – Anany Levitin, 3/e, Pearson
3. Foundations of Algorithms – Richard Neapolitan, 5/e, Jones and Barlett Learning

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	Introduction to Algorithms	9 Hours
1.1	Properties of a good Algorithm, Development of an Algorithm, Pseudo-code Conventions, Recursive Algorithms	3 Hours
1.2	Performance Analysis - Space and Time Complexity, Running Time Comparison - Worst, Best and Average Case Complexity, Asymptotic Notations, Common Complexity Functions	3 Hours
1.3	Recurrence Relations – Solving Recurrences using substitution and recurrence trees Amortized Complexity – aggregate analysis, cost-accounting and potential methods	3 Hours
2	Divide and Conquer	8 Hours
2.1	Divide and Conquer - Control Abstraction, Finding Maximum and Minimum	2 Hours
2.2	Binary Search, Strassen's Matrix Multiplication	3 Hours
2.3	Quick Sort, Merge Sort	3 Hours
3	Greedy Strategy and Dynamic Programming	9 Hours
3.1	Greedy Strategy- Control Abstraction, Fractional Knapsack Problem	2 Hours
3.2	Minimum Cost Spanning Trees – Prim's and Kruskal's Algorithm, Job sequencing with deadlines	2 Hours
3.3	Dynamic Programming- Principle of Optimality	2 Hours
3.4	DP solution for traveling salesman and 0/1 Knapsack problems, Least Common Subsequence problem	3 Hours
4	Backtracking & Branch and Bound	10 Hours
4.1	Backtracking– State Space Tree, Fixed Tuple and Variable Tuple	3 Hours

	Formulation - Control Abstraction	
4.2	Monte Carlo Method – N-Queens Problem, Sum of Subsets	2 Hours
4.3	Branch and Bound Techniques– FIFO and LIFO	2 Hours
4.4	LC Branch and Bound, Control Abstraction, 15-puzzle problem	3 Hours
5	Sophisticated Algorithms	9 Hours
5.1	Topological sort, string matching: KMP algorithm	3 Hours
5.2	Rabin-Karp algorithm, Introduction to Computational Complexity – complexity classes, Determinism and Non-determinism	3 Hours
5.3	Approximation Algorithms – Planar Graph Colouring, Vertex cover	3 Hours



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT306	DATA SCIENCE	PCC	3	1	0	4

Preamble: This course is designed to provide learners with working knowledge of the theoretical background of various aspects of Data Science and enable them to incorporate and apply the principles of statistics and machine learning to solve real-world problems for large-scale data analysis.

Prerequisites:

- MAT 101 Linear Algebra and Calculus
- MAT 208 Probability and Statistics and Advanced Graph Theory
- ITT 205 Problem Solving Using Python
- ITT 201 Data Structures
- ITT 206 Database Management Systems

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category Level
CO 1	Explain the fundamental concepts and various aspects of data science	Level 2: Understand
CO 2	Choose data validation techniques suitable for statistical analysis and present results using data visualization techniques.	Level 2: Understand
CO 3	Identify different statistical learning algorithm for solving a problem	Level 3: Apply
CO 4	Use statistical analysis to characterize and interpret data sets	Level 3: Apply
CO 5	Compare the pros/cons of various models and algorithms used for data analysis and data mining	Level 2: Understand
CO 6	Develop the ability to perform basic data analysis in Python and understand the fundamentals of deep learning.	Level 3: Apply

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	2	-	-	-	-	-	-	-
CO 2	3	2	1	1	3	-	-	-	-	2	-	-
CO 3	3	2	1	1	3	-	-	-	1	2	-	-
CO 4	3	3	2	1	3	-	-	-	1	2	-	-

CO 5	2	3	1	1	3	-	-	-	1	2	-	-
CO 6	3	2	1	1	3	-	-	-	1	2	-	-

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test1 (Marks)	Test2 (Marks)	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	30
Analyse			
Evaluate			
Create			

Marks distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer anyone. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. What is data science? What are the different models for data science?
2. Explain data science process with a neat diagram.
3. Explain different types of Data Sets in Data Science

Course Outcome 2 (CO 2):

1. List any four two tools for data visualisation?

2. What is data visualization and what are the different techniques used for visualizing data?
3. Discuss methods of evaluating models in data science?

Course Outcome 3(CO 3):

1. Explain random forest ensemble method with an example.
2. What is data cleaning? What are the different operations in data cleaning?
3. Is regression a supervised learning technique? Justify your answer. Compare it with classification giving examples.
4. What are ensemble methods? Explain the bagging technique
5. Discuss Linear discriminant analysis.
6. What is decision tree? Explain the working of decision tree with information gain algorithm.

Course Outcome 4 (CO 4):

1. Differentiate between supervised and unsupervised learning techniques.
2. Classify different types of clustering. What are the practical issues in clustering?
3. Summarise different kernel tricks in SVM.
4. Illustrate with examples different Resampling methods.
5. Suppose that our task is to cluster data points into two clusters. Let the data points are {2, 4, 10, 12, 3, 20, 30, 11, 25}. Let 2 and 4 are initial cluster centroids. Apply Two rounds of k-means algorithm and find a set of clusters. Use Euclidean distance as the measure.

Course Outcome 5 (CO 5):

1. Compare Apriori and FP Growth algorithm. What are the advantages of FP Growth over Apriori algorithm?
2. How will you relate constraint-based mining with frequent pattern mining?
3. A database has five transactions. Let min_sup=60% and min_conf=80%. With the following transaction, list all the strong association rules.

T100 {M, O, N K, E, Y}

T200 {D, O, N, K, E, Y}

T300 {M, A, K, E}

T400 {M, U, C, K, Y}

T500 {C, O, O, K, I, E}

Course Outcome 6 (CO 6):

1. Write an example of multiplying three dimensional matrices in NumPy.
2. Identify the essential libraries in Python.
3. Is Jupyter notebook IDE? How can you relate IPython and Jupyter?
4. What are the ways to store text data in pandas?

Course Code: ITT306

Course Name: Data Science

Max.Marks:100

Duration: 3

Hours

Part A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. What is data science? What are the different models for data science?
2. What is data visualization and what are the different techniques used for visualizing data?
3. Is regression a supervised learning technique? Justify your answer. Compare it with classification giving examples.
4. Explain random forest ensemble method with an example.
5. Explain different types of clustering. What are the practical issues in clustering?
6. What is Support Vector Machine? How classification is done using SVM?
7. Explain the concept of constraint-based mining.
8. Compare Apriori and FP Growth algorithm. What are the advantages of FP Growth over Apriori algorithm?
9. Briefly explain the essential libraries in Python.
10. What makes deep learning deep? What are the different deep learning techniques?

Part B

Each question set carries 14 marks (5 * 14 = 70 Marks)

11. Explain data science process with a neat diagram.
12. Describe data science classification with a neat diagram.

OR

13. What is data cleaning? What are the different operations in data cleaning?
14. Explain different types of Data Sets in Data Science.
15. What is decision tree? Explain the working of decision tree with information gain algorithm.
16. What are ensemble methods? Explain the bagging technique.

OR

17. Differentiate supervised and unsupervised learning techniques with examples.
18. Discuss Linear discriminant analysis.

19. Explain different types of Resampling methods.
 20. What is SVM? Explain Different kernel tricks in SVM.

OR

21. Write a short note on Maximal Margin Hyperplanes. (MMH).
 22. Suppose that our task is to cluster data points into two clusters. Let the data points are {2, 4, 10, 12, 3, 20, 30, 11, 25}. Let 2 and 4 are initial cluster centroids. Apply Two rounds of k-means algorithm and find a set of clusters. Use Euclidean distance as the measure.
 23. Consider the transaction database given below. Set minimum support count as 2 and minimum confidence threshold as 70%.
 a) Find the frequent item-set using FP Growth Algorithm.
 b) Generate strong association rules.

Transaction ID	List of Item_Ids
T100	I1,I2,I5
T200	I2,I4
T300	I2,I3
T400	I1,I2,I4
T500	I1,I3
T600	I2,I3
T700	I1,I3
T800	I1,I2,I3,I5
T900	I1,I2,I3

24. Explain Multi-level and multi-dimensional pattern mining.

OR

25. What is data mining? Explain the process of Knowledge discovery from database.
 26. A database has five transactions. Let min_sup=60% and min_conf=80%. With the following transaction, list all the strong association rules.

T100 {M, O, N K, E, Y}

T200 {D, O, N, K, E, Y}

T300 {M, A, K, E}

T400 {M, U, C, K, Y}

T500 {C, O, O, K, I, E}

27. What are the basic universal functions in Numpy?
 28. What are the applications of deep learning?

OR

29. Write an example of multiplying three dimensional matrices in NumPy.
 30. What are the ways to store text data in pandas?

Module 1: Foundations Data Science, process, and tools (9 Hours)
Introduction to data science, properties of data, asking interesting questions, classification of data science, data science process, collecting, cleaning and visualizing data, languages, and models for data science
Module 2: Statistical machine learning: introduction, regression, and classification, decision tress, random forests (11 Hours)
Introduction to statistical machine learning, parametric and non-parametric methods, supervised vs. unsupervised learning, regression and classification, linear discriminant analysis, decision trees, random forests, and bagging
Module 3: Unsupervised learning, support vector machines and resampling (9 Hours)
Principal Component Analysis, clustering algorithms, practical issues in clustering, support vector classifiers and support vector machines, resampling methods: cross-validation and bootstrapping
Module 4: Data mining, pattern mining and association rule mining (9 Hours)
Data and pattern mining, types, issues, mining frequent patterns and associations, apriori and FP growth algorithms, multi-level association mining, constraint-based mining, pruning pattern space and data space
Module 5: Python for Data Analysis, Deep learning (7Hours)
Using Python for data analysis, essential python libraries, IPython, Jupyter notebook, NumPy basics, working with pandas, deep learning methods.

Textbooks

1. Kotu, V., & Deshpande, B. (2019). Data science: Concepts and practice., Morgan Kaufmann.
2. Skiena, S. S. (2017). The data science design manual., Springer.
3. James, G., Witten, D., Hastie, T., Tibshirani, R. (2017). An Introduction to Statistical Learning: with Applications in R., Springer.
4. Han, J., Kamber, M. & Pei, J. (2012). Data mining concepts and techniques, Morgan Kaufmann.

5. McKinney, W. (2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. Beijing: O'Reilly.

Reference Books

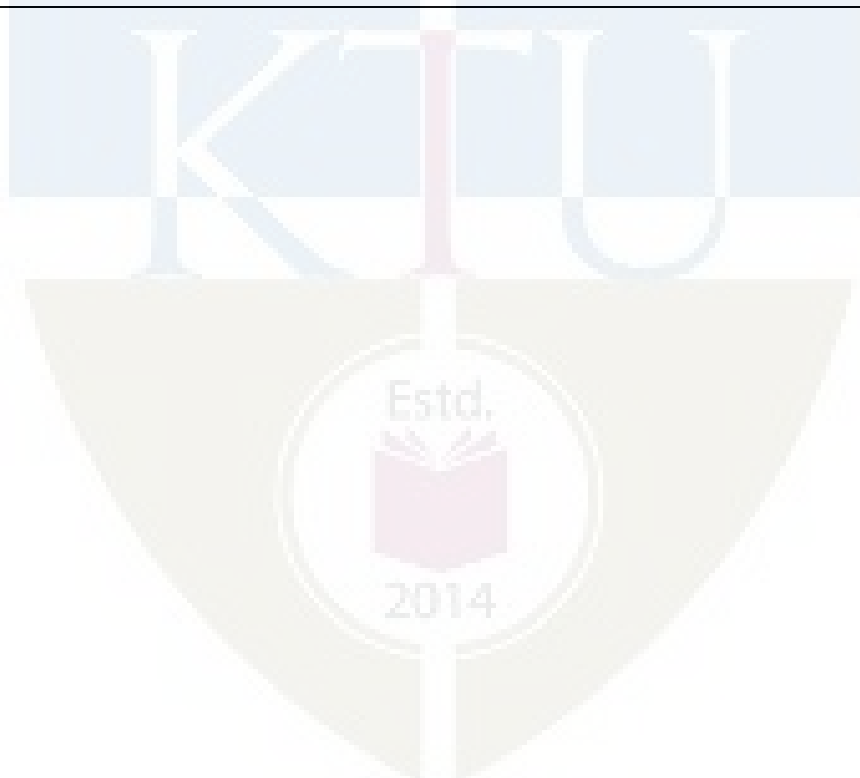
1. Montgomery, D. C., Runger, G. C. (2017). Applied Statistics and Probability for Engineers. John Wiley and Sons.
2. Provost, F., Fawcett, T. (2013). Data Science for Business. Beijing: O'Reilly
3. Igual, L., Seguí, S. (2017). Introduction to Data Science - A Python Approach to Concepts, Techniques and Applications. Springer.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Foundations Data Science, process, and tools	9 Hours
1.1	What is Data Science, relation with AI and machine learning (1.1, 1.2 of Kotu, V., & Deshpande, B. (2019). <i>Data science: Concepts and practice.</i> , Morgan Kaufmann.)	1 Hour
1.2	Case for Data Science, Data science classification (1.3, 1.4 of Kotu, V., & Deshpande, B. (2019). <i>Data science: Concepts and practice.</i> , Morgan Kaufmann.)	1 Hour
1.3	Properties of data, asking interesting questions (1.1, 1.2 and 1.3 of Skiena, S. S. (2017). <i>The data science design manual.</i> , Springer.)	1 Hour
1.4	Data Science process: preparation, modelling, and application (2.1, 2.2, 2.3 and 2.4 of Kotu, V., & Deshpande, B. (2019). <i>Data science: Concepts and practice.</i> , Morgan Kaufmann.)	2Hours
1.5	Collecting and cleaning data (3.2 and 3.3 of Skiena, S. S. (2017). <i>The data science design manual.</i> , Springer.)	1 Hour
1.6	Visualizing data (6.1, 6.2 and 6.3 of Skiena, S. S. (2017). <i>The data science design manual.</i> , Springer.)	1Hour
1.7	Languages and models for Data Science, evaluating models (3.1, 7.2, 7.3 and 7.4 of Skiena, S. S. (2017). <i>The data science design manual.</i> , Springer.)	2 Hours
2	Statistical machine learning: introduction, regression, and classification, decision tress, random forests (Reference Textbook for all topics: James, G., Witten, D., Hastie, T., Tibshirani, R. (2017). <i>An Introduction to Statistical Learning: with Applications in R.</i> , Springer.)	11 Hours
2.1	What is statistical learning, parametric and non-parametric methods (2.1)	1 Hour
2.2	Supervised vs. unsupervised learning, Classification vs. regression (2.1)	1 Hour
2.3	Simple linear regression, assessing model accuracy (3.1)	1Hour
2.4	Multiple linear regression, some important concerns (3.2)	1 Hour

2.5	Extensions of the linear model (3.3.2)	1 Hour
2.6	Classification (4.1)	1 Hour
2.7	Logistic regression: model, estimating coefficients, predicting (4.3.1, 4.3.2, 4.3.3)	2 Hours
2.8	Linear discriminant analysis, using Bayes' theorem for classification, case when $p=1$ (4.4.1, 4.4.2, 4.4.3)	1 Hour
2.9	Decision trees, regression and classification trees, trees vs. linear models, advantages, and disadvantages (8.1)	1 Hour
2.10	Bagging, random forests (8.2.1, 8.2.2)	1 Hour
3	Unsupervised learning, support vector machines and resampling (Reference Textbook for all topics: James, G., Witten, D., Hastie, T., Tibshirani, R. (2017). <i>An Introduction to Statistical Learning: with Applications in R.</i> , Springer.)	9Hours
3.1	Challenge of unsupervised learning, principal component analysis (10.1, 10.2.1)	1 Hour
3.2	Clustering techniques: k-means, hierarchical (10.3.1, 10.3.2)	1Hour
3.3	Practical issues in clustering (10.3.3)	1 Hour
3.4	Overview of the support vector classifier, hyperplane, maximal margin classifier (9.1.1, 9.1.2, 9.1.3)	2 Hours
3.5	Support vector classifiers: overview and details (9.2.1, 9.2.2)	1 Hour
3.6	Support vector machines: Classification with non-linear decision boundaries (9.3.1, 9.3.2)	1 Hour
3.7	Resampling: cross-validation and bootstrapping (5.1 and 5.2)	2 Hours
4	Data mining, pattern mining and association rule mining (Reference Textbook for all topics: Han, J., Kamber, M. & Pei, J. (2012). <i>Data mining concepts and techniques</i> , Morgan Kaufmann.)	9 Hours
4.1	Data mining, kinds of data that can be mined (1.2, 1.3,)	1 Hour
4.2	Pattern mining: class description, mining frequent patterns and associations, classification, and regression for predictive analysis (1.4.1, 1.4.2, 1.4.3)	1 Hour
4.3	Cluster analysis, outlier analysis (1.4.4, 1.4.5), measures of pattern interestingness (1.4.6), Issues in data mining (1.7)	1 Hour
4.4	Mining frequent patterns: market basket analysis, frequent and closed item sets, association rules (6.1.1, 6.1.2)	1 Hour
4.4	Apriori algorithm, generating rules, improving efficiency (6.2.1, 6.2.2, 6.2.3)	1 Hour
4.5	FP growth algorithm (6.2.4)	1 Hour
4.6	Multi-level and multi-dimensional pattern mining (7.2.1, 7.2.2)	1 Hour
4.7	Mining quantitative association rules (7.2.3) mining rare and negative patterns (7.2.4)	1 Hour
4.8	Constraint-based mining: meta-rule guided mining (7.3.1) pattern generation, pruning pattern space and data space (7.3.2)	1Hour

5	Python for Data Analysis, Deep learning	7Hours
5.1	Why Python for data analysis? Essential libraries (1.2 and 1.3 of McKinney, W. (2017). <i>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython</i> . Beijing: O'Reilly.)	1 Hour
5.2	IPython basics and Jupyter notebook (2.2 of McKinney, W. (2017). <i>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython</i> . Beijing: O'Reilly.), demo of appropriate examples	1 Hour
5.3	NumPy basics, universal functions, array-oriented programming, mathematical and statistical methods, file I/O, linear algebra (4.1, 4.2, 4.3, 4.4, 4.5 of McKinney, W. (2017). <i>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython</i> . Beijing: O'Reilly.)	2 Hours
5.4	Pandas basics, essential functionality, summarizing and computing descriptive statistics (5.1, 5.2, 5.3 of McKinney, W. (2017). <i>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython</i> . Beijing: O'Reilly.)	2 Hours
5.5	Deep learning: networks and depth, back propagation, word and graph embeddings (11.6.1, 11.6.2, 11.6.3 of Skiena, S. S. (2017). <i>The data science design manual.</i> , Springer.)	1Hour



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT308	COMPREHENSIVE COURSE WORK	PCC	1	0	0	1

Preamble: The course Comprehensive Course work is designed to assess the knowledge gained by the students in the core courses in the B Tech programme in Information Technology. The core subjects identified in the area of study is listed in the Prerequisite section of the syllabus. The course shall have an objective type written test of 50 marks similar to comprehensive examination like GATE. The pass minimum for this course is 25. The course will help the students in preparing for comprehensive examinations and improve the confidence in answering questions in objective mode. The course will be mapped to a faculty. The hour allotted for the course may be used by the students for practicing questions in core courses, library reading and for oral assessment if needed.

Prerequisite:

The students must have gone through the following courses before attending the comprehensive examination.

1. ITT 201 Data Structures
2. ITT 202 Principles of Object Oriented Techniques
3. ITT 206 Database Management Systems
4. ITT 303 Operating System Concepts
5. ITT 305 Data Communication and Networking

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain the core concepts in the courses listed in the prerequisite section (ITT 201, ITT 202, ITT 206, ITT 303, ITT 305).	Level2: Understand
CO 2	Interpret questions asked and answer them with confidence	Level 2: Understand
CO 3	Practice the comprehensive knowledge gained in basic courses in the field of Information Technology to build confidence for appearing for a competitive examination	Level 3: Apply

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	2	-	-	1	-	-	1	-	3
CO 2	3	-	-	2	-	-	1	-	-	1	-	3
CO 3	3	1	1	-	-	2	-	-	-	-	-	-

3/2/1: high/medium/low

Assessment Pattern**Mark distribution**

Total Marks	CIE	ESE	ESE Duration
50	-	50	1 Hour

End Semester Examination Pattern:

Written examination will be conducted by the University at the end of the sixth semester. The written examination will be of objective type similar to the competitive examination like GATE. Syllabus for the comprehensive examination consists of 5 modules based on following five core courses in the curriculum.

1. ITT 201 Data Structures
2. ITT 202 Principles of Object Oriented Techniques
3. ITT 206 Database Management Systems
4. ITT 303 Operating System Concepts
5. ITT 305 Data Communication and Networking

The written test will be of 50 marks with 50 multiple choice questions (10 questions from each module) with 4 choices of 1 mark each covering all the five core courses. There will be no negative marking. The pass minimum for this course is 25. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed above.

Written examination : 50marks

Total : 50 marks

Course Level Assessment and Sample Questions:

1. Consider the following sequence of operations and Find the value of $S + R = ?$

Stack	Queue
push (52);	enqueue (43);
push (56);	enqueue (24);
pop ();	dequeue ();
push (62);	enqueue (57);
S = pop ()	R = Dequeue ()

- A. 75
 B. 86
 C. 119
 D. None of the above
2. Consider the following statements.
- S1: The sequence of procedure calls corresponds to a preorder traversal of the activation tree.
- S2: The sequence of procedure returns corresponds to a postorder traversal of the activation tree.
- Which one of the following options is correct?
- A. S1 is true and S2 is false
 B. S1 is false and S2 is true
 C. S1 is true and S2 is true
 D. S1 is false and S2 is false
3. A full binary tree with n non-leaf nodes contains
- A. $\log_2 n$ nodes
 B. $n+1$ nodes
 C. $2n$ nodes
 D. $2n+1$ nodes
4. Which one of the following are essential features of an object-oriented programming language?
- (i) Abstraction and encapsulation
 (ii) Strictly-typedness
 (iii) Type-safe property coupled with sub-type rule
 (iv) Polymorphism in the presence of inheritance

- A. (i) and (ii) only
 - B. (i) and (iv) only
 - C. (i), (ii) and (iv) only
 - D. (i), (iii) and (iv) only
5. Which of the following is associated with objects?
- A. State
 - B. Behavior
 - C. Identity
 - D. All of the above
6. Consider the following two statements:
- S1: A publicly derived class is a subtype of its base class.
 S2: Inheritance provides for code reuse.
- A. Both the statements S1 and S2 are correct.
 - B. Neither of the statements S1 and S2 are correct
 - C. Statement S1 is correct and S2 is incorrect
 - D. Statement S1 is incorrect and S2 is correct.
7. Consider the following statements S1 and S2 about the relational data model
- S1 : A Relation schema can have at most one foreign key
 S2 : A foreign key in a relational schema R cannot be used to refer to tuples of R
- Which of the following choices is correct?
- A. Both S1 and S2 are true
 - B. S1 is true and S2 is false
 - C. S1 is false and S2 is true
 - D. Both S1 and S2 are false
8. Which among the following is false?
- A. A relation scheme can be in Third Normal Form but not in BCNF
 - B. Every BCNF relation scheme is in Third Normal Form.
 - C. BCNF provides freedom from insertion and deletion anomalies.
 - D. If a relation scheme has partial dependencies, it is in Second Normal Form.
9. Consider following schedules involving three transactions:
- S1 : R2(A); W2(A); R3(C); W2(B); W3(A); W3(C); R1(A); R1(B); W1(A); W1(B)
 S2 : R2(A); R3(C); W3(A); W2(A); W2(B); W3(C); R1(A); R1(B); W1(A); W1(B)
 S3: R1(A); R2(A); R3(B); W1(A); R2(C); R2(B); W2(B); W1(C)
- Which of the above schedules is/are NOT conflict serializable?

- A. Only S2
- B. S1 and S3
- C. Only S3
- D. S2 and S3

10. Which of the following statement(s) is/are correct in the context of CPU scheduling?

- A. Turnaround time includes waiting time
- B. The goal is to only maximize CPU utilization and minimum throughput
- C. Round-robin policy can be used even when the CPU time required by each of the processes is not known apriori
- D. Implementing preemptive scheduling needs hardware support

11. Consider the following statements about process state transitions for a system using preemptive scheduling.

- I. A running process can move to ready state.
- II. A ready process can move to running state.
- III. A blocked process can move to running state.
- IV. A blocked process can move to ready state.

Which of the above statements are TRUE ?

- A. I, II, and III only
- B. II and III only
- C. I, II, and IV only
- D. I, II, III and IV only

12. Consider the statements S1 to S4

- S1: Paging incurred memory overhead
- S2 : Multilevel paging is necessary for pages with different size
- S3 : Page size has no impact on internal fragmentation.
- S4 : Paging help solve the issue of external fragmentation

Which of the above statement(s) are true? Select the appropriate options among the following.

- A. S1 and S2
- B. S1 and S4
- C. S3 and S4
- D. S3 only

13. Ten signals, each requiring 3 KHz, are multiplexed on to a single channel using FDM. How much minimum bandwidth is required for the multiplexed channel? Assume that the guard bands are 200 Hz wide.

- A. 30,000 Hz
 B. 31,800 Hz
 C. 32,000 Hz
 D. None of the above
14. In an IPv4 packet, the value of HLEN is 15, and the value of the total length field is 0X0064. How many bytes of data are being carried by this packet?
 A. 85 bytes
 B. 49 bytes
 C. 40 bytes
 D. 20 bytes
15. Consider the three-way handshake mechanism followed during TCP connection establishment between hosts P and Q. Let X and Y be two random 32 bit initial sequence numbers chosen by P and Q respectively. Suppose P sends a TCP connection request message to Q with a TCP segment having SYN bit = 1, SEQ number = X and ACK bit = 0. Suppose Q accepts the connection request. Which of the following choices represents the information Present in the TCP segment header that is sent by Q to P?
 A. SYN bit = 1, SEQ number = X+1, ACK bit = 0, ACK number = Y, FIN bit = 0
 B. SYN bit = 0, SEQ number = X+1, ACK bit = 0, ACK number = Y, FIN bit = 1
 C. SYN bit = 1, SEQ number = Y, ACK bit = 1, ACK number = X+1, FIN bit = 0
 D. SYN bit = 1, SEQ number = Y, ACK bit = 1, ACK number = X, FIN bit = 0

Syllabus

Module 1: Data Structures

Data Structures-Introduction and Overview- **Arrays**- Searching and Sorting, **Linked lists** - singly linked list, Doubly linked list, Circular linked list, **Stack**, Applications of stacks, **Queue**, **Trees** - Binary Tree, Binary Tree Traversals, **Graph**, **Hash Tables**- closed hashing and Open Hashing

Module 2: Principles of Object Oriented Techniques

The Object-Oriented Approach – Characteristics of Object-Oriented Languages - Objects & Classes – Inheritance – Reusability - Creating New Data Types - Polymorphism and Overloading - Classes fundamentals, objects, methods, constructors, Overloading Methods, Overloading Constructors, Derived Class and Base Class, Usage of super keyword, Creating a Multilevel Hierarchy, Method Overriding, Using Abstract Classes, **Exception handling**- Exception Types, Using try and catch in Java, Java's Built-in Exceptions, Creating

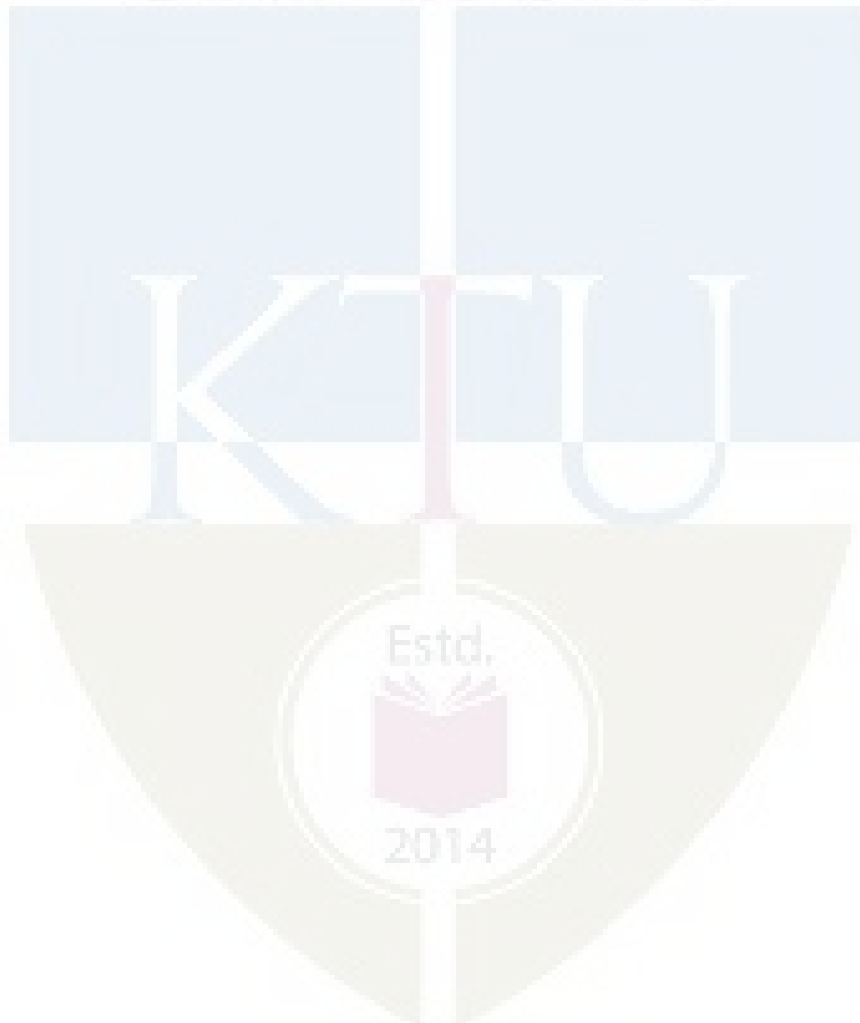
Exception subclasses, the Java Thread Model, Event Handling-delegation event model,.
Module 3: Database Management Systems
Fundamentals of Database Management Systems (DBMS), Database System Architecture, Entity-Relationship Model -ER Diagrams, Relational Model - Relational Schema, Relational Algebra Operations, SQL , Normalization , Transaction Processing -Concurrency Control
Module 4: Operating System Concepts
Operating Systems - types, System kernel, Shell, Processes - . Process Scheduling methods, Inter process Communication, CPU scheduling -scheduling algorithms, Dead locks - conditions for deadlock, prevention, avoidance, detection, recovery from dead lock, resource trajectories –starvation, Memory management -fixed &variable partitions, paging & segmentation - virtual memory concepts - demand paging - page replacement - Disk scheduling, File system concepts
Module 5: Data Communication and Networking
Channel capacity , Transmission media - Synchronous and Asynchronous transmission, Sampling theorem , Data Encoding -Encoding digital data into digital signal, Encoding analog data into digital signals, Multiplexing , Error Detecting and correcting codes , Concept of layering - OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; Data link layer - framing, error detection, Medium Access Control, Routing protocols - shortest path, flooding, distance vector and link state routing; IP addressing & fragmentation - IPv4, CIDR notation, IP support protocols -ARP, DHCP, ICMP, Network Address Translation (NAT); Transport layer - flow control and congestion control, UDP, TCP, Application layer protocols - DNS, HTTP, Email.

Reference Books

1. Samanta D., Classic Data Structures, Prentice Hall India, 2/e, 2009.
2. Ellis horowitz, Sartaj Sahni, Fundamentals of Data structures, GalgotiaBooksource
3. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
4. Bahrami A., Object Oriented Systems Development using the Unified Modeling Language, McGraw Hill, 1999.
5. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.
6. Silberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.
7. William Stallings, Operating Systems, 6th Edition, Pearson, 2009
8. Andrew S. Tanenbaum, “Modern Operating Systems”, 3/e, Prentice Hall

9. J. L. Peterson and A. Silberschatz , Operating System Concepts, 8/e, Addison Wesley.
10. Behrouz A. Forouzan, Data Communications and Networking, 4/e, Tata McGraw Hill.
11. William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.
12. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4/e, Mc Graw Hill

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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL332	COMPUTER NETWORKS LAB	PCC	0	0	3	2

Preamble: The course aims to equip students to perform networking using IPv4 and Ipv6. The lab covers static, default, and dynamic routing, setting up layer 2 switching, VLANs and security and access list.

Prerequisite: ITT305 Data Communication and Networking

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category Level
CO 1	Demonstrate internetworking and network components	Level 2: Understand
CO 2	Explain IPv4 addressing, IPv6 addressing, subnetting and design networks	Level 2: Understand
CO 3	Experiment with static, dynamic and inter VLAN routing	Level 3: Apply
CO 4	Make use of standard and extended access lists	Level 3: Apply
CO 5	Use Webserver, remote login, file transfer and automatic network configuration protocols	Level 3: Apply
CO 6	Use network simulators	Level 3: Apply

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	2	-	-	-	-	-	-	1
CO 2	3	3	3	-	-	-	-	-	-	-	-	2
CO 3	3	3	-	-	2	-	-	-	-	-	-	2
CO 4	3	3	3	-	2	-	-	-	-	-	-	2
CO 5	3	2	-	-	-	-	-	-	-	-	-	2
CO 6	3	1	2	-	3	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	: 15 marks
Continuous Assessment	: 30 marks
Internal Test (Immediately before the second series test)	: 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	: 15Marks
(b) Implementing the work/Conducting the experiment	: 10 Marks
(c) Performance, result and inference (usage of equipments and troubleshooting):	25 Marks
(d) Viva voce	: 20 marks
(e) Record	: 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Differentiate between a router and a switch
2. Crimp a network cable

Course Outcome 2 (CO2)

1. An IP address of 172.16.0.0/16 is assigned to an ISP. The ISP has to distribute it among 17 organizations. Design the subnets
2. You are given the IP Address of 193.103.20.0 /24 and need 50 Subnets. How many hosts per network, and total networks do you get once sub netted?

Course Outcome 3(CO3):

1. An organization with 7 departments is assigned an IP address of 200.0.0.0/24. The organization should assign address to each department. Design the subnets and connect the first and third network using RIP
2. Subnet the Class B IP Address 130.13.0.0 into 500 Subnets. What is the new Subnet Mask and what is the Increment? Connect the 6th and 15th Subnet using static routing

Course Outcome 4 (CO4):

1. Connect hosts on the networks 17.10.0.0/8 and 168.18.0.0/16 and block FTP traffic from the first network to the second network

Course Outcome 5 (CO5):

1. Install and configure any popular webserver
2. Configure TELNET, login to a remote machine and view the files on the remote machine
3. Configure FTP and transfer files between two machines

Course Outcome 6 (CO6):

1. Implement a mesh network in NS3 network simulator. Perform RIP routing between the nodes in the network. Analyse the packet transfer between the nodes.

LIST OF EXPERIMENTS

(All the listed experiments are mandatory)

I. Internetworking Basics

1. Familiarization of Internetworking - Network Cables- Colour coding - Crimping. Internetworking Operating Systems- Configurations.
2. Backing up and restoring IOS
3. Familiarization of network components – Hub, Switch, Bridge, Router, Access Point

II. Addressing

1. Configure and verify IPv4 addressing and sub netting
2. Configure and verify IPv6 addressing and prefix
3. Compare IPv6 address types

III. IP Routing

1. Configure and verify IPv4 routing
 - a. Static Routing
 - b. Dynamic Routing – RIP, OSPF, EIGRP
2. Implement Unicast IPv6 Addresses on Routers and verify
 - a. Static routing
 - b. Dynamic routing – RIPng, OSPFv3
3. Configure and verify dual stack routing

IV. Switching Concepts

1. Layer 2 Switching Configuration – VLAN Configuration
2. VTP Configuration, VTP Pruning
3. Implement inter-VLAN routing

V. Configuring Protocols

1. HTTP
2. TELNET

3. FTP
4. DHCP

VI. Security

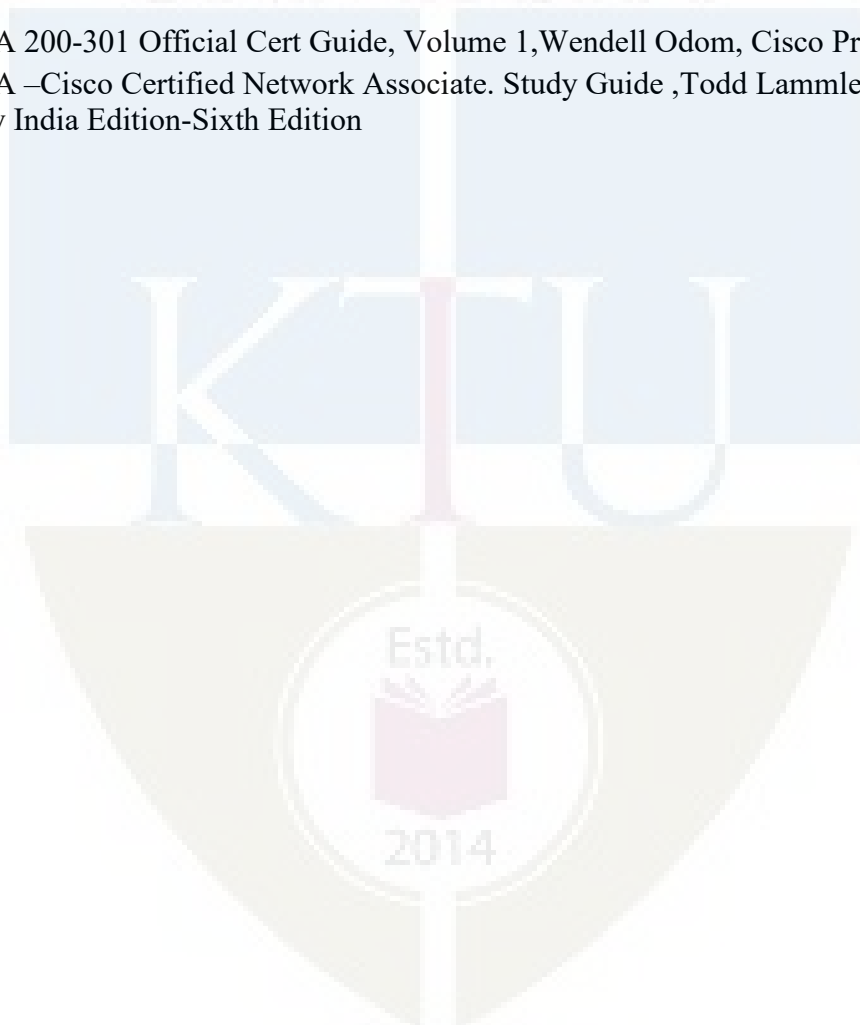
1. Standard Access List
2. Extended Access List
3. Familiarization of Wireshark

VII. Network Simulators

1. Familiarize with any popular network simulator

Reference Books

1. CCNA 200-301 Official Cert Guide, Volume 1, Wendell Odom, Cisco Press
2. CCNA –Cisco Certified Network Associate. Study Guide ,Todd Lammle, CCSI, Wiley India Edition-Sixth Edition



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITD 334	MINIPROJECT	PWS	0	0	3	2

Preamble: This course is designed for enabling the students to apply the knowledge to address the real-world situations/problems and find solutions. The course is also intended to estimate the ability of the students in transforming theoretical knowledge studied as part of the curriculum so far in to a working model of a software system. The students are expected to design and develop a software/hardware project to innovatively solve a real-world problem.

Prerequisites: Subjects studied up to sixth semester.

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Make use of acquired knowledge within the selected area of technology for project development.	Level 3: Apply
CO 2	Identify, discuss and justify the technical aspects and design aspects of the project with a systematic approach.	Level 3: Apply
CO 3	Interpret, improve and refine technical aspects for engineering projects.	Level 3: Apply
CO 4	Associate with a team as an effective team player for the development of technical projects.	Level 3: Apply
CO 5	Report effectively the project related activities and findings.	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	3	3	3	3	-	-	-	3
CO 2	3	3	3	3	3	-	2	3	-	3	2	3
CO 3	3	3	3	3	3	2	3	3	-	2	3	3
CO 4	3	3	2	2	-	-	-	3	3	3	3	3
CO 5	3	-	-	-	2	-	-	3	2	3	2	3

3/2/1: high/medium/low

Assessment Pattern

The End Semester Evaluation (ESE) will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a 3-member committee appointed by Head of the Department comprising HoD or a senior faculty member, academic coordinator for that program and project guide/coordinator. The Committee will be

evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, working knowledge and involvement.

The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the mini project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systems under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution. The review committee should assess the extent to which the implementation reflects the proposed design. A well coded, assembled and completely functional product is the expected output at this stage. The final CIE mark is the average of 1st and 2nd review marks.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest or problem domain or conduct open brain storming sessions for innovative ideas. Zeroth review will not be a part of the CIE evaluation process.

Marks Distribution

Total Marks	CIE	ESE
150	75	75

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Marks awarded by Guide : 15 marks
 Project Report : 10 marks
 Evaluation by the Committee : 40 Marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks.

- (a) Demonstration : 50 Marks
- (b) Project report : 10 Marks
- (d) Viva voce : 15marks

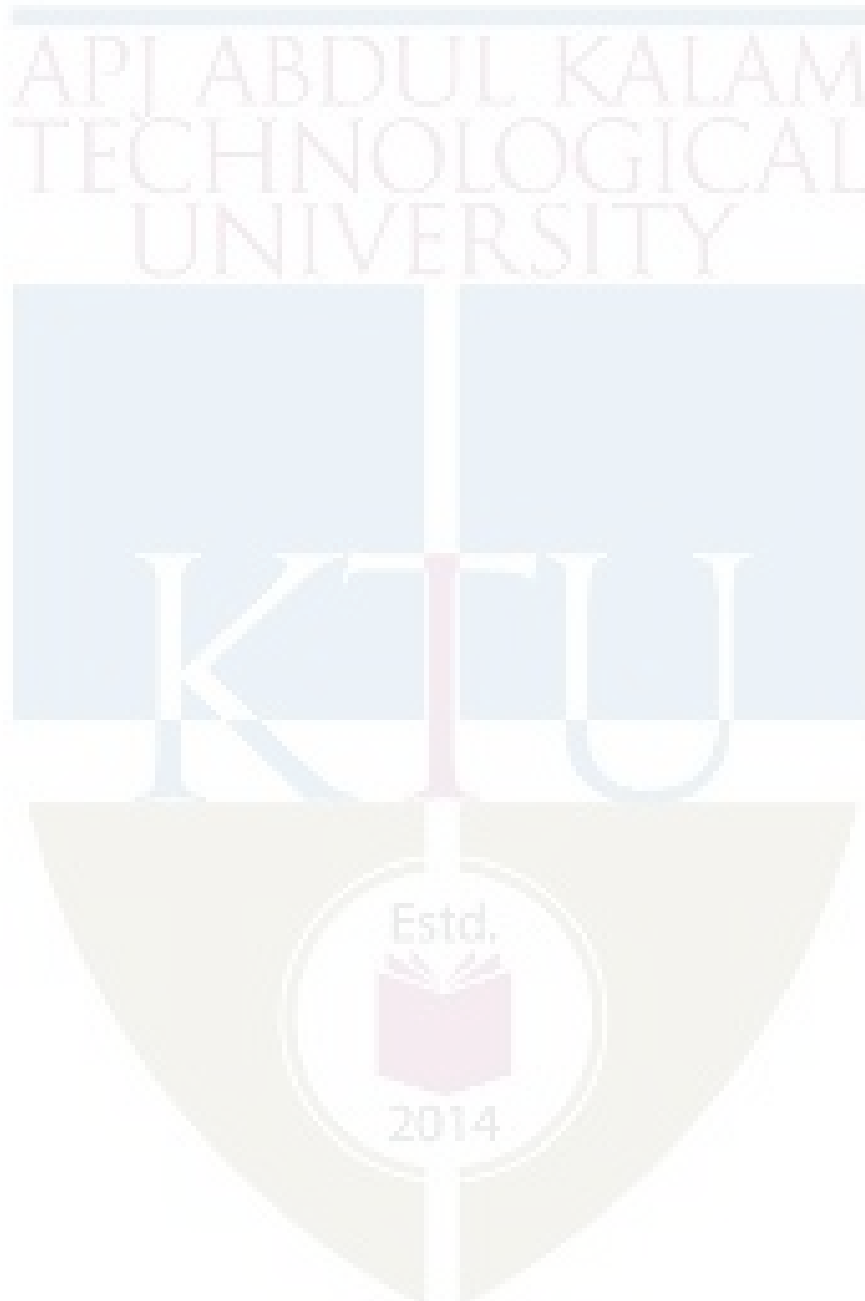
Course Plan

In this course, each group consisting of three/four members is expected to design and develop a moderately complex software/hardware system with practical applications. This should be a working model. The basic concept of product design may be taken into consideration.

Students should identify a topic of interest in consultation with Faculty-in-charge of miniproject/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the

novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews.

The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight.



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SEMESTER VI

PROGRAM ELECTIVE I



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT312	USER INTERFACE AND USER EXPERIENCE DESIGN	PEC	2	1	0	3

Preamble: User Interface and User Experience Design course is intended to deliver students the elementary concepts of User Interface Design, User Experience Design and their importance, thereby equipping them to develop great user interfaces which are appealing to users.

Prerequisite: nil

Course Outcome (CO): After completion of the course, the student will be able to

CO No.	Course outcomes (CO)	Bloom's Category Level
CO1	Outline the Basic Principles of Design and User Centered Design	Level 2: Understand
CO2	Infer the basic elements of User Experience Design	Level 2: Understand
CO3	Apply basic principles of Visual Design	Level 3: Apply
CO4	Discuss basic concepts in User Interface Design	Level 2: Understand
CO5	Develop Web and Mobile User Interface	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	1	1	1	-	-	-	-	-	2	2	3
CO2	3	1	1	1	-	-	-	-	-	2	2	2
CO3	3	3	3	1	-	-	-	-	-	2	1	2
CO4	3	1	2	1	-	-	-	-	-	2	1	2
CO5	3	3	3	1	-	-	-	-	-	3	2	3

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	5	5	10
Understand	30	30	60
Apply	15	15	30
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain the importance of seven stages of action in design.
2. Discuss Principles of design for understandability and usability

Course Outcome 2 (CO2):

1. Illustrate basic process components of UX.
2. Summarize basic process components of UX.

Course Outcome 3 (CO3):

1. Demonstrate the importance of typography with examples.
2. Summarize the basic process components of UX.

Course Outcome 4(CO4):

1. Explain the importance of a Good user interface design.
2. Differentiate two types of knowledge required for User Interface Design

Course Outcome 5 (CO5):

1. Create a web application for library with HTML and CSS.
2. List out any three mobile app designing tools.

Model Question Paper

Course Code: ITT312

Course Name: User Interface and User Experience Design

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. Define the terms understandability and usability in design.
2. Differentiate knowledge in the world and in the head in connection with design.
3. Explain User Experience.
4. Differentiate HCI and UX.
5. Differentiate Visual Design and fine arts.
6. Illustrate Iconography with an example.
7. Explain the importance of good user interface design.
8. Explain two types of knowledge needed for User Interface design.
9. What are the different design issues for websites?
10. Differentiate inline and block level elements.

PART B

Answer all questions. Each question carries 14 Marks

11. Illustrate the importance of seven stages of action as design aids with examples.

OR

12. Explain seven principles for transforming difficult tasks into simple one.
13. Illustrate funnel model for Agile UX with example.

OR

14. Explain 6D UX process.

15. Illustrate visual design process with example.

OR

16. Demonstrate the importance of any three visual design tools.

17. How to gather requirements for user interface designing?

OR

18. Demonstrate the importance of any three visual design tools.

19. Illustrate different ways for applying css with example.

OR

20. Differentiate stateful and stateless widgets in flutter.

Syllabus

Module 1: INTRODUCTION TO DESIGN (7 Hours)

Fundamentals of Design: Principles of design for understandability and usability, The Principle of mapping, How people do things: the seven stages of action, The seven stages of action as design aids, The trade of between knowledge in the world and in the head, Classification of everyday constraints, Applying affordance and constraints to everyday objects, The structure of tasks, The natural evolution of design, The complexity of design process

User Centered Design: Seven Principles for transforming difficult tasks into simple one, Deliberately making the things difficult, Design and society, The design of everyday things

Module 2: FUNDAMENTALS OF USER EXPERIENCE DESIGN (7 Hours)

Basics of UX Design: The expanding concept of interaction, Definition of UX, UX Design, The components of UX, What UX is not, Kinds of interaction and UX, The basic process components of UX, UX Design techniques as life skills, Choosing UX Processes Methods and Techniques, The funnel model of Agile UX, Shifting paradigms in HCI and UX

Introduction To 6d: 6D UX process – Discover, Design, Dream, Design, Develop, Deliver.

Module 3: VISUAL DESIGNING (7 Hours)

Introduction To Visual Design: The visual brain, Benefits to learning, The picture superiority effect, Visual design versus fine arts, The purpose of design, The role of the visual designer, A visual design process, The mindset of the visual designer, Build a graphic design

toolbox, Design with templates, Where to find visual inspiration, Know the technical terms, Use color with purpose, Establish a visual hierarchy, Tell stories with visuals, draft your verbal brand, Anatomy of typeface, color theory, understanding visual weight

VISUAL DESIGN TOOLS: visual design tools – Photoshop, Illustrator, Creating layouts, iconography, digital color schemes, infographics, typography

Module 4: USER INTERFACE DESIGNING (6 Hours)

Basics Of Ui Development: Why the user interface matters?, The importance of good user interface design, Designing for users, Evaluation, How to gather requirements: Observing your users, Interviewing users, Questionnaire and surveys; Finding out about users and domain: Users-finding out who they are, User's needs, The domain; Describing user's work, Two types of knowledge needed for User Interface design, Design principles and design rules, Usability requirements, The Modern day view of usability, wireframing, prototyping

Wireframing And Prototyping Tools: AdobeXD, Invision, AxureRP - overview

Module 5: UI DESIGNING FOR WEB AND MOBILE (8 Hours)

Designing for Web: Design principles for websites, Designing Websites, Designing Home pages and Interior pages, Design issues for web pages, Writing contents for web pages

Front End Development: Front-end development technologies – HTML, Structure of HTML Page, Mandatory tags in html page (html, head, body), Heading tags (H1...H6), Tags and attributes (Class, Id, style etc.). Inline and block level elements, CSS, Different ways of applying CSS for elements, Responsive Web Designing, Bootstrap, Material Design, DOM, JQuery- animations

Mobile Front End Development: Mobile App Designing tools- Sketch, Invisio, Adobe XD, Fluid; Mobile App Development- fundamentals, Android studio vs Flutter, Flutter framework- stateful and stateless widgets, Material icons, Basic app Development with Flutter

Textbooks

1. The Design of Everyday things- Donald A Norman, Currency and Doubleday, 2nd Edition
2. The UX Book-Rex Hartson and PardhaPyla, Morgan Kaufmann, 2nd Edition
3. Visual Design Solutions- Connie Malamed, Wiley, 1st Edition
4. User Interface Design and Evaluation - Debbie Stone, The Open University, 2nd Edition

Reference Books

1. Graphic Design For Everyone - Cath Caldwell, 2nd Edition
2. Adobe Photoshop, Illustrator, In-Design Basics - John Richards, 3rd Edition
3. Adobe XD classroom in a book - Brian Wood, 2nd Edition
4. How to build a web app in 4 stages -KarimAraoui
5. Axure RP Prototyping cookbook - John Henry Krahenbuhl

6. UI/UX Sketchbook for wireframing and prototyping - Amazon Digital Services LLC
7. Mobile UI/UX Sketchbook - (Independently published)
8. HTML and CSS: Design and Build Websites - Jon Duckett, Wiley
9. Flutter: for absolute beginners - Pouya Hosseini
10. Seductive Interaction Design: Creating Playful, Fun, and Effective User Experiences - Stephen P Anderson,

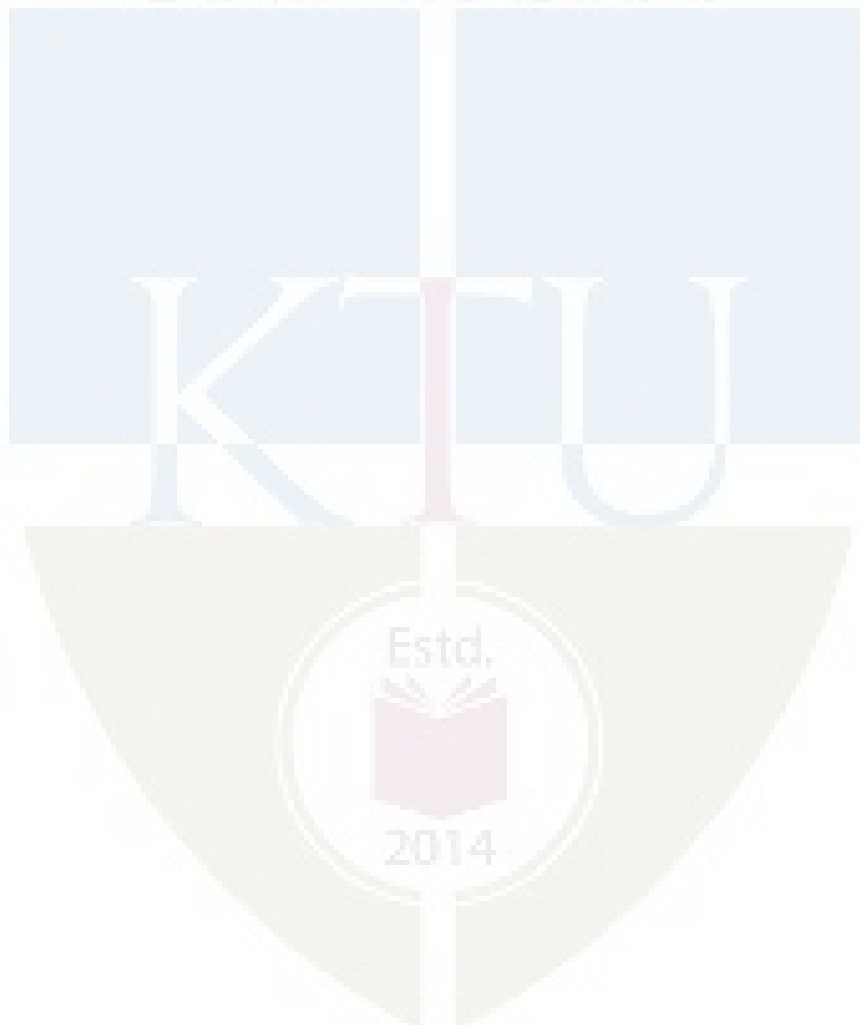
Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	INTRODUCTION TO DESIGN	7 Hours
1.1	Fundamentals of Design: Principles of design for understandability and usability, The Principle of mapping, How people do things: the seven stages of action	2 Hours
1.2	The seven stages of action as design aids, The trade of between knowledge in the world and in the head, Classification of everyday constraints	2 Hours
1.3	, Applying affordance and constraints to everyday objects, The structure of tasks, The natural evolution of design, The complexity of design process	1 Hour
1.4	User Centered Design: Seven Principles for transforming difficult tasks into simple one, Deliberately making the things difficult, Design and society, The design of everyday things	2 Hours
2	FUNDAMENTALS OF USER EXPERIENCE DESIGN	7 Hours
2.1	Basics Of UX Design: The expanding concept of interaction, Definition of UX, UX Design, The components of UX	2 Hours
2.2	What UX is not, Kinds of interaction and UX, The basic process components of UX,	1 Hour
2.3	UX Design techniques as life skills, Choosing UX Processes Methods and Techniques, The funnel model of Agile UX, Shifting paradigms in HCI and UX	2 Hours
2.4	Introduction To 6d: 6D UX process – Discover, Design, Dream, Design, Develop, Deliver.	2 Hours
3	VISUAL DESIGNING	7 Hours
3.1	Introduction To Visual Design: The visual brain, Benefits to learning,	2 Hours

	The picture superiority effect	
3.2	Visual design versus fine arts, The purpose of design, The role of the visual designer, A visual design process, The mindset of the visual designer	1 Hour
3.3	, Build a graphic design toolbox, Design with templates, Where to find visual inspiration, Know the technical terms, Use color with purpose, Establish a visual hierarchy, Tell stories with visuals, draft your verbal brand, Anatomy of typeface, color theory, understanding visual weight	3 Hours
3.4	VISUAL DESIGN TOOLS: visual design tools – Photoshop, Illustrator, Creating layouts, iconography, digital color schemes, infographics, typography	1 Hour
4	USER INTERFACE DESIGNING	6 Hours
4.1	Basics Of Ui Development: Why the user interface matters?, The importance of good user interface design, Designing for users, Evaluation,	1 Hour
4.2	How to gather requirements: Observing your users, Interviewing users, Questionnaire and surveys; Finding out about users and domain: Users-finding out who they are, User's needs, The domain; Describing user's work,	2 Hours
4.3	Two types of knowledge needed for User Interface design, Design principles and design rules, Usability requirements, The Modern day view of usability, wireframing, prototyping	2 Hours
4.4	Wireframing And Prototyping Tools: AdobeXD, Invision, AxureRP - overview	1 Hour
5	UI DESIGNING FOR WEB AND MOBILE	8 Hours
5.1	Designing for Web: Design principles for websites, Designing Websites, Designing Home pages and Interior pages, Design issues for web pages, Writing contents for web pages	1 Hour
5.2	Front End Development: Front-end development technologies – HTML, Structure of HTML Page, Mandatory tags in html page (html, head, body), Heading tags (H1...H6), Tags and attributes (Class, Id, style etc.), Inline and block level elements,	2 Hours
5.3	CSS, Different ways of applying CSS for elements, Responsive Web Designing, Bootstrap, Material Design, DOM, JQuery- animations	2 Hours

5.4	Mobile Front End Development: Mobile App Designing tools- Sketch, Invisio, Adobe XD, Fluid; Mobile App Development-fundamentals,	1 Hour
5.5	Android studio vs Flutter, Flutter framework- stateful and stateless widgets, Material icons, Basic app Development with Flutter	2 Hours

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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT322	COMPILER DESIGN	PEC	2	1	0	3

Preamble: This syllabus starts with an introduction about different phases of compilers. Each phase is discussed in detail in other modules. Second and third module contains the lexical analysis phase and automata for this phase. Parsing and different types of parsing techniques are being discussed over here. Different types of construction of parsing tables are included. Different syntax directed translation schemes are included in fourth module. Different code optimization techniques and code generation design issues are also included in the last module.

Prerequisite: ITT 307 Formal Languages and Automata theory

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category Level
CO 1	Explain the different phases of a compilers	Level 1: Remember
CO 2	Illustrate different automata, context free grammars for lexical analysis and parsing	Level 2: Understand
CO 3	Compare top-down parsers with bottom-up parsers	Level 3: Apply
CO 4	Construct different parsing tables for SLR, LALR ,LR, CLR	Level 3: Apply
CO 5	Illustrate the different syntax directed translation schemes , different code optimization techniques and code generation issues	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	-	-	-	-	-	-	-	1
CO 2	3	2	2	2	1	-	-	-	-	-	-	1
CO 3	2	3	2	3	-	-	-	-	-	-	-	1
CO 4	3	3	3	3	3	-	-	-	-	-	-	1
CO 5	2	2	2	3	3	-	-	-	-	-	-	1

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test1 (Marks)	Test2 (Marks)	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	30
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. State the different phases of a compiler.
2. List the different Finite Automata for token recognition, Lexical Analysis.
3. Define the different compiler writing tools.

Course Outcome 2 (CO2)

1. Demonstrate different context free grammars and derivation trees for ambiguous grammar.
2. Give example for recursive descent parsing.
3. Construct parsing table for LL(1) Grammar.

Course Outcome 3(CO3):

1. Demonstrate first and follow.
2. Construct parsing table for SLR.
3. Construct parsing table for LALR.

Course Outcome 4 (CO4):

1. Demonstrate the syntax directed translation for different statements.
2. Give example for generating physical address for accessing data segment.

3. Describe the bottom-up evaluation and top-down evaluation of inherited attributes.

Course Outcome 5 (CO5):

1. Illustrate the three-address code generation in different formats.
2. Demonstrate different code optimization techniques.
3. Demonstrate the design of code generator.

Model Question paper

Course Code: ITT322
Course Name: COMPILER DESIGN

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions. Each carries 3 marks)

1. Define ambiguous grammar. Give an example.
2. Write a note on derivation tree with an example.
3. Discuss about input buffering.
4. Define Lexemes, token and symbol table.
5. Write a note on operator precedence parsing.
6. What is shift reduce parsing with an example
7. Define synthesized and inherited attribute
8. Write a note on type checking
9. What are the methods used for elimination of ambiguity and non-determinism?
10. Write a note on
 - L attributed definition
 - S attributed definition

PART B

Answer all questions. Each carries 14 marks

11. Write regular expression for the following language (14 marks)
 - a. Set of all strings that contains 11 at the beginning and 00 at the end where $\Sigma = \{0,1\}$ and draw a corresponding E-NFA
 - b. Set of all strings that contains 3 consecutive a's where $\Sigma = \{a,b\}$ and draw a

corresponding E-NFA

OR

12. Explain the different phases of compiler with neat diagram (14marks)

13. Design CFG for the following language and draw corresponding parse tree (14 marks)

a. Design a CFG for $a^n b^n$

b. Design a CFG for equal number of zeros and equal number of ones

OR

14 a) Define LR Parsing. Construct LR(0) items for the below grammar. (7 marks)

$S \rightarrow AA$

$A \rightarrow aAb$

b) Differentiate between LR(0) parsing and SLR Parsing with an example (7marks)

15 . a. Write an algorithm for recursive descent parser (7 marks)

b. Write an algorithm for FIRST and FOLLOW in parser (7 marks)

OR

16. Explain LALR parsing with an example (14 marks)

17. Describe about syntax directed definition with examples (14 marks)

OR

18. Discuss about bottom up evaluation of synthesized attributes (14 marks)

19 a. Discuss about 1. Three address code 2. Quadruples 3. Triples with an example (7 marks)

b. Discuss about various storage allocation strategies (7 marks)

OR

20 a. Discuss about any three code optimization methods (7marks)

b. Write a note on various issues of code generation (7 marks)

Module 1: Introduction to compilers (6 Hours)
Introduction to compilers – Analysis of the source program, Phases of a compiler, Grouping of phases, compiler writing tools – bootstrapping Lexical Analysis: The role of Lexical Analyser, Input Buffering, Review of Finite Automata.
Module 2: Syntax Analysis (6 Hours)
Syntax Analysis: Review of Context-Free Grammars – Derivation trees and Parse Trees, Ambiguity. Top-Down Parsing: Recursive Descent parsing, Predictive parsing, LL(1) Grammars.
Module 3: Bottom-Up Parsing (9 Hours)
Bottom-Up Parsing: Shift Reduce parsing – Operator precedence parsing ,LR parsing – Constructing SLR parsing tables, Constructing, Canonical LR parsing tables and Constructing LALR parsing tables.
Module 4: Syntax directed translation (6 Hours)
Syntax directed translation: Syntax directed definitions, Bottom- up evaluation of S-attributed definitions, L- attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.
Module 5: Intermediate Code Generation (ICG) (8 Hours)
Intermediate Code Generation (ICG): Intermediate languages – Graphical representations, Three-Address code, Quadruples, Triples. Code Optimization: Principal sources of optimization, Optimization of Basic blocks Code generation: Issues in the design of a code generator, A simple code generator.

Text Books

1. Aho A. Ravi Sethi and D Ullman. Compilers – Principles Techniques and Tools, Addison Wesley, 2006.
2. D. M.Dhamdhare, System Programming and Operating Systems, Tata McGraw Hill & Company, 1996.

Reference Books

1. Kenneth C. Loudon, Compiler Construction – Principles and Practice, Cengage Learning Indian Edition, 2006.
2. Tremblay and Sorenson, The Theory and Practice of Compiler Writing, Tata McGraw Hill & Company, 1984.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to compilers	6 Hours
1.1	Analysis of the source program	1 Hour
1.2	Phases of a compiler	1 Hour
1.3	Grouping of phases, compiler writing tools ,bootstrapping	1 Hour
1.4	Lexical Analysis: The role of Lexical Analyser, Input Buffering	1 Hour
1.5	Review of Finite Automata	2 Hours
2	Syntax Analysis	6 Hours
2.1	Review of Context-Free Grammars	1 Hour
2.2	Derivation trees and Parse Trees, Ambiguity.	1 Hour
2.3	Recursive Descent parsing	2 Hours
2.4	Construction of LL(1) parsing table	2 Hours
3	Bottom-Up Parsing	9 Hours
3.1	Shift Reduce parsing	1 Hour
3.2	Operator precedence parsing	2 Hours
3.3	SLR parsing tables	2 Hours
3.4	Constructing LALR parsing tables	2 Hours
3.5	Canonical LR parsing tables	2 Hours
4	Syntax directed translation	6 Hours
4.1	Syntax directed definitions	1 Hour
4.2	Bottom- up evaluation of S- attributed definitions	2 Hours
4.3	L- attributed definitions	1 Hour
	Top-down translation	1 Hour
	Bottom-up evaluation of inherited attributes.	1 Hour
5	Intermediate Code Generation (ICG)	8 Hours
5.1	Intermediate languages – Graphical representations, Three-Address code, Quadruples, Triples.	2 Hours
5.2	Code Optimization: Principal sources of optimization	2 Hours
5.3	Optimization of Basic blocks	2 Hours
5.4	Code generation: Issues in the design of a code generator	1 Hour
5.5	A simple code generator	1 Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT332	SOFT COMPUTING	PEC	2	1	0	3

Preamble: The objective of the course is to introduce the basic concepts of soft computing techniques such as Artificial Neural Networks, Fuzzy Logic, Genetic Algorithm and Hybrid Systems.

Prerequisite: Nil

Course Outcomes: After the completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain various soft computing techniques and their roles in building intelligent machines	Level 2: Understand
CO 2	Discuss Artificial Neural Network Architectures and different Learning Methods	Level 2: Understand
CO 3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems	Level 3: Apply
CO 4	Apply genetic algorithm to solve optimization problems	Level 3: Apply
CO 5	Explain the concepts of hybrid systems	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	3	-	1	-	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	2
CO 5	2	1	-	1	-	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
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Apply	10	20	30
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
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Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
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Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Describe various soft computing techniques.
2. List applications of Neural Networks.
3. Soft computing techniques give best solution to complex problems. Justify.

Course Outcome 2 (CO2):

1. What is unsupervised learning and how is it different from reinforced learning.

2. How does learning takes place in supervised learning.
3. Draw the architecture of back propagation algorithm.

Course Outcome 3(CO3):

1. With suitable example, explain how membership assignment is performed using intuition.
2. Design computer software to perform image processing to locate objects within a scene. The two fuzzy sets representing a plane and a train image are

$$\text{Plane : } \left\{ \frac{0.2}{\text{train}} + \frac{0.5}{\text{bike}} + \frac{0.3}{\text{boat}} + \frac{0.8}{\text{plane}} + \frac{0.1}{\text{house}} \right\}$$

$$\text{Train : } \left\{ \frac{1}{\text{train}} + \frac{0.2}{\text{bike}} + \frac{0.4}{\text{boat}} + \frac{0.5}{\text{plane}} + \frac{0.2}{\text{house}} \right\}$$

Find the following

(a) Plane $\square$ Train	(b) Plain $\square$ Train
(c) $\overline{\text{Plane}}$	(d) $\overline{\text{Train}}$
(e) Plane $\square$ Train	(f) $\overline{\text{Plane} \cup \text{Train}}$
(g) $\overline{\text{Plane} \cap \text{Train}}$	(h) $\overline{\text{Plane} \cup \overline{\text{Plane}}}$
(i) Plain $\square$ $\overline{\text{Plane}}$	(j) Train $\square$ $\overline{\text{Train}}$

Course Outcome 4 (CO4):

1. Determine the maximum of a function $f(x) = x^2$ using genetic algorithm.
2. With a neat flowchart, explain the operation of a simple genetic algorithm.

Course Outcome 5 (CO5):

1. Describe Neuro Genetic hybrid systems.
2. Mention the characteristics and properties of Neuro-Fuzzy hybrid systems

Model Question paper

Course Code: ITT 332
Course Name: Soft Computing

Max.Marks:100

Duration: 3 Hour

Part A

Answer all questions. Each question carries 3 marks.

1. Discuss the back propagation process in a neural network.
2. How is fuzzy relation converted into a crisp relation using lamda-cut process?
3. Differentiate convex and nonconvex fuzzy set
4. What is ANFIS?
5. Differentiate hard computing and soft computing
6. What is the significance of weight in an Artificial Neural Network?
7. Define Fuzzy Equivalence Relation.
8. Compare Tuning and learning problems
9. What are the advantages and limitations of Genetic Algorithm?
10. List various encoding techniques used in genetic algorithm.

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. (a) State the basic components of soft computing (6 marks)
- (b) What are the different applications of Soft Computing? (8 marks)

OR

12. (a) What are the characteristics of hard computing and soft computing? (6 marks)
- (b) Describe various soft computing techniques (8 marks)

13. (a) Explain Exclusive OR problem. How it is solved with two layer perceptrons

(8 marks)

- (b) Calculate the output y of a three-input neuron with bias. The input feature vector is $(x_1, x_2, x_3) = (0.3, 0.5, 0.6)$ and weight values are $[w_1, w_2, w_3, b] = [0.1, 0.3, -0.2, 0.35]$. Use (i) binary sigmoidal and (ii) bipolar sigmoidal activation functions

(6 marks)

OR

14. (a) (i) Construct a feed forward network with five input nodes, three hidden nodes and four output nodes.

(ii) Construct a recurrent network with four input nodes, three hidden nodes and two output nodes that has feedback links from the hidden layer to the input layer.

(8 marks)

(b) Compare Supervised and Unsupervised Learning Methods. (6 marks)

15. (a) Using the inference approach, find the membership values for the fuzzy triangular shapes (i) isosceles triangle, (ii) equilateral triangle, (iii) right angle triangle, (iv) isosceles and right angle triangle (v) other triangles for a triangle with angles $45^\circ, 55^\circ, 80^\circ$ (10 marks)

(b) What are the different features of membership functions? (4 marks)

OR

16. (a) Explain different Defuzzification methods (8 marks)

(b) Describe Max-min composition and Max-product composition of Classical Relations (6 marks)

17. (a) Define the following Aggregation of Fuzzy Rules

(i) Conjunctive system of rules (ii) Disjunctive system of rules (6 marks)

(b) Explain four modes of Fuzzy Approximate Reasoning (8 marks)

OR

18. (a) Compare Mamdani Fuzzy Interface System and Takagi-Sugeno Fuzzy Model (8 marks)

(b) What is meant by compound rule? List the different methods used for decomposition of compound linguistic rules into simple canonical rules. (6 marks)

19. (a) Briefly explain the selection operation in genetic algorithm. (5 marks)

(b) Compare and contrast cooperative Neuro-fuzzy systems and hybrid Neuro-fuzzy systems. (9 marks)

OR

20. (a) Explain Two-Point Crossover. In a Genetic algorithm, suppose that two potential parents are given by

1	1	0	0	1	1	0	1	1	1
0	0	1	1	1	0	1	0	0	1

Assuming the numbering goes from left to right and that $\square_1=4$ and $\square_2=8$, show result of two point crossover

(6 marks)

(b) Describe Neuro Genetic Hybrid Systems

(8 marks)

Syllabus

Module 1: Introduction to Soft Computing (5 Hours)
Evolution of Computing-From Conventional Artificial Intelligence to Computational Intelligence, Characteristics of Hard Computing and Soft Computing, Soft Computing Constituents, Applications of Soft Computing
Module 2: Artificial Neural Networks (7 Hours)
Biological Neuron, Artificial Neural Network Architectures: Single-Layer Feed Forward Network, Multi-Layer Feed Forward Network and Recurrent Network, Learning Methods: Supervised, Unsupervised and Reinforced Learning
Module 3: Fuzzy Logic (8 Hours)
Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Membership Functions, Fuzzification, Methods of Membership Value Assignments, Defuzzification Methods
Module 4: Fuzzy System (6 Hours)
Fuzzy Rules: Formation, Decomposition and Aggregation, Fuzzy Reasoning, Fuzzy Inference System: Mamdani Fuzzy System and Sugeno Fuzzy System
Module 5: Genetic Algorithm and Hybrid Systems (9 Hours)
Genetic Algorithm: Basic Version of Genetic Algorithm, Encoding Methods, Operators in Genetic Algorithm: Selection, Crossover and Mutation
Hybrid Systems: Basic Concept, Neuro-Fuzzy Hybrid System, Neuro-Genetic Hybrid System and Fuzzy-Genetic Hybrid System

Text Books

1. S.N.Sivanandam , S.N.Deepa, Principles of Soft Computing, Wiley India Pvt. Ltd., 2nd Edition, 2011.
2. S.Rajasekaran, G.A.Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications , PHI Learning Pvt. Ltd., 2017.

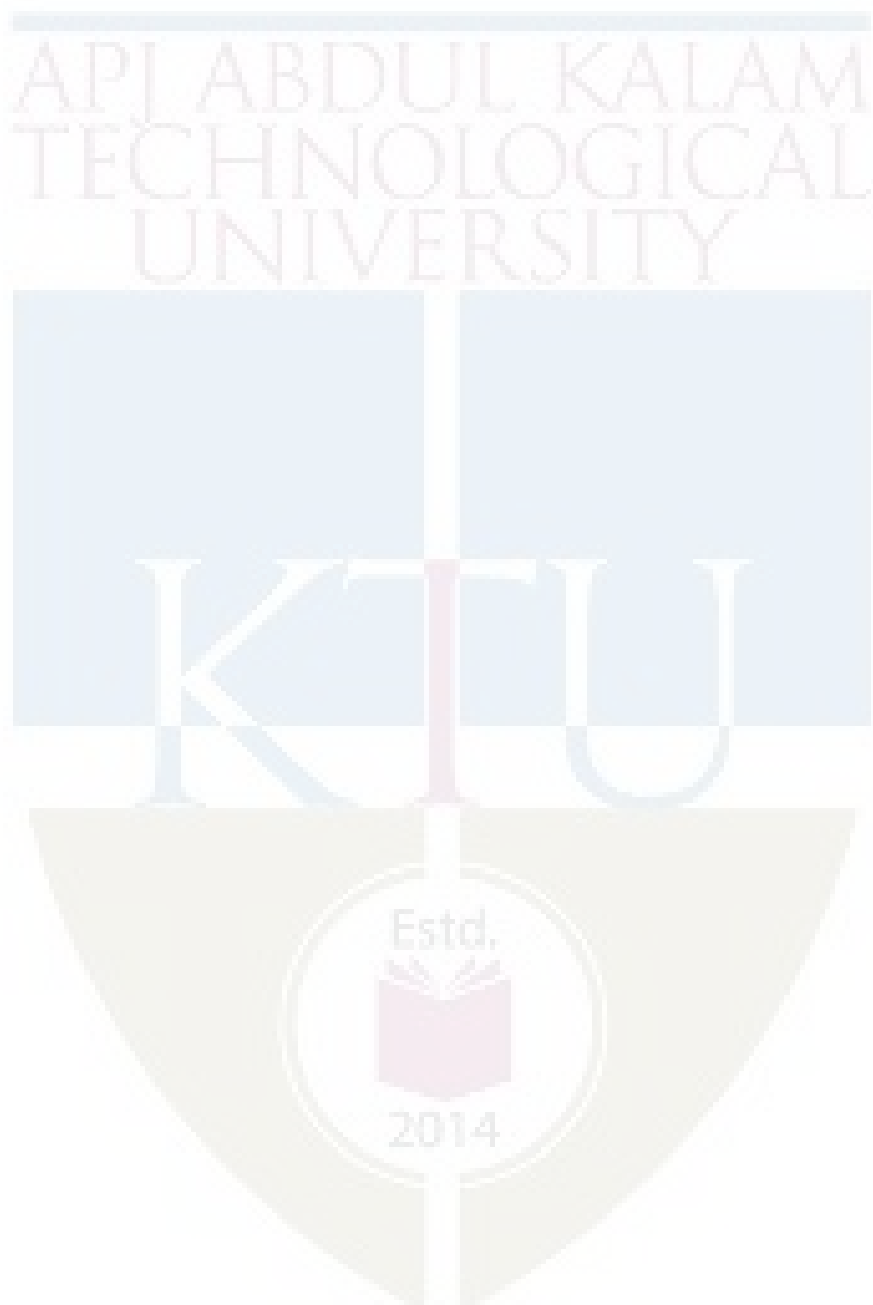
Reference Books

1. James A. Freeman and David M. Skapura, —Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
2. Jacek M. Zurada, Introduction to Artificial Neural Systems, PWS Publishers, 1992.
3. George J. Klir and Bo Yuan, —Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.
4. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall, 1998.
5. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison Wesley, 1997.
6. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, —Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to Soft Computing	5 Hours
1.1	Evolution of Computing-From Conventional Artificial Intelligence to Computational Intelligence	2 Hours
1.2	Characteristics of Hard Computing and Soft Computing,	1 Hour
1.3	Soft Computing Constituents	1 Hour
1.4	Applications of Soft Computing	1 Hour
2	Artificial Neural Networks	7 Hours
2.1	Biological Neuron and Artificial Neural Network Concepts	1 Hour
2.2	Single-Layer and Multi-Layer Feed Forward Networks	2 Hours
2.3	Recurrent Network	1 Hour
2.4	Supervised Learning	1 Hour
2.5	Unsupervised Learning	1 Hour
2.6	Reinforced Learning	1 Hour
3	Fuzzy Logic	8 Hours
3.1	Fuzzy Sets and Operations on Fuzzy Sets	2 Hours
3.2	Fuzzy Relations and Operations on Fuzzy Relations	2 Hours
3.3	Fuzzy Membership Functions	2 Hours
3.4	Fuzzification and Methods of Membership Value Assignments	1 Hour
3.5	Defuzzification Methods	1 Hour
4	Fuzzy System	6 Hours
4.1	Fuzzy Rules: Formation, Decomposition and Aggregation	2 Hours
4.2	Fuzzy Reasoning	2 Hours
4.3	Fuzzy Inference System: Mamdani and Sugeno Fuzzy Systems	2 Hours
5	Genetic Algorithm and Hybrid Systems	9 Hours
5.1	Basic Version of Genetic Algorithm	1 Hour

5.2	Encoding Methods	1 Hour
5.3	Operators in Genetic Algorithm: Selection, Crossover and Mutation	3 Hours
5.4	Basic Concept of Hybrid Systems	1 Hour
5.5	Neuro-Fuzzy Hybrid System	1 Hour
5.6	Neuro-Genetic Hybrid System	1 Hour
5.7	Fuzzy-Genetic Hybrid System	1 Hour



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT342	MICROPROCESSORS	PEC	2	1	0	3

Preamble: This course is intended to deliver students the concepts of Microprocessors and Micro-controllers. It also helps them to learn how to write an 8086 program assembly language. Introduction to Interfacing of micro-processors, its use and applications are also covered in the syllabus

Prerequisite: ITT204 Computer Organization

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain different modes of operations of a typical microprocessor and microcontroller.	Level 2: Understand
CO 2	Develop assembly language programs for problem solving using software interrupts and various assembler directives.	Level 3: Apply
CO 3	Illustrate how to handle 8086 interrupts	Level 2: Understand
CO 4	Identify interfacing of various I/O devices to the microprocessor through assembly language programming	Level 2: Understand
CO 5	Develop assembly language programs using 8051 microcontrollers.	Level 3: Apply

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	1
CO 2	3	3	3	-	2	-	-	-	-	-	-	2
CO 3	3	2	-	2	-	-	-	-	-	-	-	1
CO 4	3	3	3	2	3	-	-	-	3	2	3	3
CO 5	3	3	3	-	-	-	-	-	-	-	-	3

3/2/1:high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test2(Marks)	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	30
Analyse			

Evaluate		INFORMATION TECHNOLOGY	
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. State the functionality of a finite state machine and the microprocessor.
2. List the microprocessors launched by various company.
3. Define the functionality of a microprocessor.

Course Outcome 2 (CO2)

1. Demonstrate the segment override instructions in x86
2. List the registers present in x86 microprocessors.
3. Define the functionality of a stack and stack pointer.

Course Outcome 3 (CO3):

1. Illustrate that how to handle interrupts in x86 architecture.
2. Show the program for accessing a maskable interrupt in x86.
3. Discuss Interfacing with 8259.

Course Outcome 4 (CO4):

1. Explain the Interfacing and mode of operation of 8257 with 8086.
2. Outline the Interfacing 8253 with 8086.
3. Write a program to do LED display using 8279 with 8086.

Course Outcome 5 (CO5):

1. List criteria for Selecting a microcontroller for Applications.
2. Draw and explain 8051 Architecture
3. Explain Memory and I/O addressing with 8051

Model Question paper

Course Code: ITT342
Course Name: MICROPROCESSORS

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 Marks)

1. Compare microprocessor and microcomputer.
2. List the instructions which are used for memory operation in 8088 microprocessors.
3. Explain the purpose of the following signals in 8086.
(i) READY (ii) HOLD
4. Write a program to do data conversions from HEX to ASCII in 8086 assembly code.
5. Explain MOV, AAA, HLT instructions of 8086 Micro-processor.
6. Illustrate with an example how arrays are used in 8086.
7. Describe different modes of operation of the following peripheral ICs:
i) 8255 ii) 8257
8. Write the Control Word Format in 8255.
9. Write any three applications of microcontrollers.
10. Write short notes on memory and IO addressing of 8051 microcontrollers.

PART B INFORMATION TECHNOLOGY

(Answer all questions. Each full question carries 14 marks)(5*14=70)

11.a) Draw the architectural diagram of 8086 microprocessor and explain. (8 marks)

b) Draw the pin diagram of 8086 micro-processor and explain the function of each pin. (6 marks)

OR

12. a) Compare 8086 and 8088 processors. (7 marks)

b) Explain 8086 Addressing mode (7 marks)

13.a) Write an 8086 program to perform linear search (8 marks)

b) An array of 10 numbers is stored in the internal data RAM starting from location 30 H. Write an assembly language program to sort the array in ascending order starting from location 40 H. (7 marks)

OR

14.a) Write an 8086 based assembly language program to perform addition of two 2x2 matrices. (7 marks)

b) Write an assembly program to add N numbers. (5 marks)

15.a) Explain multiple Interrupt handling. (6 marks)

b) Explain the architecture of programmable interrupt controller 8259. (8 marks)

OR

16. a) What are different types of Interrupts? What is Interrupt service Routine? (6 marks)

b) Draw the memory map and briefly explain the memory organization for 128-byte internal RAM of 8086 micro-controller. (8 marks)

17.a) Explain 8255 Interfacing (7 marks)

b) Explain modes of 8257 (7 marks)

OR

18. a). Explain Keyboard Display controller 8279. (7 marks)

b) Give the advantage of using 8279 for keyboard/display interface? What are scan lines used for? Explain (i) Encoded Scan Mode and (ii) Decoded scan mode. (7 marks)

19.(a) List out criteria for selecting a microcontroller for Applications. (6 marks)

(b) Explain the interfacing of 8253 Timer using 8051 micro-controllers. (8 marks)

OR

20.(a) Explain the functions of ports in 8051 micro-controllers. How can P1 be used as both output and input port? (6 marks)

b) Discuss the addressing modes of 8051 Instruction set. (8 marks)

Syllabus

Module 1: Introduction to Microprocessors(6 Hours)
Evolution of microprocessors, 8086 Microprocessor – Architecture, Memory organisation, Minimum and maximum mode of operation, Minimum mode Timing Diagram. Comparison of 8086 and 8088, Pentium series -introduction to 8087 math coprocessors.8086 Addressing Modes.
Module 2: Instructions and Programming(8 Hours)
8086 Instruction set and Assembler Directives - Assembly Language Programming with Subroutines, Macros, Passing Parameters, Use of stack. Linking and Relocation - Stacks - Procedures – Timing and control unit, op-code fetch machine cycle, memory read/write machine cycles, I/O read/write machine cycles.
Module 3: Interrupt handling(6 Hours)
Interrupts:- Types of Interrupts and Interrupt Service Routine. Handling Interrupts in 8086, Interrupt programming. Handling multiple interrupts Basic Peripherals and their Interfacing with 8086 – Programmable Interrupt Controller - 8259 - Architecture.
Module 4: Interfacing(8 Hours)
Interfacing Memory, I/O, 8255 - Detailed study - Architecture, Control word format and modes of operation, Architecture and modes of operation of 8279 and 8257, programmable counter/interval timer (8253 and 8254)
Module 5: Microcontroller(7 Hours)
Microcontrollers - Types of Microcontrollers - Criteria for selecting a microcontroller - Example Applications. Characteristics and Resources of a microcontroller. Organization and design of these resources in a typical microcontroller - 8051. 8051 Architecture, Register Organization, Memory and I/O addressing, Interrupts and Stack.

Text Books

1. Muhammad Ali Mazidi, et.al., The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson Education, 2007
2. Barry B. Brey, The Intel Microprocessors – Architecture, Programming and Interfacing, Eighth Edition, Pearson Education, 2015
3. Douglas V. Hall, SSSP Rao, Microprocessors and Interfacing, Third Edition, McGrawHill Education, 2012.

Reference Books

1. Bhurchandi and Ray, Advanced Microprocessors and Peripherals, Third Edition McGraw Hill, 2012
2. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education, 2011.
3. A. NagoorKani, Microprocessors and Microcontrollers, Second Edition, Tata McGraw Hill, 2012.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to Microprocessors 6 Hours	
1.1	Evolution of microprocessors	1 Hour
1.2	8086 Microprocessor – Architecture	1 Hour
1.3	Memory organisation, Minimum and maximum mode of operation,	1 Hour
1.4	Minimum mode Timing Diagram.	1(T) Hour
1.5	8086 Addressing Modes	1 Hour
1.6	Comparison of 8086 , 8088 and Pentium series	1(T) Hour
2	Instructions and Programming 8 Hours	
2.1	8086 Instruction set and Assembler Directives	2 Hours
2.2	Assembly Language Programming with Subroutines, Macros, Passing Parameters	1 Hour
2.3	Linking and Relocation - Stacks - Procedures	1 Hour
2.4	Timing and control unit	1 Hour
2.5	Op-code fetch machine cycle, memory read/write machine cycles, I/O read/write machine cycles,	2 Hours
2.6	8086 Programming	1(T) Hour
3	Interrupt handling 6 Hours	
3.1	Interrupts - Types of Interrupts and Interrupt Service Routine.	1 Hour
3.2	Handling Interrupts in 8086,	1 Hour
3.3	Handling multiple interrupts	1 Hour

3.4	Basic Peripherals and their Interfacing with 8086	1Hour
3.5	Programmable Interrupt Controller - 8259 - Architecture.	1Hour
3.6	Interrupt programming.	1(T)Hour
4	Interfacing8Hours	
4.1	Interfacing Memory, I/O,	1Hour
4.2	8255 - Detailed study - Architecture	1Hour
4.3	Control word format and modes of operation	1Hour
4.4	Architecture and modes of operation of 8279	1Hour
4.5	Architecture and modes of operation of 8257	1Hour
4.6	Programmable counter/interval timer (8253 and 8254)	1Hour
4.7	Interfacing using Simulator	2(T)Hours
5	Microcontroller7 Hours	
5.1	Microcontrollers - Types of Microcontrollers - Criteria for selecting a microcontroller - Example Applications.	1Hour
5.2	Characteristics and Resources of a microcontroller. Organization and design of these resources in a typical microcontroller -8051	1 Hour
5.3	8051 Architecture, Register Organization,	2Hours
5.4	Memory and I/O addressing,	1Hour
5.5	Interrupts and Stack.	1Hour
5.6	Interfacing with Timer using simulator	1(T)Hour



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT352	DISTRIBUTED SYSTEMS	PEC	2	1	0	3

Preamble: This course covers introductory concepts in the design and implementation of distributed systems. The course aims to cover all the fundamental and applied techniques in distributed systems ranging from various distributed architectural styles to consistency, replication and fault tolerance in distributed systems. It also covers design of computer clusters for scalable parallel computing.

Prerequisites:

- ITT201 Data Structures
- ITT305 Data Communication and Networking

Course Outcomes: After the completion of the course the student will be able to

CO No	Course Outcomes (CO)	Bloom's Category Level
CO 1	Discuss the characteristics and design goals of basic distributed systems.	Level 2: Understand
CO 2	Apply knowledge of distributed systems techniques and methodologies.	Level 3: Apply
CO 3	Explain the design and development of distributed systems and distributed systems applications.	Level 3: Understand
CO 4	Use the application of fundamental computer science methods and algorithms in the development of distributed systems and distributed systems applications.	Level 3: Apply
CO 5	Interpret the design and testing of a large software system, and to be able to communicate that design to others.	Level 3: Apply

Mapping of course outcomes with program outcomes:

POs Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	-	-	-	-	-	-	-	2
CO 2	3	3	-	1	-	-	-	-	-	-	-	2
CO 3	3	3	2	1	-	-	-	-	-	-	-	2
CO 4	3	3	3	1	-	-	-	-	-	-	-	2
CO 5	3	3	3	3	3	-	-	-	-	3	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	10
Understand	20	20	40
Apply	20	20	50
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Specify the characteristics of a distributed system.
2. What are the design objectives of computer clusters?

Course Outcome 2 (CO2):

1. Identify the major design issues of clustered and massively parallel processor system.
2. Differentiate and exemplify compact versus slack clusters.

Course Outcome 3(CO3):

1. Discuss about InfiniBand system fabric built in a typical high-performance computer cluster.
2. Give the organization of an internet search engine and explain the layers associated with it.

Course Outcome 4 (CO4):

1. With an example, explain how bully algorithm works.
2. Explain in detail checkpointing and recovery techniques used cluster systems?

Course Outcome 5 (CO5):

1. Specify the operate-repair cycle of a computer system.
2. Explain in detail how gossip-based publish-subscribe system handles subscriber queries.

Model Question paper

Course Code: ITT352
Course Name: Distributed Systems

Max.Marks:100

Duration: 3 Hours

PART A

(Answer all Questions. Each question carries 3 Marks)

- 1 What are the different forms of transparency in a distributed system?
- 2 What are the important role of wrappers?
- 3 Differentiate stateless and stateful serv(ers.
- 4 A major drawback of user level threads comes from deploying the many-to-one threading model. Explain.
- 5 Mention the properties of a true identifier.
- 6 What is the alternative technique used, when GPS is not an option?
- 7 Clarify the difference between consistency and coherence
- 8 What is the role of orphan process?
- 9 List the parts of a job management system.

- 10 Explain gang scheduling.

PART B

(Answer all questions. Each full question carries 14 marks) (5*14=70)

- 11.a Illustrate a layered communication protocol stack?

OR

- 12.a With a neat diagram, explain the basic NFS architecture for unix system

- 13.a What is code migration? List the reasons for migrating code.

- b. Explain how RPC achieves its transparency?

OR

14. What is virtualisation? Explain the different types of virtualisation based on the interfaces of a computer system.

- 15.a Flat names are good for machines, but are generally not very convenient for humans to use. Explain the alternative human friendly way of naming system and the way these names are resolved to address.

- b. How clock synchronisation happens in a wireless network?

OR

- 16.a Explain attribute-based naming scheme.

- b. With an example, explain how bully algorithm works.

- 17.a Explain the three different types of replicas of content replication and placement

- b. What is a dependable system? Mention the requirements of a distributed system for dependable.

OR

- 18.a How client-centric consistency is implemented?

- b. Give solution to reach reliable group communication.

- 19.a Draw and explain the architecture of a computer cluster built with commodity hardware, software, middleware and network components supporting HA and SSI.

OR

20.a Explain the design principals of SSI.

Syllabus

Module 1: Introduction and Architectural style (5 Hours)
Introduction and Architectures – Characteristics – Design goals – Types of distributed systems - High performance distributed computing – Distributed information systems – Pervasive systems – Architectural styles – Middleware organization – System architecture – Centralized – Decentralized – Hybrid organizations - The Network File System.
Module 2: Processes & Communication (8 Hours)
Processes & Communication – Threads in distributed systems – Virtualization – Clients – Servers – code migration – Communication – layered protocols and types of communication – remote procedure call – Basic RPC operation – Parameter passing – RPC-based application support – Variations on RPC – Message-oriented communication – Simple transient messaging with sockets – Advanced transient messaging – Message-oriented persistent communication – multicast communication.
Module 3: Naming & Coordination (7 Hours)
Naming & Coordination – Names, identifiers, and addresses – Flat naming – Structured naming - Attribute-based naming – Coordination - Clock synchronization Logical clocks – Mutual exclusion - Election algorithms - Location systems
Module 4: Consistency, replication, and Fault tolerance (9 Hours)
Consistency, replication, and Fault tolerance – Reasons for replication - Replication as scaling technique - Data-centric consistency models - Client-centric consistency models - Replica management – Consistency protocols - Example: Caching and replication in the Web - Fault tolerance – Basic concepts - Failure models – Failure masking by redundancy - Process resilience – Resilience by process groups – Failure masking and replication – Consensus in faulty systems with crash failures – Example: Paxos – Consensus in faulty systems with arbitrary failures – limitations on realizing fault tolerance – Failure detection.
Module 5: Computer Clusters for Scalable Parallel Computing (6 Hours)
Computer Clusters for Scalable Parallel Computing – Clustering for Massive Parallelism – Computer Clusters and MPP Architectures – Design Principles of Computer Clusters – Cluster Job and Resource Management.

Text Books

1. Tanenbaum, Andrew S, Van. Steen, Maarten, “ Distributed systems Principles and paradigms”, Third Edition , Pearson, 2017.
2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra , “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things.”, Morgan Kaufman, 2012.

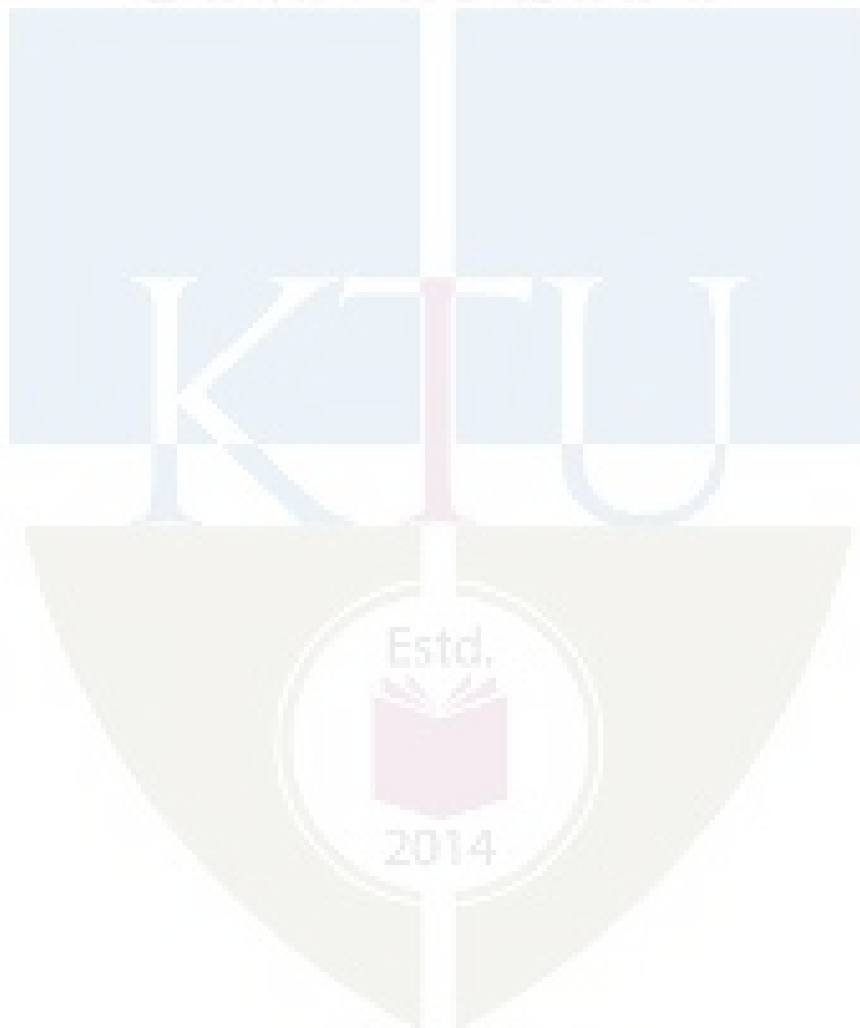
References

1. Distributed Systems: Concepts and Design, G. Coulouris, Jean Dollimore and Tim Kindberg, Addison Wesley, 4th Edition
2. Principles of Computer System Design. Jerome Saltzer and M. Frans Kaashoek, Morgan Kaufmann.
3. Large-scale Incremental Processing Using Distributed Transactions and Notifications, Proceedings of the 9th USENIX Symposium on Operating Systems Design and Implementation, 2010
4. The Google File System, Proceedings of the 19th ACM Symposium on Operating Systems Principles, 2003
5. Vijay Garg, Elements of Distributed Computing, Wiley, 2002.
6. Nancy A. Lynch, Distributed Algorithms, Morgan Kaufmann, 1996.
7. Kurose and Ross, Computer Networking: A top-down approach, Pearson, 2013.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction and Architectural style	5 Hours
1.1	Introduction and Types of distributed systems	2 Hours
1.2	Architectural styles	2 Hours
1.3	Middleware organization - System architecture	1 Hour
2	Processes & Communication	8 Hours
2.1	Threads in distributed systems and Virtualization	2 Hours
2.2	Clients – Servers - code migration	2 Hours
2.3	Remote procedure call	3 Hours
2.4	Message-oriented communication	1 Hour
3	Naming & Coordination	7 Hours
3.1	Naming types	1 Hour
3.2	Clock synchronization Logical clock	2 Hours
3.3	Election algorithms	3 Hours
3.4	Location systems	1 Hour

4	Consistency, replication, and Fault tolerance	9 Hours
4.1	Replication and consistency models	3 Hours
4.2	Replica management - Consistency protocols	3 Hours
4.3	Failure models and Process resilience	3 Hours
5	Computer Clusters for Scalable Parallel Computing	6 Hours
5.1	Clustering for Massive Parallelism, MPP architectures	2 Hours
5.2	Design Principles of Computer Clusters	2 Hours
5.3	Cluster Job and Resource Management .	2 Hours



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT362	DIGITAL IMAGE PROCESSING	PEC	2	1	0	3

Preamble: This course is intended to make the students capable of Understanding the fundamental concepts and applications of digital image Processing and methods for image segmentation and compression. They should also be able to perform various basic operations such as transforms, morphological operations and filters in digital image processing

Prerequisite: Basic understanding on signals and systems

Course Outcomes: After the completion of the course the student will be able to

CO No	Course outcomes (CO)	Bloom's Category Level
CO 1	Demonstrate the fundamentals of image processing such as representation of digital images, pixel relationships and representation of color images.	Level 2: Understand
CO 2	Apply various image transforms and different image compression techniques.	Level 3: Apply
CO 3	Summarize various methods for digital image enhancement in spatial domain.	Level 2: Understand
CO 4	Explain various methods for digital image enhancement in frequency domain.	Level 2: Understand
CO 5	Discuss the various methods for image segmentation and morphological operations in digital image processing.	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	2	2	-	-	-	-	-	-	2
CO 2	3	2	2	1	2	-	-	-	-	-	-	2
CO 3	3	2	2	2	-	-	-	-	-	-	-	2
CO 4	3	2	2	2	2	-	-	-	-	-	-	2
CO 5	3	2	2	-	-	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	20
Understand	30	30	60
Apply	10	10	20

Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Describe fundamentals of image representation
2. Discuss standards for representing colour images
3. Explain applications of image processing.

Course Outcome 2 (CO2)

1. Apply various image transforms
2. Compare lossy and lossless image compression
3. Compare techniques and standards for image compression

Course Outcome 3(CO3):

1. Compare various image transformation functions
2. Discuss the use of image transformation functions for image enhancement in spatial domain
3. Explain the basics of spatial filtering

Course Outcome 4 (CO4):

1. Differentiate various image enhancement methods in frequency domain
2. Differentiate smoothing and sharpening filters in frequency domain
3. Illustrate the concept of homomorphic filtering for image enhancement

Course Outcome 5 (CO5):

1. Discuss the concept of image segmentation
2. Explain various approaches for image segmentation
3. Discuss various morphological operations in digital image processing

Model Question paper

Course Code: ITT362

Course Name: DIGITAL IMAGE PROCESSING

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. Define m-adjacency
2. Explain RGB model for colour image representation
3. Compute the value of the underlined pixel after 5x5 median filter for the image $\begin{bmatrix} 2 & 1 & 3 & 4 & 5 \\ 1 & 1 & 4 & 2 & 3 \\ 2 & 1 & \underline{0} & 1 & 2 \\ 5 & 1 & 4 & 3 & 1 \\ 4 & 3 & 1 & 2 & 0 \end{bmatrix}$
4. Write mathematical equation for power law gray level transformations
5. Differentiate between ideal low pass and high pass filter in frequency domain
6. Describe the concept of homomorphic filtering for image enhancement
7. Explain Huffman coding with simple example.
8. Discuss about region growing based image segmentation.
9. Differentiate between dilation and erosion
10. Explain closing and opening morphological operations with suitable examples

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. a) Explain the image formation model and briefly explain significance of sampling and quantization. 7 Marks

b) List and explain three areas in which digital image processing is widely used. 7 Marks

OR

12 a) With a neat block diagram, explain the fundamental steps in digital image processing.

6 Marks

b) Describe the terms i) brightness ii) contrast iii) hue iv) saturation 8 Marks

13. a) Define the 2D Walsh transform function and construct the Walsh basis matrix for $N = 4$ 6 Marks

b) A file contains the following characters with the frequencies as shown. If Huffman Coding is used for data compression, determine-

1. Huffman Code for each character
2. Average code length
3. Length of Huffman encoded message (in bits)

characters	frequencies
a	10
e	15
i	12
o	3
u	4
s	13
t	1

8 Marks

OR

14 a) Explain JPEG image compression with help of a block schematic

7 marks

b) Compute the inverse 2D DFT of the transform coefficient given below 7 Marks

$$\left[\begin{array}{c} \\ \\ \\ \end{array} \right]$$

16 0 0 0
0 0 0 0
0 0 0 0
0 0 0 0

15. a) Explain the following methods of image enhancement in spatial domain.

i) Power Law Transformation.

ii) Gray level slicing

8 marks

b) Differentiate between linear and nonlinear spatial filter.

6 Marks

OR

16. a) Explain the various sharpening filters used in spatial domain.

7 marks

b) Explain the following grey level transformation functions

i) image negatives

ii) Log Transformation

7 Marks

17. a) Explain Butterworth filters for image smoothening and image sharpening.

7 Marks

b) Write short note on

(i) Averaging filter (ii) Weighted Averaging filter.

6 marks

OR

18. a) Describe about unsharp masking and highboost filtering in frequency domain. 7 Marks

b) What do you mean by histogram of an image? Explain about the histogram of basic image types.

8 Marks

19. a) Explain region split and merge technique for image segmentation

7 Marks

b) Write a short note on edge detection.

8 Marks

OR

20. a) Discuss the concept of boundary segments.

7 Marks

b) Define image gradient and explain its uses in edge detection.

7 Marks

Module 1: Introduction to Image processing (7 Hours)
Introduction to Image processing: Fundamental steps in image processing; Pixels; Image sampling and quantization; Representation of digital images; Basic relationship between pixels; Brightness, contrast, hue, saturation; Colour image fundamentals-RGB, CMY, HIS models; Applications of Image Processing
Module 2: Image transforms (7 Hours)
Image transforms - Discrete Fourier Transform; Discrete Cosine Transform; Walsh Transform; Hadamard Transform. Image compression –Fundamental concepts of image compression – Compression models. Lossless Compression – Huffman Coding, Run length coding. Lossy compression – Transform coding, JPEG standard
Module 3: Image Enhancement in spatial domain (7 Hours)
Image Enhancement in spatial domain: Basic Gray Level Transformation functions – Image Negatives; Log Transformations; Power-Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Processing–Equalization. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters; Ordered Statistic Filters; Sharpening Filters: Laplacian
Module 4: Image Enhancement in Frequency Domain (7 Hours)
Image Enhancement in Frequency Domain: Basics of Filtering in Frequency Domain, Filters - Smoothing Frequency Domain Filters : Ideal Low Pass Filter; Butterworth Low Pass Filter; Sharpening Frequency Domain Filters: Ideal High Pass Filter; Butterworth High Pass Filter; Homomorphic Filtering.
Module 5 : Image Segmentation (7 Hours)
Image Segmentation: Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method; Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators. Morphological Operations, Basics of Set Theory; Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing;

Text Books

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (English) 3rd Edition, Pearson India, 2013.
2. S Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Procesing, McGraw Hill Education , 2009.

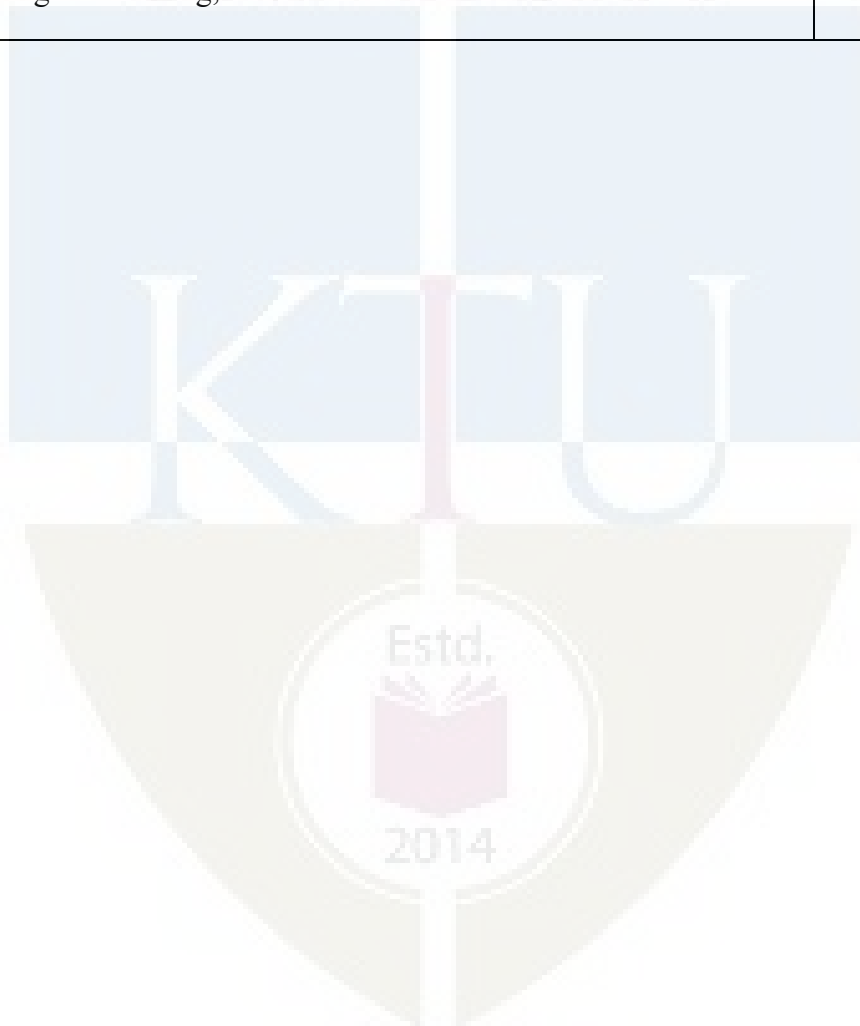
Reference Books

1. A K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989
2. AlBovik, The Essential Guide to Image Processing, Academic Press, 2009
3. MilanSonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, 2008.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to Image processing	7 Hours
1.1	Fundamental steps in image processing	1 Hour
1.2	Pixels; Image sampling and quantization	1 Hour
1.3	Representation of digital images;	1 Hour
1.4	Basic relationship between pixels; Brightness, contrast, hue, saturation	2 Hours
1.5	Colour image fundamentals-RGB, CMY, HIS models	1 Hour
1.6	Applications of Image Processing	1 Hour
2	Image transforms	7 Hours
2.1	Discrete Fourier Transform, Discrete Cosine Transform;	1 Hour
2.2	Walsh Transform; Hadamard Transform	1 Hour
2.3	Image compression –Fundamental concepts of image compression	1 Hour
2.4	Compression models. Lossless Compression , Huffman Coding, Run length coding	2 Hours
2.5	Lossy compression – Transform coding	1 Hour
2.6	JPEG standard	1 Hour
3	Image Enhancement in spatial domain	7 Hours
3.1	Basic Gray Level Transformation functions – Image Negatives;	1 Hour
3.2	Log Transformations; Power-Law Transformations	1 Hour
3.3	Piecewise-Linear Transformation Functions, Contrast Stretching;	2 Hours
3.4	Histogram Processing–Equalization	1 Hour
3.5	Basics of Spatial Filtering – Smoothing, Smoothing Linear Filters; Ordered Statistic Filters, Sharpening Filters: Laplacian	2 Hours
4	Image Enhancement in Frequency Domain	7 Hours
4.1	Basics of Filtering in Frequency Domain	1 Hour
4.2	Filters -Smoothing Frequency Domain Filters	1 Hour
4.3	Ideal Low Pass Filter; Butterworth Low Pass Filter	1 Hour
4.4	Sharpening Frequency Domain Filters: Ideal High Pass Filter	2 Hours
4.5	Butterworth High Pass Filter	1 Hour

4.6	Homomorphic Filtering.	1 Hour
5	Image Segmentation	7 Hours
5.1	Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method	1 Hour
5.2	Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge	2 Hours
5.3	Edge Detection - Edge Operators. Morphological Operations, Basics of Set Theory;	2Hours
5.4	Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing;	2 Hours



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT372	SEMANTIC WEB	PEC	2	1	0	3

Preamble: This course is intended to make the students capable of understanding the limitations of today's web. Keyword-based search will be replaced by semantic query answering. It covers handling RDF Schema Language and Querying RDF document using SPARQL and developing the basic idea of OWL Language.

Prerequisite: ITT301 Web application Development

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome	Bloom's Category Level
CO 1	Demonstrate the concepts of semantic web technologies and semantic web architecture	Level 2: Understand
CO 2	Explain the use of XML in Semantic Web	Level 2: Understand
CO 3	Discuss RDF and OWL Languages.	Level 2: Understand
CO 4	Interpret Logic and Inference	Level 3: Apply
CO 5	Develop applications of semantic web and make use of the concepts of ontology engineering	Level 3: Apply

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	2	3	2	1	-	-	1	-	-	2
CO 2	2	2	1	1	2	2	-	-	1	-	-	-
CO 3	1	2	1	2	3	1	-	-	-	2	-	-
CO 4	2	2	1	3	1	2	-	2	-	-	-	-
CO 5	2	3	1	2	1	2	1	-	1	-	1	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2(Marks)	
Remember	5	5	10
Understand	30	30	60
Apply	15	15	30
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Continuous Assessment Test (2 numbers) : 25 marks
 Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment**Questions Course Outcome 1****(CO1):**

1. Define Semantic Web.
2. Describe about Software Agents?
3. Explain about semantic web layers?

Course Outcome 2 (CO2):

1. What is a Statement in RDF?
2. Explain Core Classes and Core Properties in RDF.
3. State the Reification in Statements?

Course Outcome 3(CO3):

1. Describe in detail about OWL Full, OWL DL, and OWL Lite.
2. Define Thing Class and Nothing Class in OWL.
3. Explain the concept of OWL DLP with Diagram.

Course Outcome 4 (CO4):

1. State Defeasible rules and Competing Rules.
2. Explain the importance of Logic.
3. Describe about First-Order Interpretation of Goals in Monotonic Rules. Also explain Parameterized Witnesses and Ground Witnesses.

Course Outcome 5 (CO5):

1. State the Elsevier Problem? Explain the contribution of Semantic web Technology in Elsevier Problem.
2. Describe about Main stages in Ontology Development.
3. Explain about Ontology Mapping.

Model Question paper

Course Code: ITT372

Course Name: SEMANTIC WEB

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all Questions. Each question carries 3 Marks)

- 1.State the Problems of Keyword Based Search Engines
2. What is an XML Prolog?
- 3.Explain Resource, Properties in RDF with Example.
- 4.What is a Statement in RDF?
- 5.Write notes on Meta Classes.
6. Describe about OWL DL
7. Write notes on SWRL
- 8.Define Variables, Constants, Predicates and Function Symbols with Example.
- 9.Restate about Elsevier Problem.
10. List out the points of DAML-S and OWL-S.

Part B

(Answer all Questions. Each question carries 14 marks)

- 11 a) Explain about Semantic Layers with neat Diagram. (7 Marks)
 - b) Explain about Semantic Web Technologies. (7Marks)
- OR
12. a) Write the Examples of Semantic Web. (7 Marks)
 - b) Describe about Structuring of XML Document this using XML Schema (7 Marks)
- 13.a) Describe in detail about OWL Full, OWL DL, and OWL Lite. (6 Marks)

b) Explain about Querying in SPARQL. (8 Marks)

OR

14. a) Summarize the Constraints of axiomatic semantics for RDF and RDF Schema (7 Marks)

b) Write the RDF Schema of “Lecturer is a subclass of Academic Staff Member. (7 Marks)

15. a) Explain three Sublanguages of OWL (7 Marks)

b) Describe about the Requirements of Ontology Languages? (7 Marks)

OR

16. a) State Defeasible rules and Competing Rules (6 Marks)

b) Explain the two kinds of Properties in OWL with Example. (8 Marks)

17 a) Explain about the Semantics of Monotonic Rules (7 Marks)

b) Explain about Description Logic Programs. (7 Marks)

OR

18 a) How would you apply Priorities are used to resolve some conflicts between 19 Non-Monotonic Rules? (7 Marks)

b) Describe about First-Order Interpretation of Goals in Monotonic Rules. Also explain Parameterized Witnesses and Ground Witnesses. (7 Marks)

20 a) What is Elsevier Problem? How would you solve this Problem by using Semantic Web Technology? (6 Marks)

b) Discuss about main stages of ontology development. (8 Marks)

OR

21 a) Explain the contribution of Semantic Web Technology in E-Learning.(7 Marks)

b) Restate about the four Sub ontologies of OWL-S Ontology. (7 Marks)

Syllabus

Module 1: Introduction and Semantic Web Technologies (8 Hours)
The Semantic Web Vision, Today's Web, From Today's Web to the Semantic Web: Examples, Semantic Web Technologies, A Layered Approach, Structured Web Document in XML, The XML Language, Structuring, Namespace.
Module 2: RDF Schema Language (6 Hours)
Describing Web Documents in RDF, RDF: XML-Based Syntax, RDF Schema, An Axiomatic Semantics for RDF and RDF Schema, Querying in RQL
Module 3: Web Ontology Language (OWL) (6 Hours)
Web Ontology Language (OWL), Examples, OWL in OWL, Future Extensions
Module 4: Logic and Inference (6 Hours)
Logic and Inference: Rules, Example of Monotonic Rules: Family Relationships, Monotonic Rules Syntax and Semantics, Nonmonotonic Rules: Motivation, Syntax and Example, Rule Markup in XML
Module 5: Applications and Ontology Engineering (9 Hours)
Applications: Horizontal Information Products at Elsevier, e-Learning, Web Services
Ontology Engineering: Constructing Ontologies Manually, Reusing Existing Ontologies, Ontology Mapping, On-To- Knowledge Semantic Web Architecture

Text Books

1. Grigoris Antoniou, Frank Van Harmelen, "A Semantic Web Primer", Second Edition, The MIT Press.
2. J. Davies, D. Fensel, and F. van Harmelen. Towards the Semantic Web: Ontology-Driven Knowledge Management, New York, Wiley, 2003.

Reference Books

1. Natalya F. Noy and Deborah L. McGuinness, Ontology Development 101: A Guide to Creating Your First Ontology,
http://protege.stanford.edu/publications/ontology_development/ontology101.pdf

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction and Semantic Web Technologies	8 Hours
1.1	From Today's Web to the Semantic Web	2 hours
1.2	The Semantic Web Impact	3 hours
1.3	Semantic Web Technologies	3 hours
2	RDF Schema Language	6 Hours
2.1	XML Basics	2 hours
2.2	RDF Schema Language	2 hours
2.3	An Axiomatic Semantics for RDF and RDF Schema	2 hours
3	Web Ontology Language(OWL)	6 Hours
3.1	Examples of OWL	1 hours
3.2	OWL Sublanguages	3 hours
3.3	OWL in OWL	2 hours
4	Logic and Inference	6 Hours
4.1	Monotonic Rules	2 hours
4.2	Non Monotonic Rules	3 hours
4.3	Rule Markup in XML	1 hours
5	Applications and Ontology Engineering	9 Hours
5.1	Elsevier, e-Learning, Web Services	4 hours
5.2	Constructing Ontologies Manually	3 hours
5.3	Reusing Existing Ontologies	2 hours

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VI

MINOR



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT382	ANDROID PROGRAMMING	VAC	3	1	0	4

Preamble: The syllabus is prepared with the intended to deliver students the elementary concepts of Android App Development and equip them to code android application built over those concepts. It also introduces to them advanced level areas like event driven programming with Android.

Prerequisite: Java Programming (ITT281), Database Management (ITT282).

Course Outcome (CO): After completion of the course, the student will be able to

CO No.	Course Outcome	Bloom's Category Level
CO1	Summarize about different technologies used in mobile.	Level2: Understand
CO2	Summarize Kotlin Programming Language Concepts	Level 2: Understand
CO3	Summarize about Android Framework	Level 2: Understand
CO4	Build basic android applications.	Level 3: Apply
CO5	Build android apps using advanced android concepts.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	2	2	-	1	-	-	-	-	-	-	-
CO2	1	1	2	1	-	-	-	-	-	-	-	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	1	1	1	-	-	-	-	-	-	-	-
CO5	3	1	1	2	2	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain processors used in mobile.
2. Describe different sensors used in mobile.
3. Familiarization with mobile peripherals and display technologies...
4. Familiarization with mobile operating systems.
5. Explain different mobile platform architectures.

Course Outcome 2 (CO2):

1. Describe the fundamentals of Kotlin Language.
2. Explain about the conditional and looping statements.

3. Illustrate the concept of Higher Order Functions with an Example.
4. Demonstrate the concept of Classes with an example.
5. Explain ranges and collections in Kotlin programming language.

Course Outcome 3 (CO3):

1. Describe the android framework.
2. Describe AndroidManifest.xml.
3. Illustrate the concept of Activity with an example.
4. Demonstrate the concept of Services with an example.
5. Explain about Broadcast Receiver.

Course Outcome 4 (CO4):

1. Explain Android user interface.
2. Describe UI Layouts in Android.
3. Explain UI Controls in Android.
4. Illustrate the concept of Event handling.
5. Develop an Android app with appropriate UI, UI Layouts, UI Controls and Event handling.

Course Outcome 5 (CO5):

1. Explain device location access.
2. Demonstrate usage of SQLite database with an example.
3. Illustrate how data can be accessed from the internet.
4. Develop an efficient android app using RecyclerView and database connectivity.

Model Question Paper

Course Code: ITT382

Course Name: ANDROID PROGRAMMING

Max.Marks:100

Duration: 3 Hours

PART A

(Answer all questions, each carries 3 marks)

1. What are the advantages of using ARM Processor?
2. What is AMOLED?
3. With an example explain the use of lambdas.
4. What is the concept of null safety?
5. Name any three Android Studio IDE project components and their use?
6. How notifications can be provided?
7. Describe UI Layout attributes.
8. Explain intents in Android.
9. How can an android application be published?
10. Compare and contrast different types of location access?

PART B**(Answer all questions. Each full question carries 14 marks)(5*14=70)**

- 11 a. With a neat diagram, explain the architecture of the Android operating system. (8)
b. Mention about different sensors used in mobile devices. (6)

OR

- 12 a. With a neat diagram, explain the architecture of the iOS. (8)
b. What are the features of a mobile operating system? Give examples of mobile OS. (6)

- 13 a. Write a menu driven program to perform arithmetic operations. (10)
a. With an example explain the use of higher order functions. (4)

OR

- 14 a. Define class. How they can be implemented in Kotlin? (8)
b. What are the different types of inheritance in Kotlin. Give examples. (6)

- 15 a. Define Android activity. Explain the callbacks defined in activity class (7)
b. Explain the use and significance of AndroidManifest.xml (7)

OR

- 16 a. With an example illustrate how Broadcast Receiver can be created and used. (7)
b. With a neat diagram explain about Android Service lifecycle (7)

- 17 a. Explain about different Android Layouts. Give examples (9)
b. Illustrate how an activity can be started from another activity. (5)

OR

- 18 a. Explain about any four Android UI Controls. (8)
b. With an example demonstrate event handling in Android. (6)

- 19 a. Explain how content providers supply data from one application to another. Write the steps for creating your own content provider. Also, list out the methods needed to be overridden for the proper working of user defined content provider. (9)
b. Write an android program to access data from internet to implement a social media app with posting capability. (6)

OR

- 20 a. Write an android program with proper configuration files to show lists using RecyclerView. (14)

Syllabus

MODULE 1: GENERAL MOBILE TECHNOLOGY AWARENESS (8 Hours)
Device hardware - Processors - ARM processors. Sensors - Base sensors, Composite Sensors, Uncalibrated, and Interaction composite sensors. Peripherals - audio and custom accessories. Display technologies - Touch, LCD, LED, OLED, AMOLED, display densities. Operating systems - Android, iOS, KaiOS, Tizen, and other operating systems. Platform Architecture: iOS and Android. App Stores – Apple App Store - Google Play. Development languages: Swift for iOS, Kotlin for Android.
MODULE 2: INTRODUCTION TO KOTLIN PROGRAMMING LANGUAGE (8 Hours)
Introduction to Kotlin - basic data types, variables, control flow - conditional statements, Null safety, loops - for loop, while loop, when expression, ranges, collections, functions, higher order functions, lambdas, inline functions. Classes, inheritance, extensions, data classes, objects, enums.
MODULE 3: INTRODUCTION TO ANDROID FRAMEWORK (11 Hours)
Introduction to android framework. Process and application Lifecycle. Introduction to Android Studio IDE. Project components - source files, resources, images, layout XML, and raw assets. Build system - Gradle, build.gradle, adding dependencies. Android app components - Activities, Services, Notifications, Broadcast Receivers, Content Providers.
MODULE 4: BUILDING BASIC ANDROID APPS (9 Hours)
Developing Basic apps using Kotlin, Activities, lifecycle, starting another Activity, Intents. Basic UI components - Layouts, TextView, EditText, Button, CheckBox, ImageView, ToggleButton, ProgressBar. Events and Event Handling.
MODULE 5: ADVANCED ANDROID CONCEPTS (9 Hours)
Showing lists using RecyclerView. Accessing device location, SQLite database, Accessing data from the Internet.

References

1. Android Studio 4.0 Development Essentials - Kotlin Edition by Neil Smyth, Payload Media, June 2020.
2. Android Programming Unleashed, B. M. Harwani, Sams, December 2012
3. ARM Architecture: https://en.wikipedia.org/wiki/ARM_architecture
4. Android Sensors: <https://source.android.com/devices/sensors/sensor-types>
5. Mobile OS list: https://en.wikipedia.org/wiki/Mobile_operating_system
6. Swift: <https://docs.swift.org/swift-book/GuidedTour/GuidedTour.html>
7. Kotlin: <https://kotlinlang.org/docs/reference/basic-syntax.html>
8. Android Platform Architecture: <https://developer.android.com/guide/platform>
9. Kotlin basics: <https://kotlinlang.org/docs/reference/basic-syntax.html>
10. Process & App Lifecycle: <https://developer.android.com/guide/components/activities/process-lifecycle>
11. Android Studio setup: <https://developer.android.com/studio/intro>

12. Android Studio project files: <https://developer.android.com/studio/projects>
13. Android App Components: <https://developer.android.com/guide/components/fundamentals>
14. Activities: <https://developer.android.com/guide/components/activities/intro-activities>
15. UI Components: <https://developer.android.com/guide/topics/ui>
16. Google Codelabs for app development: <https://codelabs.developers.google.com/android-kotlin-fundamentals/>
17. RecyclerView: <https://developer.android.com/reference/kotlin/androidx/recyclerview/widget/RecyclerView>
18. SQLite: <https://developer.android.com/training/data-storage/sqlite>
19. Location tracking: <https://developer.android.com/training/location>

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	General Mobile Technology Awareness	8 Hours
1.1	Device hardware - Processors - ARM processors. Sensors- Base sensors, Composite Sensors, Uncalibrated, and Interaction composite sensors. Peripherals- audio and custom accessories.	2 Hours
1.2	Display technologies - Touch, LCD, LED, OLED, AMOLED, display densities.	1 Hour
1.3	Operating systems - Android, iOS, KaiOS, Tizen, and other operating systems.	2 Hours
1.4	Platform Architecture: iOS and Android. App Stores – Apple App Store - Google Play. Development languages: Swift for iOS, Kotlin for Android.	3 Hours
2	Introduction to Kotlin Programming Language	8 Hours
2.1	Introduction to Kotlin - basic data types, variables, control flow - conditional statements, Null safety, loops - for loop, while loop, when expression, ranges, collections.	2 Hours
2.2	Functions - function, higher order functions, lambdas, inline functions.	3 Hours
2.3	Classes - class, inheritance, extensions, data classes, objects. Enums.	3 Hours
3	Introduction to Android Framework	11 Hours
3.1	Process and application Lifecycle.	2 Hours
3.2	Introduction to Android Studio IDE. Project components - source files, resources, images, layout XML, and raw assets. Build system - Gradle, build.gradle, adding dependencies. custom intents	4 Hours
3.3	Android app components - Activities, Services, Notifications - Toast, Broadcast Receivers, Content Providers.	5 Hours

4	Building Basic Android apps	9 Hours
4.1	Developing Basic apps using Kotlin - Activities, lifecycle, starting another Activity, Intents.	3 Hours
4.2	UI components - Layouts, TextView, EditText, Button, CheckBox, ImageView, ToggleButton, ProgressBar.	3 Hours
4.3	Event handling – Event, Event Listener, Event Handler.	3 Hours
5	Advanced Android Concepts	9 Hours
5.1	RecyclerView – concept, implementation and advantages	3 Hours
5.2	Accessing Device Location – Types of location access (Foreground location and Background location)	2 Hours
5.3	SQLite database – Insert, update, delete and access data	2 Hours
5.4	Accessing data from internet – Different methods to access data from internet.	2 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT384	INTERNETWORKING	VAC	3	1	0	4

Preamble: This subject is about the TCP/IP protocol suite and how it is used on the internet. It begins with a review of the underlying communications technologies needed for the internet. The course provides a detailed examination of IP routing, UDP, TCP, network virtualization, and label switching. Finally, internet applications and Software defined networking are discussed.

Prerequisite: ITT 283 Data Communication, ITT 284 Computer Networks

Course Outcomes: After the completion of the course the student will be able to A

CO No.	Course Outcome(CO)	Bloom's Category Level
CO 1	Describe internetworking concepts.	Level 2: Understand
CO 2	Identify the functions of IPv4, IPv6 protocols.	Level 3: Apply
CO 3	Familiarize with internet routing architecture and routing protocol.	Level 2: Understand
CO 4	Discuss the design issues and protocols in transport layer.	Level 3: Apply
CO 5	Familiarize with label switching, application layer protocols, network virtualization and software defined networking.	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	1	-	-	-	-	-	-	-	-	2
CO 3	3	2	-	-	2	-	-	-	-	-	-	2
CO 4	3	2	1	-	-	-	-	-	-	-	-	2
CO 5	3	2	-	-	3	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	20
Understand	30	30	60
Apply	10	10	20
Analyse			
Evaluate			
Create			

Mark distribution

INFORMATION TECHNOLOGY

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the need for multiple protocols for internetworking.
2. Explain different layers in TCP/IP reference model.

Course Outcome 2 (CO2)

1. Explain IP datagram fragmentation and reassembly. Also explain different header fields affected in these cases.
2. Compare the headers of IPv4 and IPv6.

Course Outcome 3(CO3):

1. Explain characteristics and message formats in BGP.
2. Explain RIP in detail. What is slow convergence problem and how it is solved?

Course Outcome 4 (CO4):

1. Draw and explain TCP finite state machine.
2. Explain the adaptive retransmission algorithm used by TCP.
3. What is the purpose of using a pseudo-header for UDP checksum computation?
4. Explain the format of IPv6 UDP pseudo-header

Course Outcome 5 (CO5):

1. What is label switching?
2. Explain the difference between persistent and non persistent HTTP.
3. Explain DNS.

Course Code: ITT384
Course Name: INTERNETWORKING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. What is internetworking?
2. Explain the role of routers in Networks.
3. Explain the header fields in IP that are used for datagram fragmentation and reassembly
4. What are the features of connectionless delivery service?
5. Assuming that all routers and hosts are working properly and that all software in both is free of all errors, is there any chance, however small, that a packet will be delivered to the wrong destination?
6. Explain the purpose of exterior gateway routing protocols
7. How does VPN protect user data from external access?
8. A TCP machine is sending full windows of 65535 bytes over a 1 Gbps channel that has a 10 msec one way delay. What is the maximum throughput achievable?
9. What is QoS?
10. What is SDN?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 List and explain the main features of all the seven layers of the ISO/OSI reference model and compare it with TCP/IP Model.

OR

- 12 Explain in detail about IPv6 addressing
- 13 Explain the format of IPv4 and IPv6 datagram.

OR

- 14 Explain in detail about fragmentation and reassembly of IPv4 datagram
- 15 What is BGP? Explain the characteristics and message formats of BGP.

OR

- 16 What is slow convergence problem? How can it be solved?
- 17 Explain in detail about TCP segment format.

OR

- 18 What is congestion? Explain in detail about TCP congestion control.
- 19 Explain triangular routing problem

OR

- 20 Explain in detail about RTP and RSVP

Module 1: Introduction to Internetworking(8 Hours)
Introduction & Overview – Motivation for internetworking, TCP/IP internet, Internet Services. Internetworking Concept And Architectural Model – Introduction, Application-Level Interconnection, Network-Level Interconnection, Properties Of The Internet, Internet Architecture, Interconnection Of Multiple Networks With IP Routers. Protocol Layering- Introduction, The Need For Multiple Protocols, The Conceptual Layers Of Protocol Software, Functionality Of The Layers, ISO 7-Layer Reference Model, The TCP/IP 5-Layer Reference Model, IPv6 Addressing
Module 2: Network Layer (8Hours)
Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) – Introduction, Connectionless Delivery System Characteristics, Purpose and Importance Of The Internet Protocol, The IP Datagram, Datagram Type Of Service And Differentiated Services, Datagram Encapsulation, Datagram Size, Network MTU and Fragmentation, Datagram Reassembly, Header Fields Used For Datagram Reassembly, Time To Live (IPv4) And Hop Limit (IPv6), Optional IP Items, Options Processing During Fragmentation.
Module 3: Routing (10Hours)
Routing Architecture – Cores, Peers and Algorithms, Routing among Autonomous system – BGP - The Scope Of A Routing Update Protocol, Determining A Practical Limit On Group Size, Autonomous System Concept, Exterior Gateway Protocols And Reachability, BGP Characteristics, BGP Functionality And Message Types, Routing Within An Autonomous System - Introduction, Static Vs. Dynamic Interior Routes, Routing Information Protocol (RIP), Slow Convergence Problem, Solving The Slow Convergence Problem, The Disadvantage Of Using Hop Counts, Delay Metric (HELLO), Delay Metrics, Oscillation, And Route Flapping, The Open SPF Protocol (OSPF).
Module 4: Transport Layer (9Hours)
User Datagram protocol – UDP message format, Interpretation of UDP checksum, UDP checksum computation and pseudo header, IPv4 and IPv6 UDP pseudo header format, UDP encapsulation and protocol layering, reserved and available port numbers. Reliable stream transport service – need for reliable service, properties of reliable service, reliability, sliding window paradigm, transmission control protocol, Segments, streams and sequence numbers, variable window size and flow control, TCP segment format, TCP options, TCP checksum computation, acknowledgements, retransmissions and timeouts, Karn's algorithm and timer backoff, response to congestion, random early detection, establishing and closing a TCP connection, TCP finite state machine
Module 5: Application Layer (10 Hours)
Label switching, flows and MPLS. Network Virtualization: VPNs, NATs, And Overlays. Mobility and Mobile IP – Introduction, Mobility, Addressing, Routing, Mobility via host address change and changes in datagram forwarding, Mobile IP and operation, Mobile IPv4 addressing, IPv4 foreign agent discovery and registration, communication within an IPv4

foreign agent, IPv6 mobility support, datagram transmission, reception and tunnelling. Voice and video over IP (RTP, RSVP, QoS), Software defined networking – Routes, paths, connections, traffic engineering and control of path selection, connection oriented networks, routing overlays, SDN, separation of data and control plane, SDN architecture and external controllers, SDN across multiple devices, implementing SDN with conventional switches, Openflow technology.

Text Books

1. Douglas E Comer, “Internetworking with TCP/IP Principles, Protocol, and Architecture” , Volume I, 6th Edition, Pearson Education, 2013
2. Andrew S. Tanenbaum, “Computer Networks”, Prentice Hall, 5th Edition
3. James F Kurose, Keith W Ross, Computer Networking: A top Down Approach featuring the Internet, Pearson Education, 3rd Edition

Reference Books

1. Behrouz A Forouzan, TCP/IP Protocol Suite, Fourth Edition

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to Internetworking-	8 Hours
1.1	Introduction & Overview – Motivation for internetworking, TCP/IP internet, Internet Services. Internetworking Concept And Architectural Model – Introduction, Application-Level Interconnection, Network-Level Interconnection, Properties Of The Internet, Internet Architecture, Interconnection Of Multiple Networks With IP Routers.	2Hours
1.2	Protocol Layering- Introduction, The Need For Multiple Protocols, The Conceptual Layers Of Protocol Software, Functionality Of The Layers, ISO 7-Layer Reference Model.	2Hours
1.3	The TCP/IP 5-Layer Reference Model	2Hours
1.4	IPv6 Addressing	2 Hours
2	Network Layer-	8 Hours
2.1	Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) – Introduction, Connectionless Delivery System Characteristics, Purpose And Importance Of The Internet Protocol, The IP Datagram, Datagram Type Of Service And Differentiated Services, Datagram Encapsulation, Datagram Size	5Hours
2.2	Network MTU and Fragmentation, Datagram Reassembly, Header Fields Used for Datagram Reassembly, Time To Live (IPv4) and Hop Limit (IPv6), Optional IP Items, Options Processing During Fragmentation.	3Hours
3	Routing -	10 Hours
3.1	Routing Architecture – Cores, Peers and Algorithms, Routing	2 Hours

	among Autonomous system – BGP - The Scope Of A Routing Update Protocol, Determining A Practical Limit On Group Size, Autonomous System Concept	
3.2	Exterior Gateway Protocols And Reachability, BGP Characteristics, BGP Functionality And Message Types	2 Hours
3.3	Routing Within An Autonomous System - Introduction, Static Vs. Dynamic Interior Routes	1Hour
3.4	Routing Information Protocol (RIP), Slow Convergence Problem, Solving The Slow Convergence Problem, The Disadvantage Of Using Hop Counts	2 Hours
3.5	Delay Metric (HELLO), Delay Metrics, Oscillation, And Route Flapping	1 Hour
3.6	The Open SPF Protocol (OSPF).	2 Hours
4	Transport Layer-	9 Hours
4.1	User Datagram protocol – UDP message format, Interpretation of UDP checksum, UDP checksum computation and pseudo header, IPv4 and IPV6 UDP pseudo header format, UDP encapsulation and protocol layering, reserved and available port numbers.	3 Hours
4.2	Reliable stream transport service – need for reliable service, properties of reliable service, reliability, sliding window paradigm, transmission control protocol, Segments, streams and sequence numbers, variable window size and flow control	2 Hours
4.3	TCP segment format, TCP options, TCP checksum computation, acknowledgements, retransmissions and timeouts	1 Hours
4.4	Karn's algorithm and timer backoff, response to congestion, random early detection	1 Hour
4.5	Establishing and closing a TCP connection, TCP finite state machine	2 Hours
5	Application Layer-	10 Hours
5.1	Label switching, flows and MPLS. Network Virtualization: VPNs, NATs, And Overlays	2 Hours
5.2	Mobility and Mobile IP – Introduction, Mobility, Addressing, Routing, Mobility via host address change and changes in datagram forwarding, Mobile IP and operation, Mobile IPv4 addressing, IPv4 foreign agent discovery and registration, communication within an IPv4 foreign agent, IPv6 mobility support, datagram transmission, reception and tunnelling.	2Hours
5.3	Voice and video over IP (RTP, RSVP, QoS	2Hours
5.4	Software defined networking – Routes, paths, connections, traffic engineering and control of path selection, connection oriented networks, routing overlays, SDN, separation of data and control plane	1Hour
5.5	SDN architecture and external controllers, SDN across multiple devices, implementing SDN with conventional switches.	1 Hour
5.6	Openflow technology	2 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT386	PRINCIPLES OF SOFTWARE QUALITY ASSURANCE	VAC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of understanding essential principles of software quality assurance.

Prerequisite: Basics of Software Engineering

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO1	Summarize role of software quality assurance	Level 2: Understand
CO2	Identify the factors affecting software quality	Level 2: Understand
CO3	Explain the steps to assure software quality	Level 2: Understand
CO4	Explain Software quality metrics	Level 2: Understand
CO5	Discuss the role of management in quality assurance	Level 2: Understand
CO6	Illustrate CASE tools and their effect on software quality	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	3	2	-	2	3	1	2	1
CO2	2	3	3	1	3	-	-	1	2	2	3	1
CO3	2	1	1	-	3	1	-	1	-	1	-	1
CO4	-	1	-	1	-	1	-	1	3	3	2	1
CO5	1	3	-	1	2	-	-	-	-	-	2	1
CO6	1	-	2	1	-	3	-	3	-	-	2	1

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	20
Understand	40	40	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. List out the importance of software quality assurance.
2. Explain change control.
3. Describe the elements of Software Configuration Management.
4. Illustrate the steps to develop and implement a Software Quality Assurance Plan.

Course Outcome 2 (CO2):

1. Classify software requirements into software quality factors.
2. Differentiate Verification, validation and qualification.
3. Discuss the components of the software quality assurance system
4. Illustrate the Integration of quality activities in the project life cycle.

Course Outcome 3 (CO3):

INFORMATION TECHNOLOGY

1. Compare and contrast team review methods.
2. Illustrate the types of external participants.
3. Explain software testing strategies and implementation.
4. Discuss the process of Assuring the quality of software maintenance components

Course Outcome 4 (CO4):

1. Analyze the basis for economic analysis of architecture.
2. Identify the objectives of quality measurement.
3. Describe Team Software Process (TSP) and Personal Software Process (PSP)
4. Explain the process of Measuring Process Improvement.

Course Outcome 5 (CO5):

1. Explain the classic model of cost of software quality.
2. Illustrate the models of Cost of software quality

Course Outcome 6 (CO6):

1. Analyse the contribution of CASE tools to improved project Management.
2. Explain the effect of CASE tools on software quality.

Model Question Paper

Course Code: ITT386

Course Name: PRINCIPLES OF SOFTWARE QUALITY ASSURANCE

Max.Marks:100

Duration: 3 Hour

PART A

(Each Question carries 3 Marks) (10*3=30)

1. List out the importance of software quality assurance
2. Explain change control.
3. Classify software requirements into software quality factors.
4. Differentiate Verification, validation and qualification.
5. Compare and contrast team review methods.
6. Illustrate the types of external participants.
7. Analyze the basis for economic analysis of architecture.
8. Identify the objectives of quality measurement.
9. Explain the classic model of cost of software quality.
10. Analyse the contribution of CASE tools to improved project Management.

PART B**(Answer all Questions. Each question carries 14 marks) (5*14=70)**

11. Describe the elements of Software Configuration Management.

OR

12. Illustrate the steps to develop and implement a Software Quality Assurance Plan.

13. Discuss the components of the software quality assurance system

OR

14. Illustrate the Integration of quality activities in the project life cycle.

15. Explain software testing strategies and implementation.

OR

16. Discuss the process of Assuring the quality of software maintenance components

17. Describe Team Software Process (TSP) and Personal Software Process (PSP)

OR

18. Explain the process of Measuring Process Improvement.

19. Illustrate the models of Cost of software quality

OR

20. Explain the effect of CASE tools on software quality.

Syllabus

Module 1: Introduction to software quality (9 Hours)
Quality Assurance Framework, Elements of Software Configuration Management, Quality Standards
Module 2: Software quality factors (9 Hours)
Software quality factors, The components of the software quality assurance system, Integrating quality activities in the project life cycle
Module 3: Assuring the quality (9 Hours)
Reviews, Software testing – strategies, implementation, Assuring the quality of software maintenance components, Assuring the quality of external participants' contributions.
Module 4: Software quality metrics (9 Hours)
Objectives of quality measurement, Software Quality Indicators, Software Quality Fault Prediction
Module 5: Management and its role in software quality assurance (9 Hours)
Costs of software quality, Management and its role, CASE tools and their effect on software quality

Text Books

1. Handbook of Software Quality Assurance, Fourth Edition, G. Gordon Schulmeyer, ARTECH HOUSE, INC., 2008. ISBN-13: 978-1-59693-186-2.
2. Software Testing and Continuous Quality Improvement, William E. Lewis, 3rd Ed. CRC Press, 2016, ISBN 9781420080735

Reference Books

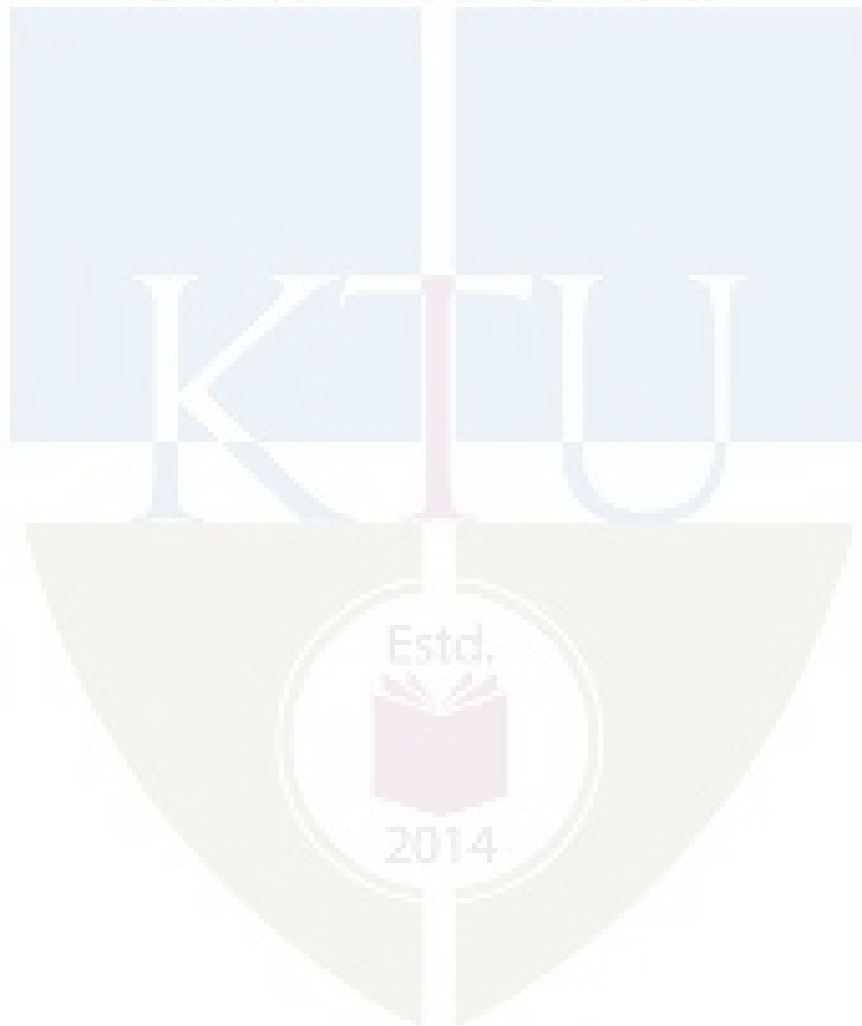
1. Software Testing: Principles, Techniques and Tools, M. G. Limaye, TMH, 2017
2. Foundations of Software Testing, Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black, Cengage Learning, 3rd
3. Software Testing: A Craftsman's Approach, Paul C. Jorgenson, CRC Press, 4th, 2017

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to software quality	9 Hours
1.1	Quality Assurance Framework:- Quality, Prevention versus Detection , Verification versus Validation	1 Hour
1.2	Software Quality Assurance, Components of Quality Assurance, Software Testing, Quality Control, Software Configuration Management	2 Hours
1.3	Elements of Software Configuration Management, Component Identification, Version Control, Configuration Building, Change Control	2 Hours
1.4	Software Quality Assurance Plan, Steps to Develop and Implement a Software Quality Assurance Plan	2 Hours
1.5	Quality Standards	2 Hours
2	Software quality factors	9 Hours
2.1	Software quality factors The need for comprehensive software quality requirements, Classifications of software requirements into software quality factors, Product operation software quality factors , Product revision software quality factors, Product transition software quality factors, Alternative models of software quality factors, Software compliance with quality factors	3 Hours
2.2	The components of the software quality assurance system – overview The SQA system – an SQA architecture, Pre-project components, Software project life cycle components, Infrastructure components for error prevention and improvement, Management SQA components, SQA standards, system certification, and assessment components, Organizing for SQA – the human components, Considerations guiding construction of an organization's SQA system	3 Hours
2.3	Integrating quality activities in the project life cycle Classic and other software development methodologies, Factors affecting	3 Hours

	intensity of quality assurance activities in the development process, Verification, validation and qualification, A model for SQA defect removal effectiveness and cost	
3	Assuring the quality	9 Hours
3.1	Reviews Review objectives, Formal design reviews (DRs) , Peer reviews , A comparison of the team review methods, Expert opinions	1 Hour
3.2	Software testing – strategies Definition and objectives, Software testing strategies , Software test classifications , White box testing , Black box testing	2 Hours
3.3	Software testing – implementation The testing process, Test case design, Automated testing, Alpha and beta site testing programs	2 Hours
3.4	Assuring the quality of software maintenance components The foundations of high quality, Pre-maintenance software quality components, Maintenance software quality assurance tools	2 Hours
3.5	Assuring the quality of external participants' contributions Types of external participants , Risks and benefits of introducing external participants , Assuring quality of external participants' contributions: objectives , SQA tools for assuring the quality of external participants' contributions	2 Hours
4	Software quality metrics	9 Hours
4.1	Objectives of quality measurement, Classification of software quality metrics, Process metrics Product metrics, Implementation of software quality metrics , Limitations of software metrics	2 Hours
4.2	Software Quality Indicators, Practical Software and Systems Measurement (PSM) , CMMI Measurement and Analysis , CMMI Higher Maturity Measurements	2 Hours
4.3	Practical Implementations, Hewlett Packard, Quantitative SQA, Pragmatic Quality Metrics, Effectiveness Measure , Team Software Process (TSP) , and Personal Software Process (PSP).	3 Hours
4.4	Software Quality Fault Prediction, Measuring Process Improvement Using Stoplight Charts , Six Sigma , Project Managers Control Panel , Predicting Software Quality	2 Hours
5	Management and its role in software quality assurance	9 Hours
5.1	Costs of software quality Objectives of cost of software quality metrics , The classic model of cost of software quality , An extended model for cost of software quality , Application of a cost of software quality system , Problems in the application of cost of software quality metrics	3 Hours

5.2	Management and its role in software quality assurance Top management's quality assurance activities , Department management responsibilities for quality assurance , Project management responsibilities for quality assurance	3 Hours
5.3	CASE tools and their effect on software quality CASE tool, The contribution of CASE tools to software product quality, The contribution of CASE tools to software maintenance quality, The contribution of CASE tools to improved project Management.	3 Hours



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VI

HONOURS



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT394	DESIGN AND ANALYSIS OF NETWORKS	VAC	3	1	0	4

Preamble: This course covers problems in design and analysis of computer networks.

Prerequisite: ITT272 Mathematical Foundation for Networking, ITT393 Wireless Communication

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Identify the requirements of a network	Level 2: Understand
CO 2	Identify the characteristics of traffic flow on a network and design network architecture.	Level 3: Apply
CO 3	Describe the fundamental concepts about addressing and routing for IP networks and implement network management and the network management architecture.	Level 3: Apply
CO 4	Describe the mechanisms to achieve performance and understand the security mechanisms such as physical security, protocol and application security, encryption/decryption, and perimeter and remote access security	Level 2: Understand
CO 5	Discuss the need to evaluate the vendor or service provider and come up with traceable blueprints to suit the need of the vendor or service provider	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	2	-	-	-	-	-	-	-	3
CO 2	3	3	3	2	-	-	-	-	-	-	-	2
CO 3	3	3	3	2	-	-	-	-	-	-	-	2
CO 4	3	3	3	2	-	-	-	-	-	-	-	2
CO 5	3	3	3	2	-	-	-	-	-	-	-	3

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	10
Understand	20	20	50
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Why is requirements analysis important to network architecture and design? Give three reasons.
2. Your customer is a hospital that wants to upgrade its LAN. Develop a questionnaire to gather requirements from users, hospital management, and staff. What kinds of questions would you ask to better understand their environment?

Course Outcome 2 (CO2)

1. Develop a flow model for real-time/near-real-time flows. How would you characterize the flows for this model? What are likely data sources and sinks? Apply your model to an online transaction processing (OLTP) application.

2. What are the differences between the LAN/MAN/WAN and Access/Distribution/Core architectural models? Under what conditions might each be applied to a network?

Course Outcome 3(CO3):

1. Subnet 136.178.0.0 into 16 subnets. Show the binary and dotted-decimal forms of each subnet, as well as the subnet mask.
2. Which of the following are end-to-end characteristics? Per-link/per-network/per-element characteristics?
 - a. Round-trip delay between a network management device and a computing server
 - b. Percent utilization of the buffers in an IP router
 - c. Maximum throughput between two devices (client and server) using a client-server application
 - d. Bit error rate (BER) of a DS3 link

Course Outcome 4 (CO4):

1. List four types of problems that the performance architecture addresses. Give examples of each type of problem
2. Explain threat analysis. Give an example of a threat analysis worksheet for an organization

Course Outcome 5 (CO5):

1. Compare differentiated service and integrated service.
2. What are the mechanisms used for traffic management? Explain.

Model Question Paper

Course Code:ITT394

Course Name: DESIGN AND ANALYSIS OF NETWORKS

Max.Marks:100

Duration: 3 Hour

PART A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

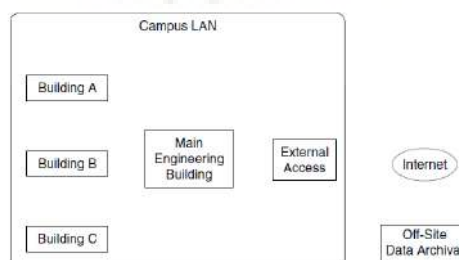
1. Give an example of a mission-critical application for each of these three environments: government, military, commercial. Why would each application be considered mission-critical?
2. Describe two ways to make an uptime requirement of 99.999% more precise.
3. Which flow models apply to each set of flows described below?

- a. Users on the Internet accessing the same Web server
 - b. Forty workstations processing batch jobs overnight, managed by a central mainframe
 - c. Email use across the Internet
4. Give examples of physical and functional entities that you would use as building blocks for a network.
 5. What is the class of each address? Give the default subnet mask.
 - a. 192.12.102.0
 - b. 10.20.30.100
 - c. 130.5.77.15
 6. Give any two ways that the management data collected via SNMP counters from each of the routers could be verified.
 7. Give two examples each of the requirements which indicate single-tier performance and which indicate Multi-tier performance?
 8. What are the common problems that are addressed by the performance architecture?
 9. What are ad hoc design decisions? Give an example of an ad hoc design decision.
 10. What are the primary differences between first-order, second-order, and third-order design products?

PART B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. Based on the following application locations, develop an applications map using the template provided
 - a. There is a distributed computing application between all compute servers.
 - b. There is a data storage/access application between all compute servers and the storage servers in Main Engineering.
 - c. There is a data migration application between Main Engineering, External Access Building, and Off-Site Data Archival.



OR

12. A) Service metrics are used to monitor, measure, and verify services in the network and determine if performance requirements are being met. Therefore, service metrics must be meaningful to the network operators, managers, users, and staff. For each performance requirement below, describe a service metric that could be used to measure and verify the requirement.

- d. Reliability of a T1 link between an enterprise network and its ISP, with IP routers on each end of the T1.
- e. Round-trip delay between devices on network A and servers on server LAN B.
- f. Average traffic rate in and out of a compute server, measured across all four of its LAN interfaces over 15-minute intervals.

B) Given an MTBCF requirement of 8000 hours and an MTTR requirement of 4 hours, calculate an availability requirement.

13. Develop a flow model for real-time/near-real-time flows. How would you characterize the flows for this model? What are likely data sources and sinks? Apply your model to a videoconferencing application.

OR

14. A) A network's architecture differs from its design, in terms of its scope, level of detail, description, and location information. Describe how an architecture and design differ in each characteristic.

B) Explain the network architectural models based on flows.

15. Given the network address 129.99.0.0/16, develop a variable-length addressing scheme that best fits the design, with the following numbers of users:

AS Number	Location	Department	Users
1	Chicago Campus Building 1	Legal	120
		Accounting	370
	Chicago Campus Building 2	HQ	1580
		Engineering	200
2	Toronto	Sales	75
	Boston	Sales	110
3	Philadelphia	Operations1	2150
		Operations2	975
		Sales	575

OR

16. What are the layers of network management? Give an example of management at each layer (what is managed, how it is managed).

17. For the queuing mechanisms given below, give an example of how each would be used within a network. What problem(s) is each mechanism solving?

- g. First in first out (FIFO)
- h. Class-based queuing (CBQ)
- i. Weighted fair queuing (WFQ)
- j. Random early detect (RED)
- k. Weighted RED (WRED)

OR

18. Explain the process for PPP/PPPoE Session Establishment.

19. Which of the following evaluation criteria most likely apply to equipment evaluations, which ones apply to service-provider evaluations, and which apply to both?

- l. Available service-level agreements (SLAs)
- m. Standards compliance (IETF)
- n. Mean time between failure (MTBF)
- o. Mean time between service outage (MTBSO)
- p. Hardware scalability

OR

20. Using any suitable example, explain criteria refinement and rating development.

Syllabus

Module 1: REQUIREMENT ANALYSIS (8Hours)

Requirements Analysis: objective and background, User Requirements, Application Requirements, Device Requirements, Network Requirements, Other Requirements, Requirements Specification and Map

Requirements Analysis: Process- Gathering and Listing Requirements, Developing Service Metrics, Characterizing behaviour, Developing RMA requirements, Developing delay Requirements, Developing capacity Requirements, Environment-Specific Thresholds and Limits, Requirements for Predictable and Guaranteed Performance, Requirements mapping

Module 2 :FLOW ANALYSISAND NETWORK ARCHITECTURE (10 Hours)

Flow Analysis: Background, Flows, Identifying and Developing Flows, Data Sources and Sinks, Flow Models, Flow Prioritization, The Flow Specification, Example Application of Flow Analysis

Network Architecture: Background, Component Architectures, Reference Architecture, Architectural Models, Systems and Network Architectures

Module 3: ADDRESSING AND NETWORK MANAGEMENT(10 Hours)

Addressing and Routing Architecture: Background, Addressing Mechanisms, Routing Mechanisms Addressing Strategies, Routing Strategies, Architectural Considerations

Network Management Architecture: Background, Network Devices and Characteristics, Network Management Mechanisms, In-Band and Out-of-Band Management, Centralized, Distributed, and Hierarchical Management, Scaling Network Management Traffic

Module 4: PERFORMANCE AND SECURITY ARCHITECTURE (9 Hours)

Performance Architecture: Background, Developing Goals for Performance, Performance Mechanisms, Evaluation of Performance Mechanisms

Security and Privacy Architecture: Background, Developing a Security and Privacy Plan, Security and Privacy Administration, Security and Privacy Mechanisms, Evaluation of Security Mechanisms

Module 5: NETWORK DESIGN (8 Hours)

Network Design: Objectives, Design Concepts, Design Process, Vendor, Equipment, and Service-Provider Evaluations, Network Layout, Design Traceability, Design Metrics

Text Books

1. Network Analysis, Architecture and Design, 3RD Edition (The Morgan Kaufmann Series in Networking) James D. McCabe, Elsevier Science (USA), 2007.

Reference Books

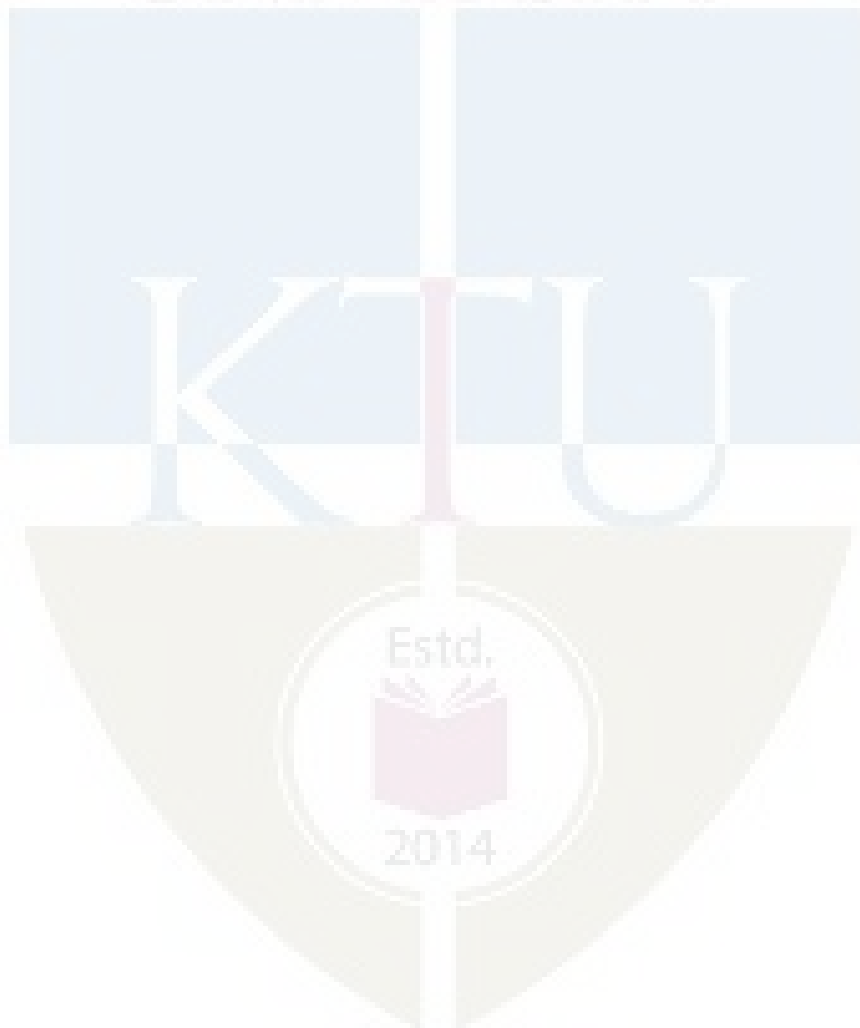
1. Computer Networks: A Systems Approach by Larry L. Peterson, Bruce S. Davie - 2007, Elsevier Inc.
2. Top-down Network Design: [a Systems Analysis Approach to Enterprise Network Design] By Priscilla Oppenheimer, Cisco Press , 3rd Edition, ISBN-13: 978-1-58720-283-4 ISBN-10: 1-58720-283-2
3. Integrated Management of Networked Systems: Concepts, Architectures, and Their Operational Application (The Morgan Kaufmann Series in Networking), Heinz-Gerd Hegering, Sebastian Abeck, and Bernhard Neumair, 1999.
4. "Network Design and Management" – by Steven T. Karris, Orchard publications, Second edition, Copyright 2009, ISBN 978-1-934404-15-7
5. "Network Design, Management and Technical Perspective", Teresa C. Mann-Rubinson and Kornel Terplan, CRC Press, 1999

6. “Ethernet Networks-Design, Implementation, Operation and Management by Gilbert Held, John Wiley and sons, Fourth Edition
7. James Kurose and Keith Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, 1999

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	REQUIREMENT ANALYSIS	8Hours
1.1	Requirements Analysis: objective and background, User Requirements	1 Hour
1.2	Application Requirements, Device Requirements, Network Requirements, Other Requirements, Requirements Specification and Map	2Hours
1.3	Requirements Analysis: Process- Gathering and Listing Requirements, Developing Service Metrics	1Hour
1.4	Characterizing behaviour, Developing RMA requirements, Developing delay Requirements	2Hours
1.5	Developing capacity Requirements, Environment-Specific Thresholds and Limits, Requirements for Predictable and Guaranteed Performance, Requirements mapping	2 Hours
2	FLOW ANALYSIS AND NETWORK ARCHITECTURE	10Hours
2.1	Flow Analysis: Background, Flows, Identifying and Developing Flows, Data Sources and Sinks	3 Hours
2.2	Flow Models, Flow Prioritization, The Flow Specification, Example Application of Flow Analysis	3Hours
2.3	Network Architecture: Background, Component Architectures	1 Hour
2.3	Reference Architecture, Architectural Models, Systems and Network Architectures	3 Hours
3	ADDRESSING AND NETWORK MANAGEMENT	10 Hours
3.1	Addressing and Routing Architecture: Background, Addressing Mechanisms	3 Hours
3.2	Routing Mechanisms Addressing Strategies, Routing Strategies, Architectural Considerations	3 Hours
3.3	Network Management Architecture: Background, Network Devices and Characteristics, Network Management Mechanisms	2 Hours
3.4	In-Band and Out-of-Band Management, Centralized, Distributed, and Hierarchical Management, Scaling Network Management Traffic	2 Hours
4	PERFORMANCE AND SECURITY ARCHITECTURE	9Hours
4.1	Performance Architecture: Background, Developing Goals for Performance	1 Hour
4.2	Performance Mechanisms, Evaluation of Performance	2Hours

	Mechanisms	
4.3	Security and Privacy Architecture: Background, Developing a Security and Privacy Plan	2Hours
4.4	Security and Privacy Administration	2 Hours
4.5	Security and Privacy Mechanisms, Evaluation of Security Mechanisms	2 Hours
5	NETWORK DESIGN	8Hours
5.1	Network Design: Objectives, Design Concepts	2Hours
5.2	Design Process, Vendor, Equipment, and Service-Provider Evaluations	3Hours
5.3	Network Layout, Design Traceability, Design Metrics	3Hours



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT396	APPLIED COMPUTER SECURITY	VAC	3	1	0	4

Preamble: The syllabus is designed with the view of preparing the students capable of understanding various application areas of computer security. The students will get to know about vulnerabilities and threats occurring in various information systems. Furthermore, the student will be able to identify suitable security mechanisms to handle security issues faced by various applications.

Prerequisite: ITT206 Database management systems , ITT303 Operating systems, ITT305 Data communication and Networking, ITT395 Security in Computing,

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category Level
CO 1	Outline the basic concepts and techniques to secure various applications	Level 2: Understand
CO 2	Explain various security mechanisms for storage infrastructure	Level 2: Understand
CO 3	Interpret the security techniques of IoT environment	Level 2: Understand
CO 4	Apply the underlying principles of security to cloud computing platforms	Level 3: Apply
CO 5	Apply the significance of blockchain technology for securing various applications	Level 3: Apply

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	1	1	1	1	-	-	-	2
CO 2	3	2	2	1	1	-	-	1	-	-	-	2
CO 3	3	2	2	1	1	1	-	1	-	-	-	1
CO 4	3	2	1	1	2	-	-	2	-	-	-	2
CO 5	3	3	2	2	2	2	1	2	2	1	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	Test1(Marks)	Test2(Marks)	
Remember	10	10	20
Understand	40	20	40
Apply		20	40
Analyze			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain various issues and challenges in smartphone security.
2. Summarize key success factors for biometric systems.
3. Outline various countermeasures to protect from threats posed through emails.

Course Outcome 2 (CO2):

1. Compare auditing the security of a storage environment with SAN, NAS, and iSCSI implementations.
2. Outline various threats and vulnerabilities occur in virtualized and cloud environments.
3. Explain various security concerns and measures in the virtualized and cloud environment.

Course Outcome 3 (CO3):

1. Summarize various attack types that relate to IoT
2. Outline the importance of IoT security CONOPS document in IoT System development.
3. Explain the IoT System security verification and validation (V&V) procedure.

Course Outcome 4 (CO4):

1. Identify the effect of six surfaces of attacks in a cloud computing environment on SaaS,PaaS,IaaS.
2. Compare the benefits and the potential problems due to virtualization on public,private and hybrid clouds.
3. Identify the implications of a two-level security model of commodity operating systems.

Course Outcome 5 (CO5):

1. Explain various building blocks of blockchain technology.
2. Identify the ways in which blockchain technology can be compromised.
3. Apply blockchain technology to solve automotive security and privacy issues.

Model Question Paper

Course Code: ITT396

Course Name: APPLIED COMPUTER SECURITY

Max.Marks:100

Duration: 3 Hour

PART A

(Each Question carries 3 Marks) (10*3=30)

1. Explain security threats associated with wearable devices.
2. Outline various security issues and concerns in electronic commerce.
3. Explain the concept of risk triad.
4. Outline IP SAN security implementation in storage networking.
5. Summarize the essential components of information assurance (IA).
6. Compare the use of attack trees with that of an attack vector for understanding a system's security posture.
7. Examine the security risks posed by the cloud users.
8. Identify the Surfaces of attacks in a cloud computing environment.
9. Design the structure of a block in a blockchain with the help of a neat diagram.

10. Obtain blockchain and its operations.

PART B

(Answer all Question. Each question carries 14 Marks) (5*14=70)

11. Explain key success factors for biometric systems.

OR

12. Summarize various security threats posed by electronic mails and its countermeasures.

13. Illustrate various storage security domains with suitable diagrams.

OR

14. Outline security implementations in storage networking. (i) FC SAN and (ii) NAS

15. a. Explain the need for building security into design and development. (7)

b. Summarize the issues and techniques related to securely engineering IoT systems. (7)

OR

16. a. Explain the implementation and integration aspects of the IoT security lifecycle. (10)

b. Outline the IoT System security verification and validation (V&V) procedure. (4)

17. a. Identify the indications of the lack of trusted paths in commodity operating systems with examples showing the effects of this deficiency. (10)

b. Obtain the two-level security model of commodity operating systems. (4)

OR

18. a. Obtain the Security risks posed by a management OS. (9)

b. Identify the privacy concerns for three cloud delivery models. (5)

19. Identify various peer to peer attacks on blockchain and its countermeasures.

OR

20. a. Identify various application oriented attacks on blockchain and its countermeasures. (7)

b. Apply blockchain technology to solve security and privacy issues in various applications. Explain with an example. (7)

Syllabus

Module 1: Security of Applications (10 Hours)
Security Considerations in Mobile and Wireless Computing, Smartphone Security, Biometrics for Security, Security of Electronic Mail Systems, Security of Electronic Commerce. (T1: Chapter - 6, 8, 11,18 & 19)
Module 2: Storage Security (8 Hours)
Securing the storage Infrastructure - Information Security Framework, Risk Triad, Storage Security Domains, Security Implementation in Storage Networking, Securing Storage Infrastructure in virtualized and Cloud Environments, RSA and VMware Security Products. (T2: Chapter - 14)
Module 3 : IOT Security (9 Hours)
IoT and cyber-physical systems, IoT security (vulnerabilities, attacks, and countermeasures)- Common IoT attack types-Attack trees-Building an attack tree, security engineering for IoT development-Secure design-Safety and security design, IoT security lifecycle-The secure IoT system implementation lifecycle -Implementation and integration-IoT security CONOPS document-Network and security integration-System security verification and validation (V&V)-Security training-Secure configurations. (T3: Chapter - 2,3 & 4)
Module 4 : Cloud Security (8 Hours)
Introduction to Cloud and Virtualization- Cloud Security - Cloud Security Risks, Trust, Operating System Security, VM Security, Security of Virtualization, Security Risks Posed by Shared Images, Security Risks Posed by Management OS. (T4: Chapter -9)
Module 5 : Distributed Systems Security (10 Hours)
Introduction to Blockchain - Blockchain Overview, Blockchain Building Blocks, Blockchain Commercial Use cases, Blockchain Military Cyber Operations Use cases, Blockchain Challenges, Overview of Attack Surfaces in Blockchain - Overview of Blockchain and its Operations, Blockchain Attacks, Blockchain's Peer to Peer System, Application Oriented Attacks, A Blockchain-based Solution to Automotive Security and Privacy - The Proposed Framework, Applications. (T5: Chapter - 1, 3 & 5)

Text Books

- T1. Nina Godbole, "Information System Security", 2nd Edition, Wiley
- T2. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, Wiley; 2nd Edition, EMC Corporation, 2012.
- T3. B.Rusell and D. Van Duren, "Practical Internet of Things Security," Packt Publishing, 2016.
- T4. Marinescu D C, Cloud Computing Theory and Practice, Morgan Kaufmann (2014).
- T5. Sachin Shetty, Charles A. Kamhoua , Laurent L. Njilla , "Blockchain for Distributed Systems Security", Wiley

Reference Books

R1: Sarika Gupta, "Information and Cyber Security", Khanna Publishing House, Delhi.

R2: Zhou, Honbo. The internet of things in the cloud: A middleware perspective. CRC press, 2012.

R3: Antony Lewis, "The Basics of Bitcoins and Blockchains", Mango Publishing

Course Contents and Lecture Schedule

1	Security of Applications	10 Hours
1.1	Security Considerations in Mobile and Wireless Computing	2 Hours
1.2	Smartphone Security	2 Hours
1.3	Biometrics for Security	2 Hours
1.4	Security of Electronic Mail Systems	2 Hours
1.5	Security of Electronic Commerce	2 Hours
2	Storage Security	8 Hours
2.1	Securing the storage Infrastructure - Information Security Framework,	1 Hour
2.2	Risk Triad	1 Hour
2.3	Storage Security Domains	2 Hours
2.4	Security Implementation in Storage Networking	2 Hours
2.5	Securing Storage Infrastructure in virtualized and Cloud Environments	1 Hour
2.6	RSA and VMware Security Products.	1 Hour
3	IoT Security	9 hrs
3.1	Introduction: IoT and cyber-physical systems.	1 Hour
3.2	IoT security (vulnerabilities, attacks, and countermeasures)- Common IoT attack types-Attack trees-Building an attack tree.	2 Hours
3.3	Security engineering for IoT development-Secure design-Safety and security design.	1 Hour
3.4	IoT security lifecycle-The secure IoT system implementation lifecycle - Implementation and integration-IoT security CONOPS document.	2 Hours
3.5	Network and security integration.	1 Hour

3.6	System security verification and validation (V&V)	1 Hour
3.7	Security training-Secure configurations	1 Hour
4	Cloud Security	8 hrs
4.1	Introduction to Cloud and Virtualization, Cloud Security - Cloud Security Risks-Security: The top concern for cloud users-Privacy and privacy impact assessment	2 Hours
4.2	Trust, Operating System Security	1 Hour
4.3	VM Security	1 Hour
4.4	Security of Virtualization	2 Hours
4.5	Security Risks Posed by Shared Images	1 Hour
4.6	Security Risks Posted by Management OS	1 Hour
5	Distributed Systems Security	10 hrs
5.1	Introduction to Distributed systems and Blockchain - Blockchain Overview, Blockchain Building Blocks	2 Hours
5.2	Blockchain Commercial Use cases	1 Hour
5.3	Blockchain Military Cyber Operations Use cases, Blockchain Challenges	1 Hour
5.4	Overview of Attack Surfaces in Blockchain - Overview of Blockchain and its Operations	1 Hour
5.5	Blockchain Attacks	1 Hour
5.6	Blockchain's Peer to Peer System	1 Hour
5.7	Application Oriented Attacks	1 Hour
5.8	A Blockchain-based Solution to Automotive Security and Privacy	1 Hour
5.9	The Proposed Framework, Applications.	1 Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT398	EMBEDDED SYSTEM	VAC	3	1	0	4

Preamble: Embedded Systems course is intended to deliver students the concepts of embedded hardware and software. It also helps them to develop embedded systems using Raspberry Pi and Arduino.

Prerequisites:

- Basics of Computer programming,
- ITT296 Microprocessor and Microcontroller programming,
- ITT397 Advanced Computer Architecture

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO1	Discuss the concepts of embedded systems, micro controllers and sensors	Level2: Understand
CO2	Describe examples of embedded systems, buses, protocol and ARM Processors	Level 2: Understand
CO3	Implement embedded system design techniques and software development tools	Level 3: Apply
CO4	Apply the basic concepts of real time operating systems using Raspberry Pi.	Level 3: Apply
CO5	Develop small or medium scale embedded systems using Arduino	Level 3: Apply

Mapping of course outcomes with program outcomes

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	1	-	-	2	1	-	-	-	-	-
CO2	3	3	3	-	2	2	2	-	-	-	-	2
CO3	3	3	3	-	2	2	1	-	-	-	-	2
CO4	3	3	3	-	3	2	2	-	3	2	2	3
CO5	3	3	3	-	3	3	2	-	3	2	2	3

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Test		End Semester Examination
	Test 1(Marks)	Test 2(Marks)	
Remember	15	15	30
Understand	30	15	30
Apply	5	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. With the help of a diagram explain the generic model of an embedded system.
2. Working principle of sensors.

Course Outcome 2 (CO2):

1. Describe examples of embedded systems.
2. Explain buses and protocols in Embedded systems.

Course Outcome 3 (CO3):

1. Describe the importance of design techniques in the development of embedded systems.
2. How software development tools helps in embedded programming.
3. Consider an embedded system-GPS moving map that displays the map of a terrain around the

users' current position. List the various requirements to design GPS moving map and prepare a requirement form or chart.

Course Outcome 4 (CO4):

1. With an example explain real time scheduling algorithm.
2. Write a program to illustrate reading a button using PI.

Course Outcome 5 (CO5):

1. With an example illustrate Read/write operation for Digital and Analog Input/output.
2. Write an Arduino Sketch to Read/write operation from a digital camera.

Model Question Paper

Course Code: ITT398
Course Name: EMBEDDED SYSTEM

Max.Marks:100 **Duration: 3 Hour**

PART A
(Each question carries 3 Marks) (10*3=30)

- 1.Explain the features of embedded system.
- 2.Briefly discuss about the working principle of IR sensor.
- 3.Define buses and protocol.
- 4.List any 3 applications of embedded system.
- 5.Why it is said that a requirement bug is more costlier than a coding bug?
- 6.Explain the difference between emulator and simulator.
7. Write example for hard, soft and firm real time tasks.
- 8.Differentiate Arduino and Raspberry Pi.
- 9.Make a program that light up LED in any pattern.
- 10.Write an Arduino sketch to read a RF Id tag

PART B
(Each full question carries 14 marks) (5*14=70)

11. a) What are the merits of embedded systems? (7 marks)

b) Distinguish control interface and data interface for an ADC. (7 marks)

OR

12. a) Explain the working of range and temperature sensor. (8 marks)

b) What are the factors to be considered for low power design of embedded systems? (6 marks)

13. a) The content of some registers are given as: R1=0xEF00DE12, R2=0x0456123F, R5=4, r6=28 Find the result when following instructions are executed?

i) LSL R1,#8

ii) ASR R1,R5

iii) ROR R2,R6

iv) LSR R2,#5

(8 marks)

b) With a neat diagram explain fundamental blocks of a mobile phone and explain the function of each block (6 marks)

OR

14. a) With diagram explain Following buses

i) SPI

ii) USB.

(8 marks)

b) Explain ARM Processor's Memory Organization with neat diagram.

(6 marks)

15. a) Consider an embedded system-GPS moving map that displays the map of a terrain around the users' current position. List the various requirements to design GPS moving map and prepare a requirement form or chart. (7 marks)

b) Explain the embedded program development environment.

(7 marks)

OR

16. a) Discuss how quality is assured by verifying specification. (7 marks)

b) Discuss Software Development Tools used in embedded systems. (7 marks)

17. a) Explain Inter process Communication Mechanisms. With example. (7 marks)

b) What are the general characteristics that make Raspberry Pi become popular in market. (7 marks)

OR

18. a) Explain about Real time scheduling algorithms. (7 marks)

b) Design a lamp timer using Raspberry Pi and schedule the timer using Cron utility such that lamp is switched ON at 10pm and Switched OFF at 5pm only for weekends . (7 marks)

19. a) Write an Arduino sketch to display only EVEN numbers using 7 segments display in common anode connection. (7 marks)

b) A manufacturer wants to design a new safety feature into their cars. The safety feature simply alerts the driver if the speed of the car exceeds 100 km/h by beeping a buzzer constantly until the speed drops below 100 km/h again. Develop a project, suitable for an Arduino that implements the functionality required by the manufacturer. Assume that the speedometer of the car is connected to ADC pin 5 of the Arduino and the buzzer is connected to digital pin 13. The range of the speedometer is from 0 km/h to 140km/h where:

☐ 0 km/h represents an ADC value of 0

☐ 140 km/h represents an ADC value of 1023

(7 marks)

OR

20. a) Write an Arduino program for Getting Location from a GPS. (7 marks)

- b) Write an Arduino program that light up LED from top to bottom and then goes backward with only one LED is ON at any time. (7 marks)

Syllabus

Module 1: Embedded Systems-Introduction (10 hours)
Embedded Systems-Introduction, Features, Model, Merits, Classification. The Hardware Point of View- Microcontroller Unit, 8 bit MCU, Memory for Embedded System-Flash memory, Low Power Design Sensors, ADCs and Actuators-Temperature Sensors, Light Sensors, Range Sensors, Humidity Sensors, Other Sensors, Analog to Digital Converters, Actuators.
Module 2: ARM Processor,Buses and Protocols (10 hours)
ARM Processor- Processor and Memory Organization, Data Operations, Flow of Control Buses and Protocols – Defining Buses and Protocols, On-board buses for Embedded Systems, External Buses, Automotive Buses Examples of Embedded Systems –Automotive Electronics, RFID, Robotics, Brain Machine Interface
Module 3: Embedded Systems Design Techniques and Software Development Tools (7 hours)
Embedded Systems Design Techniques – Design Methodologies, Requirements Analysis, Specifications, System Analysis and Architecture Design, Quality Assurance, Design Examples Software Development Tools-Embedded program development, Downloading the hexfile to Non-volatile memory- Emulator- Hardware simulator.
Module 4: RTOS and Raspberry Pi (9 hours)
Real Time Operating Systems, Real time Scheduling algorithms-RM,EDF Inter process Communication Mechanisms Raspberry Pi – Introduction, Python and Raspberry Pi, Arduino and Raspberry Pi, Basic Input and Output, Programming Inputs and Outputs with Python
Module 5: Interfacing of micro-controllers (9 hours)
Arduino – Introduction-Making the Sketch Simple Digital and Analog Input-Using a Switch, Reading a Keypad, Reading Analog Values Getting Input from Sensors-Detecting Movement, light, motion, distance, vibration, sound and temperature Reading RFID Tags, Getting Location from a GPS Visual Output-Connecting and Using LEDs Physical Output-Controlling the Position of a Servo Remotely Controlling External Devices-Controlling a Digital Camera

Text Books

1. Embedded Systems : An Integrated Approach -Lyla B Das, Pearson Education, 2013
2. Getting Started With Raspberry Pi-Matt Richardson, Shawn Wallace, O'Reilly, 2013
3. Arduino Cookbook -Michael Margolis, O'Reilly, 2011
4. Modern Embedded Computing -Peter Barry, Patrick Crowley, Morgan Kaufmann 2012
5. Computers as Components : Principles of Embedded Computing System Design -Wayne Wolf, Elsevier

Reference Books

1. Embedded Systems- Architecture Programming and design -Raj Kamal , McGraw-Hill, second edition
2. Introduction to Arduino Alan G. Smith , CreateSpace Independent Publishing Platform , 2011

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Embedded Systems-Introduction	10 Hours
1.1	Embedded Systems-Introduction, Features	1 Hour
1.2	Embedded Systems-Model, Merits, Classification.	1 Hour
1.3	The Hardware Point of View- Microcontroller Unit,	1 Hour
1.4	Memory for Embedded System-Flash memory	1 Hour
1.5	8 bit MCU	1 Hour
1.6	Low Power Design	1 Hour
1.7	Sensors -Temperature Sensors, Light Sensors	1 Hour
1.8	Sensors-Range Sensors, Humidity Sensors, Other Sensors,	1 Hour
1.9	Actuators	1 Hour
1.10	Analog to Digital Converters	1 Hour
2	ARM Processor,Buses and Protocols	10 Hours
2.1	ARM Processor- Processor and Memory Organization	1 Hour
2.2	ARM-Data Operations	1 Hour
2.3	ARM- Flow of Control	1 Hour

2.4	Buses and Protocols – Defining Buses and Protocols	1 Hour
2.5	On-board buses for Embedded Systems	1 Hour
2.6	External Buses	1 Hour
2.7	Automotive Buses	1 Hour
2.8	Examples of Embedded Systems –Automotive Electronics	1 Hour
2.9	RFID, Robotics	1 Hour
2.10	Brain Machine Interface	1 Hour
3	Embedded Systems Design Techniques and Software Development Tools	7 Hours
3.1	Embedded Systems Design Techniques	1 Hour
3.2	Design Methodologies, Requirements Analysis and Architecture	1 Hour
3.3	Specifications, System Analysis	1 Hour
3.4	Quality Assurance, Design Examples	1 Hour
3.5	Software Development Tools-Embedded program development	1 Hour
3.6	Downloading the hexfile to Non-volatile memory	1 Hour
3.7	Emulator- Hardware simulator	1 Hour
4	RTOS and Raspberry Pi	9 Hours
4.1	Real Time Operating Systems	1 Hour
4.2	Real time Scheduling algorithms-RM	1 Hour
4.3	Real time Scheduling algorithms-EDF	2 Hours
4.4	Inter process Communication Mechanisms	2 Hours
4.5	Raspberry Pi – Introduction	1 Hour
4.6	Python and Raspberry Pi, Arduino and Raspberry Pi	1 Hour
4.7	Basic Input and Output, Programming Inputs and Outputs with Python	1 Hour
5	Interfacing of micro-controllers	9 Hours
5.1	Arduino – Introduction-Making the Sketch	1 Hour
5.2	Simple Digital and Analog Input-Using a Switch	2 Hours
5.3	Reading a Keypad, Reading Analog Values	1 Hour
5.5	Reading RFID Tags, Getting Location from a GPS	2 Hours
5.6	Visual Output-Connecting and Using LEDs	1 Hour
5.7	Physical Output-Controlling the Position of a Servo	1 Hour
5.8	Remotely Controlling External Devices-Controlling a Digital	1 Hour

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

COMMON COURSES

(S5 & S6)

Estd.



2014

MCN 301	DISASTER MANAGEMENT	Category	L	T	P	CREDIT	YEAR OF INTRODUCTION
		Non - Credit	2	0	0	Nil	2019

Preamble: The objective of this course is to introduce the fundamental concepts of hazards and disaster management.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	Define and use various terminologies in use in disaster management parlance and organise each of these terms in relation to the disaster management cycle (Cognitive knowledge level: Understand).
CO2	Distinguish between different hazard types and vulnerability types and do vulnerability assessment (Cognitive knowledge level: Understand).
CO3	Identify the components and describe the process of risk assessment, and apply appropriate methodologies to assess risk (Cognitive knowledge level: Understand).
CO4	Explain the core elements and phases of Disaster Risk Management and develop possible measures to reduce disaster risks across sector and community (Cognitive knowledge level: Apply)
CO5	Identify factors that determine the nature of disaster response and discuss the various disaster response actions (Cognitive knowledge level: Understand).
CO6	Explain the various legislations and best practices for disaster management and risk reduction at national and international level (Cognitive knowledge level: Understand).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2				2				2		2
CO2	2	3	2		2	2	3			3		2
CO3	2	3	2	2	2	2	3			3		2
CO4	3	3	3		2	2	3					2
CO5	3	3			2	2	3					2
CO6	3					2	3	3				2

Abstract POs defined by National Board of Accreditation			
PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	30
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment - Test : 25 marks

Continuous Assessment - Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A.

Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

MCN 301 Disaster Management

Module 1

Systems of earth

Lithosphere- composition, rocks, soils; Atmosphere-layers, ozone layer, greenhouse effect, weather, cyclones, atmospheric circulations, Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere

Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counselling, needs assessment.

Module 2

Hazard types and hazard mapping; Vulnerability types and their assessment- physical, social, economic and environmental vulnerability.

Disaster risk assessment –approaches, procedures

Module 3

Disaster risk management -Core elements and phases of Disaster Risk Management

Measures for Disaster Risk Reduction – prevention, mitigation, and preparedness.

Disaster response- objectives, requirements; response planning; types of responses.

Relief; international relief organizations.

Module 4

Participatory stakeholder engagement; Disaster communication- importance, methods, barriers; Crisis counselling

Capacity Building: Concept – Structural and Non-structural Measures, Capacity Assessment; Strengthening Capacity for Reducing Risk

Module 5

Common disaster types in India; Legislations in India on disaster management; National disaster management policy; Institutional arrangements for disaster management in India.

The Sendai Framework for Disaster Risk Reduction- targets, priorities for action, guiding principles

Reference Text Book

1. R. Subramanian, Disaster Management, Vikas Publishing House, 2018
2. M. M. Sulphery, Disaster Management, PHI Learning, 2016
3. UNDP, Disaster Risk Management Training Manual, 2016
4. United Nations Office for Disaster Risk Reduction, Sendai Framework for Disaster Risk Reduction 2015-2030, 2015

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?
2. What are disasters? What are their causes?
3. Explain the different types of cyclones and the mechanism of their formation
4. Explain with examples, the difference between hazard and risk in the context of disaster management
5. Explain the following terms in the context of disaster management (a) exposure (b) resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment

Course Outcome 2 (CO2):

1. What is hazard mapping? What are its objectives?
2. What is participatory hazard mapping? How is it conducted? What are its advantages?
3. Explain the applications of hazard maps
4. Explain the types of vulnerabilities and the approaches to assess them

Course Outcome 3 (CO3):

1. Explain briefly the concept of 'disaster risk'

2. List the strategies for disaster risk management ‘before’, ‘during’ and ‘after’ a disaster
3. What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy

Course Outcome 4 (CO4):

1. What is disaster prevention? Distinguish it from disaster mitigation giving examples
2. What are the steps to effective disaster communication? What are the barriers to communication?
3. Explain capacity building in the context of disaster management

Course Outcome 5 (CO5):

1. Briefly explain the levels of stakeholder participation in the context of disaster risk reduction
2. Explain the importance of communication in disaster management
3. Explain the benefits and costs of stakeholder participation in disaster management
4. How are stakeholders in disaster management identified?

Course Outcome 6 (CO6):

1. Explain the salient features of the National Policy on Disaster Management in India
2. Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction
3. What are Tsunamis? How are they caused?
4. Explain the earthquake zonation of India

Model Question paper

QP CODE:

PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MCN 301

Course Name: Disaster Management

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?
2. What are disasters? What are their causes?
3. What is hazard mapping? What are its objectives?
4. Explain briefly the concept of 'disaster risk'
5. List the strategies for disaster risk management 'before', 'during' and 'after' a disaster
6. What is disaster prevention? Distinguish it from disaster mitigation giving examples
7. Briefly explain the levels of stakeholder participation in the context of disaster risk reduction
8. Explain the importance of communication in disaster management
9. What are Tsunamis? How are they caused?
10. Explain the earthquake zonation of India

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. a. Explain the different types of cyclones and the mechanism of their formation [10]
b. Explain with examples, the difference between hazard and risk in the context of disaster management [4]

OR

12. Explain the following terms in the context of disaster management [14]
(a) exposure (b) resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment

13. a. What is participatory hazard mapping? How is it conducted? What are its advantages? [8]
b. Explain the applications of hazard maps [6]

OR

14. Explain the types of vulnerabilities and the approaches to assess them [14]
15. a. Explain the core elements of disaster risk management [8]
b. Explain the factors that decide the nature of disaster response [6]

OR

16. a. What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy [6]
b. Explain the different disaster response actions [8]
17. a. Explain the benefits and costs of stakeholder participation in disaster management [10]
b. How are stakeholders in disaster management identified? [4]

OR

18. a. What are the steps to effective disaster communication? What are the barriers to communication? [7]
b. Explain capacity building in the context of disaster management [7]

19. Explain the salient features of the National Policy on Disaster Management in India

[14]

OR

20. Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction

[14]

Teaching Plan

	Module 1	5 Hours
1.1	Introduction about various Systems of earth, Lithosphere-composition, rocks, Soils; Atmosphere-layers, ozone layer, greenhouse effect, weather	1 Hour
1.2	Cyclones, atmospheric circulations, Indian Monsoon; hydrosphere-Oceans, inland water bodies; biosphere	1 Hour
1.3	Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard,	1 Hour
1.4	Exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, Disaster risk management, early warning systems	1 Hour
1.5	Disaster preparedness, disaster prevention, disaster, Mitigation, disaster response, damage assessment, crisis counselling, needs assessment.	1 Hour
	Module 2	5 Hours
2.1	Various Hazard types, Hazard mapping; Different types of Vulnerability types and their assessment	1 Hour
2.2	Vulnerability assessment and types, Physical and social vulnerability	1 Hour
2.3	Economic and environmental vulnerability, Core elements of disaster risk assessment	1 Hour
2.4	Components of a comprehensive disaster preparedness strategy approaches, procedures	1 Hour
2.5	Different disaster response actions	1 Hour
	Module 3	5 Hours
3.1	Introduction to Disaster risk management, Core elements of Disaster Risk Management	1 Hour
3.2	Phases of Disaster Risk Management, Measures for Disaster Risk Reduction	1 Hour
3.3	Measures for Disaster prevention, mitigation, and preparedness.	1 Hour

3.4	Disaster response- objectives, requirements. Disaster response planning; types of responses.	1 Hour
3.5	Introduction- Disaster Relief, Relief; international relief organizations.	1 Hour
	Module 4	5 Hours
4.1	Participatory stakeholder engagement	1 Hour
4.2	Importance of disaster communication.	1 Hour
4.3	Disaster communication- methods, barriers. Crisis counselling	1 Hour
4.4	Introduction to Capacity Building. Concept – Structural Measures, Non-structural Measures.	1 Hour
4.5	Introduction to Capacity Assessment, Capacity Assessment; Strengthening, Capacity for Reducing Risk	1 Hour
	Module 5	5 Hours
5.1	Introduction-Common disaster types in India.	1 Hour
5.2	Common disaster legislations in India on disaster management	1 Hour
5.3	National disaster management policy, Institutional arrangements for disaster management in India.	1 Hour
5.4	The Sendai Framework for Disaster Risk Reduction and targets	1 Hour
5.5	The Sendai Framework for Disaster Risk Reduction-priorities for action, guiding principles	1 Hour

HUT 300	Industrial Economics & Foreign Trade	Category	L	T	P	CREDIT
		HSMC	3	0	0	3

Preamble: To equip the students to take industrial decisions and to create awareness of economic environment.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	Explain the problem of scarcity of resources and consumer behaviour, and to evaluate the impact of government policies on the general economic welfare. (Cognitive knowledge level: Understand)
CO2	Take appropriate decisions regarding volume of output and to evaluate the social cost of production. (Cognitive knowledge level: Apply)
CO3	Determine the functional requirement of a firm under various competitive conditions. (Cognitive knowledge level: Analyse)
CO4	Examine the overall performance of the economy, and the regulation of economic fluctuations and its impact on various sections in the society. (Cognitive knowledge level: Analyse)
CO5	Determine the impact of changes in global economic policies on the business opportunities of a firm. (Cognitive knowledge level: Analyse)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2										3	
CO2	2	2			2	2	3				3	
CO3	2	2	1								3	
CO4	2	2	1			1					3	
CO5	2	2	1								3	

Abstract POs defined by National Board of Accreditation			
PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	20	20	40
Apply	15	15	30

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment - Test (2 numbers)	: 25 marks
Continuous Assessment - Assignment	: 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B.

Part A	: 30 marks
Part B	: 70 marks

Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 3 sub-divisions and carries 14 marks.

SYLLABUS

HUT 300 Industrial Economics & Foreign Trade

Module 1 (Basic Concepts and Demand and Supply Analysis)

Scarcity and choice - Basic economic problems- PPC – Firms and its objectives – types of firms – Utility – Law of diminishing marginal utility – Demand and its determinants – law of demand – elasticity of demand – measurement of elasticity and its applications – Supply, law of supply and determinants of supply – Equilibrium – Changes in demand and supply and its effects – Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.

Module 2 (Production and cost)

Production function – law of variable proportion – economies of scale – internal and external economies – Isoquants, isocost line and producer's equilibrium – Expansion path – Technical progress and its implications – Cobb-Douglas production function - Cost concepts – Social cost: private cost and external cost – Explicit and implicit cost – sunk cost - Short run cost curves - long run cost curves – Revenue (concepts) – Shutdown point – Break-even point.

Module 3 (Market Structure)

Perfect and imperfect competition – monopoly, regulation of monopoly, monopolistic completion (features and equilibrium of a firm) – oligopoly – Kinked demand curve – Collusive oligopoly (meaning) – Non-price competition – Product pricing – Cost plus pricing – Target return pricing – Penetration pricing – Predatory pricing – Going rate pricing – Price skimming.

Module 4 (Macroeconomic concepts)

Circular flow of economic activities – Stock and flow – Final goods and intermediate goods - Gross Domestic Product - National Income – Three sectors of an economy- Methods of measuring national income – Inflation- causes and effects – Measures to control inflation- Monetary and fiscal policies – Business financing- Bonds and shares -Money market and Capital market – Stock market – Demat account and Trading account - SENSEX and NIFTY.

Module 5 (International Trade)

Advantages and disadvantages of international trade - Absolute and Comparative advantage theory - Heckscher - Ohlin theory - Balance of payments – Components – Balance of Payments

deficit and devaluation – Trade policy – Free trade versus protection – Tariff and non-tariff barriers.

Reference Materials

1. Gregory N Mankiw, 'Principles of Micro Economics', Cengage Publications
2. Gregory N Mankiw, 'Principles of Macro Economics', Cengage Publications
3. Dwivedi D N, 'Macro Economics', Tata McGraw Hill, New Delhi.
4. Mithani D M, 'Managerial Economics', Himalaya Publishing House, Mumbai.
5. Francis Cherunilam, 'International Economics', McGraw Hill, New Delhi.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Why does the problem of choice arise?
2. What are the central problems?
3. How do we solve the basic economic problems?
4. What is the relation between price and demand?
5. Explain deadweight loss due to the imposition of a tax.

Course Outcome 2 (CO2):

1. What is shutdown point?
2. What do you mean by producer equilibrium?
3. Explain break-even point;
4. Suppose a chemical factory is functioning in a residential area. What are the external costs?

Course Outcome 3 (CO3):

1. Explain the equilibrium of a firm under monopolistic competition.
2. Why is a monopolist called price maker?
3. What are the methods of non-price competition under oligopoly?

4. What is collusive oligopoly?

Course Outcome 4 (CO4):

1. What is the significance of national income estimation?
2. How is GDP estimated?
3. What are the measures to control inflation?
4. How does inflation affect fixed income group and wage earners?

Course Outcome 5 (CO5):

1. What is devaluation?
2. Suppose a foreign country imposes a tariff on Indian goods. How does it affect India's exports?
3. What is free trade?
4. What are the arguments in favour of protection?

Model Question paper

QP CODE:

PAGES:3

Reg No:_____

Name :_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIFTH /SIXTH SEMESTER
B.TECH DEGREE EXAMINATION, MONTH & YEAR**

Course Code: HUT 300

Course Name: Industrial Economics & Foreign Trade

Max.Marks:100

Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

1. Why does an economic problem arise?
2. What should be the percentage change in price of a product if the sale is to be increased by 50 percent and its price elasticity of demand is 2?
3. In the production function $Q = 2L^{1/2}K^{1/2}$ if $L=36$ how many units of capital are needed to produce 60 units of output?
4. Suppose in the short run $AVC < P < AC$. Will this firm produce or shut down? Give reason.
5. What is predatory pricing?
6. What do you mean by non- price competition under oligopoly?
7. What are the important economic activities under primary sector?
8. Distinguish between a bond and share?
9. What are the major components of balance of payments?

10. What is devaluation?

(10 x 3 = 30 marks)

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Prepare a utility schedule showing units of consumption, total utility and marginal utility, and explain the law of diminishing marginal utility. Point out any three limitations of the law.
- b) How is elasticity of demand measured according to the percentage method? How is the measurement of elasticity of demand useful for the government?

Or

12. a) Explain the concepts consumer surplus and producer surplus.
- b) Suppose the government imposes a tax on a commodity where the tax burden is met by the consumers. Draw a diagram and explain dead weight loss. Mark consumer surplus, producer surplus, tax revenue and dead weight loss in the diagram.

MODULE II

13. a) What are the advantages of large-scale production?
- b) Explain Producer equilibrium with the help of isoquants and isocost line. What is expansion path?

Or

14. a) Explain break-even analysis with the help of a diagram.
- b) Suppose the monthly fixed cost of a firm is Rs. 40000 and its monthly total variable cost is Rs. 60000.
- If the monthly sales is Rs. 120000 estimate contribution and break-even sales.
 - If the firm wants to get a monthly profit of Rs.40000, what should be the sales?
- c) The total cost function of a firm is given as $TC=100+50Q - 11Q^2+Q^3$. Find marginal cost when output equals 5 units.

MODULE III

15. a) What are the features of monopolistic competition?
b) Explain the equilibrium of a firm earning supernormal profit under monopolistic competition.

Or

16. a) Make comparison between perfect competition and monopoly.
b) Explain price rigidity under oligopoly with the help of a kinked demand curve.

MODULE IV

17. a) How is national income estimated under product method and expenditure method?
b) Estimate GDPmp, GNPmp and National income

Private consumption expenditure	= 2000 (in 000 cores)
Government Consumption	= 500
NFIA	= -(300)
Investment	= 800
Net=exports	=700
Depreciation	= 400
Net-indirect tax	= 300

Or

18. a) What are the monetary and fiscal policy measures to control inflation?
b) What is SENSEX?

MODULE V

19. a) What are the advantages of disadvantages of foreign trade?
b) Explain the comparative cost advantage.

Or

20. a) What are the arguments in favour protection?
b) Examine the tariff and non-tariff barriers to international trade.

(5 × 14 = 70 marks)

Teaching Plan

Module 1 (Basic concepts and Demand and Supply Analysis)		7 Hours
1.1	Scarcity and choice – Basic economic problems - PPC	1 Hour
1.2	Firms and its objectives – types of firms	1 Hour
1.3	Utility – Law of diminishing marginal utility – Demand – law of demand	1 Hour
1.4	Measurement of elasticity and its applications	1 Hour
1.5	Supply, law of supply and determinants of supply	1 Hour
1.6	Equilibrium – changes in demand and supply and its effects	1 Hour
1.7	Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.	1 Hour
Module 2 (Production and cost)		7 Hours
2.1	Productions function – law of variable proportion	1 Hour
2.2	Economies of scale – internal and external economies	1 Hour
2.3	producers equilibrium – Expansion path	1 Hour
2.4	Technical progress and its implications – cob Douglas Production function	1 Hour
2.5	Cost concepts – social cost: private cost and external cost – Explicit and implicit cost – sunk cost	1 Hour
2.6	Short run cost curves & Long run cost curves	1 Hour
2.7	Revenue (concepts) – shutdown point – Break-even point.	1 Hour
Module 3 (Market Structure)		6 hours
3.1	Equilibrium of a firm, MC – MR approach and TC – TR approach	1 Hour
3.2	Perfect competition & Imperfect competition	1 Hour
3.3	Monopoly – Regulation of monopoly – Monopolistic competition	1 Hour
3.4	Oligopoly – kinked demand curve	1 Hour
3.5	Collusive oligopoly (meaning) – Non price competition	1 Hour
3.6	Cost plus pricing – Target return pricing – Penetration, Predatory pricing – Going rate pricing – price skimming	1 Hour

Module 4 (Macroeconomic concepts)		7 Hours
4.1	Circular flow of economic activities	1 Hour
4.2	Stock and flow – Final goods and intermediate goods – Gross Domestic Product - National income – Three sectors of an economy	1 Hour
4.3	Methods of measuring national income	1 Hour
4.4	Inflation – Demand pull and cost push – Causes and effects	1 Hour
4.5	Measures to control inflation – Monetary and fiscal policies	1 Hour
4.6	Business financing – Bonds and shares – Money market and capital market	1 Hour
4.7	Stock market – Demat account and Trading account – SENSEX and NIFTY	1 Hour
Module 5 (International Trade)		8 Hours
5.1	Advantages and disadvantages of international trade	1 Hour
5.2	Absolute and comparative advantage theory	2 Hour
5.3	Heckscher – Ohlin theory	1 Hour
5.4	Balance of payments - components	1 Hour
5.5	Balance of payments deficit and devaluation	1 Hour
5.6	Trade policy – Free trade versus protection	1 Hour
5.7	Tariff and non tariff barriers.	1 Hour

HUT 310	Management for Engineers	Category	L	T	P	Credit
		HMC	3	0	0	3

Preamble: This course is intended to help the students to learn the basic concepts and functions of management and its role in the performance of an organization and to understand various decision-making approaches available for managers to achieve excellence. Learners shall have a broad view of different functional areas of management like operations, human resource, finance and marketing.

Prerequisite: Nil

Course Outcomes After the completion of the course the student will be able to

CO1	Explain the characteristics of management in the contemporary context (Cognitive Knowledge level: Understand).
CO2	Describe the functions of management (Cognitive Knowledge level: Understand).
CO3	Demonstrate ability in decision making process and productivity analysis (Cognitive Knowledge level: Understand).
CO4	Illustrate project management technique and develop a project schedule (Cognitive Knowledge level: Apply).
CO5	Summarize the functional areas of management (Cognitive Knowledge level: Understand).
CO6	Comprehend the concept of entrepreneurship and create business plans (Cognitive Knowledge level: Understand).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				1	2	2	2		2	1	1
CO2	2				1	1		2	1	2	1	1
CO3	2	2	2	2	1							
CO4	2	2	2	2	1						2	1
CO5	2					1	1		1	2	1	
CO6		2	2	2	1	1	1	1	1	1	1	1

Abstract POs defined by National Board of Accreditation			
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	Test 1 (Marks in percentage)	Test 2 (Marks in percentage)	End Semester Examination (Marks in percentage)
Remember	15	15	30
Understand	15	15	30
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 Hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment - Test : 25 marks

Continuous Assessment - Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

HUT 310 Management for Engineers (35 hrs)

Module 1 (Introduction to management Theory- 7 Hours)

Introduction to management theory, Management Defined, Characteristic of Management, Management as an art-profession, System approaches to Management, Task and Responsibilities of a professional Manager, Levels of Manager and Skill required.

Module 2 (management and organization- 5 hours)

Management Process, Planning types , Mission, Goals, Strategy, Programmes, Procedures, Organising, Principles of Organisation, Delegation, Span of Control, Organisation Structures, Directing, Leadership, Motivation, Controlling..

Module 3 (productivity and decision making- 7 hours)

Concept of productivity and its measurement; Competitiveness; Decision making process; decision making under certainty, risk and uncertainty; Decision trees; Models of decision making.

. Module 4 (project management- 8 hours)

Project Management, Network construction, Arrow diagram, Redundancy. CPM and PERT Networks, Scheduling computations, PERT time estimates, Probability of completion of project, Introduction to crashing.

Module 5 (functional areas of management- 8 hours)

Introduction to functional areas of management, Operations management, Human resources management, Marketing management, Financial management, Entrepreneurship, Business plans, Corporate social responsibility, Patents and Intellectual property rights.

References:

1. H. Koontz, and H. Weihrich, Essentials of Management: An International Perspective. 8th ed., McGraw-Hill, 2009.
2. P C Tripathi and P N Reddy, Principles of management, TMH, 4th edition, 2008.
3. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, Marketing Management: A South Asian Perspective. 14th ed., Pearson, 2012.
4. M. Y. Khan, and P. K. Jain, Financial Management, Tata-McGraw Hill, 2008.
5. R. D. Hisrich, and M. P. Peters, Entrepreneurship: Strategy, Developing, and Managing a New Enterprise, 4th ed., McGraw-Hill Education, 1997.
6. D. J. Sumanth, Productivity Engineering and Management, McGraw-Hill Education, 1985.
7. K.Ashwathappa, 'Human Resources and Personnel Management', TMH, 3rd edition, 2005.
8. R. B. Chase, Ravi Shankar and F. R. Jacobs, Operations and Supply Chain Management, 14th ed. McGraw Hill Education (India), 2015.

Sample Course Level Assessment Questions

Course Outcome1 (CO1): Explain the systems approach to management?

Course Outcome 2 (CO2): Explain the following terms with a suitable example Goal, Objective, and Strategy.

Course Outcome 3 (CO3): Mr. Shyam is the author of what promises to be a successful novel. He has the option to either publish the novel himself or through a publisher. The publisher is offering Mr. Shyam Rs. 20,000 for signing the contract. If the novel is successful, it will sell 200,000 copies. Else, it will sell 10,000 copies only. The publisher pays a Re. 1 royalty per copy. A market survey indicates that there is a 70% chance that the novel will be successful. If Mr. Shyam undertakes publishing, he will incur an initial cost of Rs. 90,000 for printing and marketing., but each copy sold will net him Rs. 2. Based on the given information and the

decision analysis method, determine whether Mr. Shyam should accept the publisher's offer or publish the novel himself.

Course Outcome 4 (CO4): Explain the concepts of crashing and dummy activity in project management.

Course Outcome 5 (CO5): Derive the expression for the Economic order quantity (EOQ)?

Course Outcome 6 (CO6): Briefly explain the theories of Entrepreneurial motivation.?

Model Question Paper

QP CODE:

PAGES: 4

Reg No: _____

Name: _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR**

Course Code: HUT 310

Course name: Management for Engineers

Max Marks: 100

Duration: 3 Hours

PART-A (Answer All Questions. Each question carries 3 marks)

1. "Management is getting things done through other." Elaborate.
2. Comment on the true nature of management. Is it a science or an art?
3. Planning is looking ahead and controlling is looking back. Comment with suitable examples
4. Explain the process of communication?
5. Explain the hierarchy of objectives?
6. Explain the types of decisions?
7. Describe the Economic man model?
8. Explain the concepts of crashing and dummy activity in project management.
9. Differentiate the quantitative and qualitative methods in forecasting.
10. What are the key metrics for sustainability measurement? What makes the measurement and reporting of sustainability challenging?

PART-B (Answer any one question from each module)

11. a) Explain the systems approach to management. (10)
b) Describe the roles of a manager (4)

OR

12. a) Explain the 14 principles of administrative management? **(10)**

b) Explain the different managerial skills **(4)**

13. a) What are planning premises, explain the classification of planning premises. **(10)**

b) Distinguish between strategy and policy. How can policies be made effective. **(4)**

OR

14 a) Explain three motivational theories. **(9)**

b) Describe the managerial grid. **(5)**

15. a) Modern forest management uses controlled fires to reduce fire hazards and to stimulate new forest growth. Management has the option to postpone or plan a burning. In a specific forest tract, if burning is postponed, a general administrative cost of Rs. 300 is incurred. If a controlled burning is planned, there is a 50% chance that good weather will prevail and burning will cost Rs. 3200. The results of the burning may be either successful with probability 0.6 or marginal with probability 0.4. Successful execution will result in an estimated benefit of Rs. 6000, and marginal execution will provide only Rs. 3000 in benefits. If the weather is poor, burning will be cancelled incurring a cost of Rs. 1200 and no benefit. i) Develop a decision tree for the problem. (ii) Analyse the decision tree and determine the optimal course of action. **(8)**

b) Student tuition at ABC University is \$100 per semester credit hour. The Education department supplements the university revenue by matching student tuition, dollars per dollars. Average class size for typical three credit course is 50 students. Labour costs are \$4000 per class, material costs are \$20 per student, and overhead cost are \$25,000 per class. (a) Determine the total factor productivity. (b) If instructors deliver lecture 14 hours per week and the semester lasts for 16 weeks, what is the labour productivity? **(6)**

OR

16. a) An ice-cream retailer buys ice cream at a cost of Rs. 13 per cup and sells it for Rs. 20 per cup; any remaining unsold at the end of the day, can be disposed at a salvage price of Rs. 2.5 per cup. Past sales have ranged between 13 and 17 cups per day; there is no reason to believe that

sales volume will take on any other magnitude in future. Find the expected monetary value and EOL, if the sales history has the following probabilities:

(9)

Market Size	13	14	15	16	17
Probability	0.10	0.15	0.15	0.25	0.35

b) At Modern Lumber Company, Kishore the president and a producer of an apple crates sold to growers, has been able, with his current equipment, to produce 240 crates per 100 logs. He currently purchases 100 logs per day, and each log required 3 labour hours to process. He believes that he can hire a professional buyer who can buy a better quality log at the same cost. If this is the case, he increases his production to 260 crates per 100 logs. His labour hours will increase by 8 hours per day. What will be the impact on productivity (measured in crates per labour-hour) if the buyer is hired? What is the growth in productivity in this case?

(5)

17. a) A project has the following list of activities and time estimates:

Activity	Time (Days)	Immediate Predecessors
A	1	-
B	4	A
C	3	A
D	7	A
E	6	B
F	2	C, D
G	7	E, F
H	9	D
I	4	G, H

(a) Draw the network. (b) Show the early start and early finish times. (c) Show the critical path.

(10)

b) An opinion survey involves designing and printing questionnaires, hiring and training personnel, selecting participants, mailing questionnaires and analysing data. Develop the precedence relationships and construct the project network. **(4)**

OR

18. a) The following table shows the precedence requirements, normal and crash times, and normal and crash costs for a construction project:

Activity	Immediate Predecessors	Required Time (Weeks)		Cost (Rs.)	
		Normal	Crash	Normal	Crash
A	-	4	2	10,000	11,000
B	A	3	2	6,000	9,000
C	A	2	1	4,000	6,000
D	B	5	3	14,000	18,000
E	B, C	1	1	9,000	9,000
F	C	3	2	7,000	8,000
G	E, F	4	2	13,000	25,000
H	D, E	4	1	11,000	18,000
I	H, G	6	5	20,000	29,000

Draw the network. (b) Determine the critical path. (c) Determine the optimal duration and the associated cost. **(10)**

b) Differentiate between CPM and PERT. **(4)**

19. a) What is meant by market segmentation and explain the process of market segmentation **(8)**

b) The Honda Co. in India has a division that manufactures two-wheel motorcycles. Its budgeted sales for Model G in 2019 are 80,00,000 units. Honda's target ending inventory is 10,00, 000 units and its beginning inventory is 12, 00, 000 units. The company's budgeted selling price to its distributors and dealers is Rs. 40, 000 per motorcycle. Honda procures all its wheels from an

outside supplier. No defective wheels are accepted. Honda's needs for extra wheels for replacement parts are ordered by a separate division of the company. The company's target ending inventory is 3,00,000 wheels and its beginning inventory is 2,00,000 wheels. The budgeted purchase price is Rs. 1,600 per wheel.

(a) Compute the budgeted revenue in rupees.

(b) Compute the number of motorcycles to be produced.

Compute the budgeted purchases of wheels in units and in rupees.? **(6)**

OR

20. a) a) "Human Resource Management policies and principles contribute to effectiveness, continuity and stability of the organization". Discuss. (b) What is a budget? Explain how sales budget and production budgets are prepared? **(10)**

b) Distinguish between the following: (a) Assets and Liabilities (b) Production concept and Marketing concept (c) Needs and Wants (d) Design functions and Operational control functions in operations **(4)**

Teaching Plan

Sl.No	TOPIC	SESSION
	Module I	
1.1	Introduction to management	1
1.2	Levels of managers and skill required	2
1.3	Classical management theories	3
1.4	neo-classical management theories	4
1.5	modern management theories	5
1.6	System approaches to Management,	6
1.7	Task and Responsibilities of a professional Manager	7
	Module 2	
2.1	Management process – planning	8
2.2	Mission – objectives – goals – strategy – policies – programmes – procedures	9
2.3	Organizing, principles of organizing, organization structures	10
2.4	Directing, Leadership	11
2.5	Motivation, Controlling	12
	Module III	
3.1	Concept of productivity and its measurement Competitiveness	13
3.2	Decision making process;	14
3.3	Models in decision making	15
3.4	Decision making under certainty and risk	16
3.5	Decision making under uncertainty	17
3.6	Decision trees	18
3.7	Models of decision making.	19
	Module IV	
4.1	Project Management	20

Sl.No	TOPIC	SESSION
	Module I	
4.2	Network construction	21
4.3	Arrow diagram, Redundancy	22
4.4	CPM and PERT Networks	23
4.5	Scheduling computations	24
4.6	PERT time estimates	25
4.7	Probability of completion of project	26
4.8	Introduction to crashing	
	Module V	
5.1	Introduction to functional areas of management,	28
5.2	Operations management	29
5.3	Human resources management ,	30
5.4	Marketing management	31
5.5	Financial management	32
5.6	Entrepreneurship,	33
5.7	Business plans	34
5.8	Corporate social responsibility, Patents and Intellectual property rights	35

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VII

KTU



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT401	DATA ANALYTICS	PCC	2	1	0	3

Preamble: This course will equip the learners with the popular technologies used in gathering, storing, manipulating, and analyzing big data. It is designed in such a way that the students will get an exposure to the analytic concepts from basic level to the advanced level.

Prerequisites:

- ITT201 - Data Structures
- ITT 206 - Database Management Systems
- MAT 208 - Probability, Statistics and Advanced Graph theory
- ITT 306 - Data Science

Course Outcomes: After completion of the course the student will be able to:

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe the introductory concepts of data analytics; integrate statistical learning into data analytic processing and tools	Level 2: Understand
CO 2	Summarize the big data concepts, methods, tools and applications; explain the evolution of NoSQL with popular NoSQL products like MongoDB	Level 3: Apply
CO 3	Illustrate the ideas of distributed processing with Hadoop, MapReduce paradigm and related projects namely HBase, Spark, YARN, Hive and Pig	Level 2: Understand
CO 4	Experiment with R language to perform data exploration, wrangling and modelling	Level 3: Apply
CO 5	Analyze how big data techniques could be used in diverse application domains of real world	Level 4: Analyze

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	-	-	-	-	-	-	-	2
CO 2	2	3	3	2	3	-	-	-	-	-	-	2
CO 3	2	2	2	2	3	-	-	-	-	-	-	2
CO 4	2	3	3	3	3	2	-	-	-	2	-	3
CO 5	2	3	3	3	-	3	3	-	-	2	-	3

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	20	15	35
Level 3: Apply	20	15	35
Level 4: Analyse	0	10	10
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. Define data analytics.
2. Describe the different types of data analytics with examples.
3. Illustrate data analytics life cycle.
4. Explain different statistical evaluation methods or tests.

Course Outcome 2 (CO 2):

1. Define big data.
2. List the characteristics of big data and different technologies related to it.
3. Explain the tools NoSQL and MongoDB.
4. Explain how MongoDB can be applied to create, update, and delete documents.

Course Outcome 3 (CO 3):

1. Describe the HDFS framework and interface.
2. Outline the Pig and Hive architecture.
3. Illustrate the anatomy of a YARN application.
4. Compare HBase and Hive.

Course Outcome 4 (CO 4):

1. Explain the basic programming concepts in R.
2. Summarize how ggplot2 and dplyr are applied in visualization of R.
3. List the methods of exploratory data analysis.
4. Explore the ways of tidying data.

Course Outcome 5 (CO 5):

1. Discuss Recommender Systems and its types in detail with a case study of Netflix.
2. Analyze Facebook data to do a case study on citizen centric public services.
3. Analyze uplift modelling with a case study on student dropout in higher education.

Model Question Paper**Course Code: ITT401****Course Name: Data Analytics****Max.Marks :100****Duration: 3 Hrs****Part A*****Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)***

1. What is the relationship between BI and data science?
2. Differentiate between descriptive analytics and predictive analytics.
3. What are the steps involved in big data acquisition?
4. Define web data analysis.
5. Draw the architecture of Hive and explain the services provided by it.
6. How does data flow among clients that interact in HDFS?
7. What is the significance of functions gather() and spread() in tidying data? Illustrate with an example.
8. What does geom_ref_line() do? What package does it come from? Why is displaying a reference line in plots that show residuals useful and important?
9. What do you mean by hybrid filtering? What are the advantages?
10. What are the tools used in social media analytics?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 a With a diagram, explain the various phases of Data Analytics Lifecycle. 10
b What is the significance of ANOVA? 4

OR

- 12 a Describe the following resampling techniques: 10
(i) Cross-Validation (ii) Bootstrapping
b Explain any method to test the difference in sample means of two populations. 4
13 a Explain the process of data pre-processing in big data acquisition. 8
b Write a review about moving data into and out of the database in MongoDB. 6

OR

- 14 a How is cloud computing and IoT related to big data? 8
b Define NoSQL. Explain Key value data stores. 6
15 a Explain the role of MapReduce in Hadoop with a suitable example. 9
b Describe Spark with an example. 5

OR

- 16 a Explain the architecture of HDFS. Discuss on how the MapReduce 7
framework is modified using YARN.
b Discuss on how the MapReduce framework is modified using YARN. 7
17 a Define ggplot2. What are the features provided by ggplot2? What are the 8
problems faced while using ggplot2 and how can we overcome them?
b Write the R code to import a .csv file, examine its contents and generate its 6
descriptive statistics

OR

- 18 a With examples, illustrate how these R functions help in data analysis. 14
• filter()
• arrange()
• summarize()
• mutate()
• select()
19 a Explain the insights for using social media as a platform to improve 9
government–citizen interaction.
b Explain different types of recommender systems. 5

OR

- 20 a Analyze uplift modelling with an appropriate example. 7
b Elaborate on recommender systems with Netflix application. 7

Syllabus

Module 1: Introduction and statistics for data analytics (7 hours)
Introduction and evolution of data analytics - Types of data analytics - Data analytics life cycle - Statistical methods for evaluation – Resampling
Module 2: Big data, IoT, NoSQL technologies (8 hours)
Introduction to big data, Related Technologies- Cloud computing, IoT, Big data generation, Big data acquisition, Big data analysis- methods and tools, Big data applications Non-relational databases -MongoDB
Module 3: Big data processing – Hadoop, Spark, Hive, Pig (8 hours)
Hadoop, HDFS and MR, HBase, Spark, YARN, Hive, Pig
Module 4: R programming for data analytics (7 hours)
R programming basics for data analytics, data import and export, visualization, transformation, exploratory analysis, tidying, modelling
Module 5: Popular data analytics case studies (5 hours)
Recommender systems, social media analytics , churn prediction and uplift modeling with appropriate case studies

Text Books

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley Publishing(1st. ed.). 2015.
2. Thomas Erl, Wajid Khattak, and Paul Buhler. Big Data Fundamentals: Concepts, Drivers & Techniques. Prentice Hall Press, USA.(1st. ed.). 2016.
3. Michael Berthold and David J. Hand. Intelligent Data Analysis: An Introduction Springer-Verlag, Berlin, Heidelberg.(1st. ed.). 1999.
4. Min Chen, Shiwen Mao, Yin Zhang, and Victor C. M. Leung. Big Data: Related Technologies, Challenges and Future Prospects. Springer Publishing Company, Incorporated.2014.
5. Shashank Tiwari. Professional NoSQL.Wrox Press Ltd., GBR. 2011.
6. Kristina Chodorow and Michael Dirolf. Mongo DB: The Definitive Guide. O'Reilly Media, Inc. (1st. ed.). 2010.
7. Tom White. Hadoop: The Definitive Guide. O'Reilly Media, Inc.(4th. ed.). 2015.
8. Hadley Wickham and Garrett Grolemund. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. O'Reilly Media, Inc.(1st. ed.). 2017.
9. Bart Baesens. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications. Wiley Publishing.(1st. ed.). 2014.

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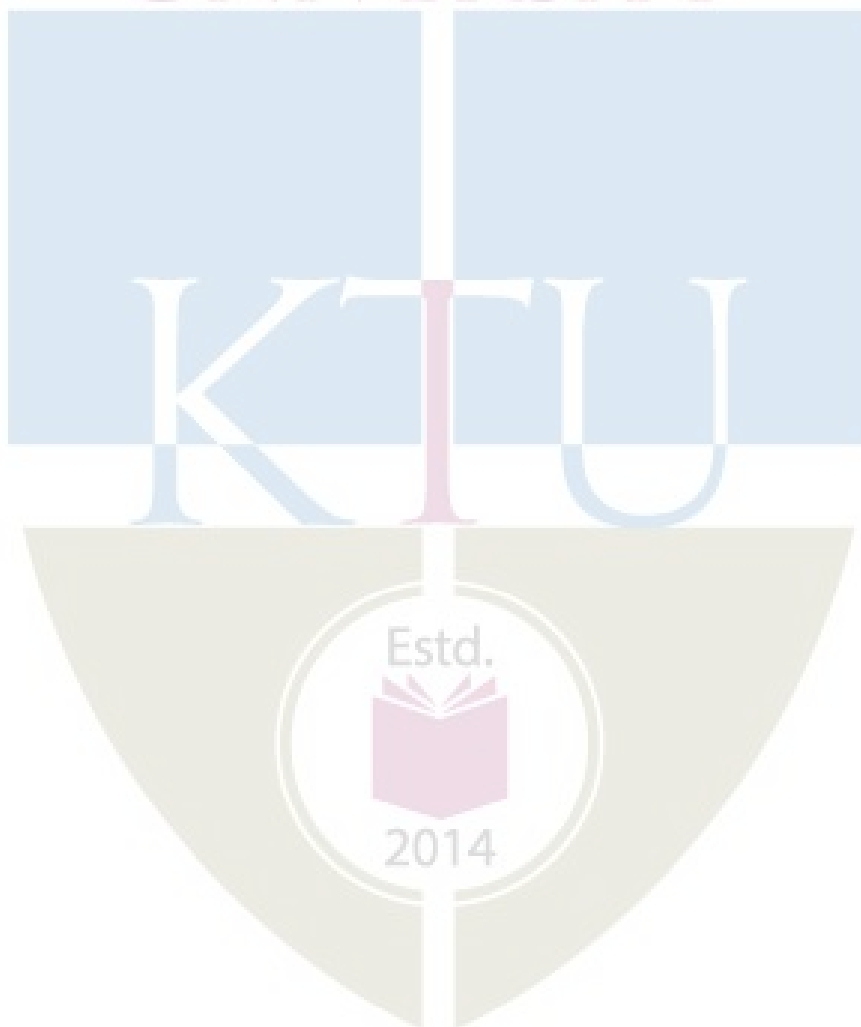
1. Michael Minelli, Michele Chambers, and AmbigaDhiraj. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses. Wiley Publishing.(Wiley CIO) (1st. ed.). 2013.
2. Eelco Plugge, Tim Hawkins, and Peter Membrey. The Definitive Guide to MongoDB: The NoSQL Database for Cloud and Desktop Computing. Apress, USA. (1st. ed.). 2010.
3. Joe Celko. Joe Celko's Complete Guide to NoSQL: What Every SQL Professional Needs to Know about Non-Relational Databases. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA. (1st. ed.). 2013.
4. Benjamin Bengfort and Jenny Kim. Data Analytics with Hadoop: An Introduction for Data Scientists. O'Reilly Media, Inc. (1st. ed.). 2016.
5. Brett Lantz. Machine Learning with R. Packt Publishing. (2nd. ed.). 2015.
6. The R Manuals - <https://cran.r-project.org/manuals.html>
7. Carlos A. Gomez-Urbe and Neil Hunt. (2016). *The Netflix Recommender System: Algorithms, Business Value, and Innovation*. ACM Trans. Manage. Inf. Syst. 6, 4, Article 13 (January 2016), 19 pages. DOI:<https://doi.org/10.1145/2843948>
8. Chicago Reddick, C., Chatfield, A., & Ojo, A. (2017). *A social media text analytics framework for double-loop learning for citizen-centric public services: A case study of a local government Facebook use*. Gov. Inf. Q., 34, 110-125.
9. Diego Olaya, Jonathan Vásquez, Sebastián Maldonado, Jaime Miranda, Wouter Verbeke, *Uplift Modeling for preventing student dropout in higher education*, Decision Support Systems, Volume 134, 2020, 113320, ISSN 0167-9236, <https://doi.org/10.1016/j.dss.2020.113320>.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Introduction and statistics for data analytics	7 Hours
1.1	Introduction and evolution of data analytics (Text1: 1.1, 1.1.2, 1.2)	1
1.2	Data Analytics Lifecycle (Text1: 2.1 -2.7)	1
1.3	Types of data analytics (descriptive, prescriptive, predictive, diagnostic) (Text2: 1)	1
1.4	Statistical Methods for Evaluation (Text1: 3.3)	2

1.5	Resampling (Text3: 2.6)	2
2	Big data, IoT, NoSQL technologies	8 Hours
2.1	Introduction to big data-Definition, features and challenges (Text4:Ch.1)	1
2.2	Related Technologies-Cloud computing and IoT(Text4:Ch.2- 2.1,2.2)	1
2.3	Big data Generation and Acquisition(Text4:Ch.3 – 3.1,3.2)	1
2.4	Big data analysis - (Text4:Ch.5 - 5.2, 5.3, 5.4)	1
2.5	Big data applications (Text4:Ch.6 - 6.2)	1
2.6	NoSQL:introduction and need for NoSQL, column oriented stores, key-value stores, document databases and graph databases (Text5:Ch.1)	1
2.7	MongoDB features , database, collection, documents, data types, configuration, shell,(Text6:Ch.1, 2)	1
2.8	Creating, updating, and deleting documents ,Querying (Text6:Ch.3,4)	1
3	Big data processing – Hadoop, Spark, Hive, Pig	8 Hours
3.1	What is Hadoop, brief history of Hadoop, comparison with other systems (Text7:Ch.1)	1
3.2	MapReduce data flow, weather dataset example (Text7:Ch.2)	1
3.3	Hadoop Distributed File System (HDFS) concepts, basic commands, HDFS Java interface (Text7:Ch. 3)	1
3.4	HBase (Text7:Ch.17)	1
3.5	YARN, anatomy of a YARN application, scheduling (Text7:Ch. 4)	1
3.6	Pig Latin language, running an example, comparison with databases (Text7:Ch. 16)	1
3.7	Hive data warehousing, shell, running an example, Hive architecture, comparison with databases (Text7:Ch. 17)	1
3.8	Spark framework, example, anatomy of a SPARK job run (Text7:Ch.19)	1
4	R programming for data analytics	7 Hours
4.1	R programming: basics (Text8: Ch.1)	1
4.2	Data visualization with ggplot2 (Text8: Ch.1)	1
4.3	Data transformation with dplyr (Text8: Ch.3)	1
4.4	Exploratory data analysis in R (Text8: Ch.5)	1.5
4.5	Tidy data with tidyr (Text8: Ch.9)	1.5
4.6	Modelling (Text8: Ch. 18)	1
5	Popular data analytics case studies	5 Hours

5.1	Recommender system, types (Text9: Ch.8)	1
5.2	Case study: Netflix Recommender system (Ref.7)	1
5.3	Social media analytics: current trends, tools (Text9: Ch.8)	1
5.4	Social media analytics for citizen-centric public services: a case study of a local government Facebook use (Ref.8)	1
5.5	Churn prediction (Text9: Ch.8) Uplift modelling Case study: Uplift Modeling for preventing student dropout in higher education (Ref.9)	1



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL411	DATA ANALYTICS LAB	PCC	0	0	3	2

Preamble: Data analytics lab is a practical course to supplement the Data analytics theory course. The implementation of machine learning algorithms using R and experimenting with the dynamic, interactive visualization techniques using Tableau will equip the students to pursue careers in the data analytics domain. A familiarization of the popular analytic tools like Hadoop can help in academic projects or to carry out data analysis in new application areas.

Prerequisites:

- ITT201 - Data Structures
- ITT 206 - Database Management Systems
- MAT 208 - Probability, Statistics and Advanced Graph theory
- ITT 306 - Data Science

Course Outcomes: After the completion of the course the student will be able to:

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Solve simple problems of statistical analysis of data using Microsoft Excel	Level 3: Apply
CO 2	Analyze the textual data and time series data with the data visualization techniques in R	Level 3: Analyze
CO 3	Implement the basic statistical techniques and machine learning algorithms using R	Level 3: Apply
CO 4	Execute HDFS commands and apply Map Reduce technologies associated with big data analytics using HADOOP	Level 3: Apply
CO 5	Analyze real world data by applying the suitable visualization techniques in Tableau	Level 4: Analyze

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	3	-	-	-	-	-	-	2
CO 2	3	3	3	3	3	2	2	2	2	2	-	2
CO 3	3	3	3	2	3	-	-	-	-	-	-	2
CO 4	3	3	3	2	3	-	-	-	-	-	-	2
CO 5	3	3	3	3	3	2	2	2	2	2	-	2

3/2/1: High/Medium/Low

Assessment Pattern

INFORMATION TECHNOLOGY

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	:	15 marks
Continuous Assessment	:	30 marks
Internal Test (Immediately before the second series test)	:	30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	:	15 Marks
(b) Implementing the work/Conducting the experiment	:	10 Marks
(c) Performance, result and inference (usage of equipments and troubleshooting)	:	25 Marks
(d) Viva voce	:	20 marks
(e) Record	:	5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.



Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Use Excel’s Descriptive Statistics data analysis tool to show the descriptive statistics for the two samples.

Sample 1	Sample 2
28	14
19	18
56	9
23	2
24	26
35	32
99	100
10	62
4	53
67	25
82	84
17	36
33	20
61	46
48	21
85	44
72	65
97	74
12	35
29	15
34	11

2.The given data shows the age of individuals and their average medical expenses per month. Apply linear regression in Excel to draw the regression line and predict the average medical expenses of specific individuals.

Age(X)	Average Amount Spent on Medical Expenses(per month in Rs)(y)
15	100
20	135
25	135
37	150
40	250
45	270
48	290
50	360
55	375
61	400
64	500
67	1000
70	1500

3. Consider the waiting time of the customer at the cash counter of the SBI bank branch during peak hours, which was observed by the cashier. Create a histogram in Excel based on the below data.

Customer Waiting Time (in mins)
2.30
5.00
3.55
2.50
5.10
4.21
3.33
4.10
2.55
5.07
3.45
4.10
5.12

Course Outcome 2 (CO2):

1. Write an R program to perform sentiment analysis using the movie review dataset. (Reference Dataset: <https://ai.stanford.edu/~amaas/data/sentiment/>)
2. Write an R program to create a corpus of documents and preprocess them in R using stemming, stop word removal, whitespace removal, convert them to lowercase and remove punctuations.
3. Write an R program to create a term document matrix for a corpus in R.
4. Write an R program to find the frequent terms in a document and remove sparse terms in R.
5. Plot a distance versus time scatter plot.
6. Implement the analysis of single variable and multi variable data using histogram, boxplot,whisker plot, barplot and scatter plot (Use the default mtcars dataset in R).
7. Collect data related to user’s preferences for products and implement a product recommender system.

Course Outcome 3 (CO3):

1.Given the following data about average rainfall in every month in the year of 2017.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	10	10	10	10	10	560	640	520	320	90	20	10

Calculate Arithmetic, Geometric, Harmonic mean, Median and Mode, First quartile, 56thpercentile for the above data using R.

- 2.Interpret the data in Anscombe dataset in R with linear regression.
3. Use logistic regression to find the best predictor variables for customer churn prediction.

4. Using decision trees, predict whether to play golf given factors such as weather outlook, temperature, humidity, and wind.
5. Group 620 high school seniors based on their grades in three subject areas: English, mathematics, and science with K-means clustering method.

Course Outcome 4 (CO4):

1. Write a map reduce program to count the words.
(<https://www.kaggle.com/rtatman/english-word-frequency>)
2. Write a map reduce program to mine weather data (Data available at <https://github.com/tomwhite/hadoop-book/tree/master/input/ncdc/all>)
3. Write a map reduce program to analyze web log files (<https://www.microsoft.com/en-in/download/details.aspx?id=37003>)
4. Write HDFS commands to:
 - Create a directory on HDFS in home directory.
 - Create two directories in a single command in home directory.
 - List the directories created in HDFS.
 - Create a sample text file in any of the directories created above.
 - Copy file/files from local file system to one of the directories created on HDFS.
 - Verify the file upload.
 - Copy a file from HDFS to local file system
 - Copy the file from one directory to another directory in HDFS.
 - Move the file from one directory to another directory in HDFS.
 - Copy a file from/To Local file system to HDFS.
 - Display last few lines from the file in HDFS.
 - Display the size of the file in KB and MB in the HDFS.
 - Append a file from Local File system to file in HDFS
 - Merge two file contents (in HDFS) in to one file (in Local file system)
 - Copy one directory structure to another.
 - Set the replication to the file created to 4
 - Remove a file from the directory in HDFS.
 - Remove a directory in HDFS.

Course Outcome 5 (CO5):

1. Using visualization with Tableau , analyze a Superstore data to identify prospective regions for its expansion.
2. There Are Three Customer Segments in the Superstore Dataset. What Percent of the Total Profits Are Associated with the Corporate Segment? Visualize using Tableau
3. Calculate the “average delay to ship using Tableau.” The data set considered should have information regarding order date and ship date for four different regions.

LIST OF EXPERIMENTS

INFORMATION TECHNOLOGY

Data Analysis using EXCEL

- 1.Descriptive Statistics*
- 2.Linear Regression*
- 3.Histogram*

R programming

1. Basic Concepts of R - Data structures , Control flow , Functions, Packages*
- 2 Data reshaping and merging using R *
- 3.Text Data Analysis using appropriate datasets.*
4. Data Visualisation in R (Scatter plot, Histogram, Box and Whisker, Dot plots,ggplot package).*
- 5.Exercises to implement Time series Analysis using R.
- 6.Exercises to create Dashboard, analytics report for a dataset.
- 7.Recommender systems like product recommendation or movie recommendation

Machine Learning algorithms using R

- 1.Statistics using R – Mean, Mode, median*
- 2.Linear Regression and logistic regression*
- 3.Decision Tree based Classification*
- 4.K-Means Clustering*
- 5.SVM classification
- 6.Neural Network based classification
7. Principal Component Analysis

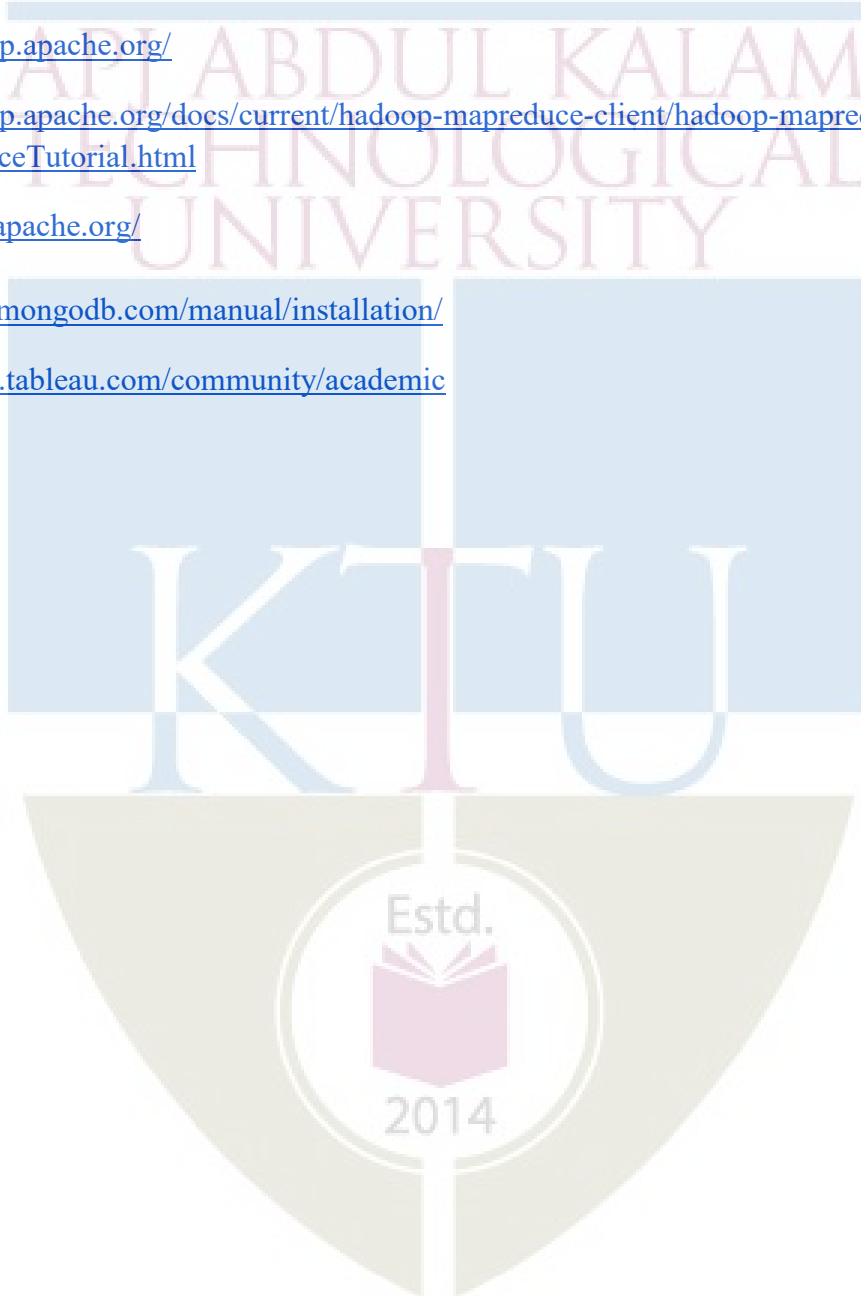
Big Data Tools and Techniques

1. Installation and configuration of Hadoop*
2. Manipulation of HDFS files using commands*
3. Implementation of Map Reduce programs *
- 4.Interactive Data Visualization with Tableau Public*
5. Installing and configuring Hive and implementing partitioning and bucketing in Hive
6. Exercises to implement map reduce in MongoDB

(Note: * marked experiments are mandatory.)

References

1. Joseph Schmuller. Statistical Analysis with Excel For Dummies (4th. edn.)2016.
2. <https://cran.r-project.org/manuals.html>
3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley Publishing.(1st. ed.). 2015.
4. <https://bradleyboehmke.github.io/HOML/index.html>
5. <https://hadoop.apache.org/>
6. <https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html>
7. <https://hive.apache.org/>
8. <https://docs.mongodb.com/manual/installation/>
9. <https://www.tableau.com/community/academic>



ITQ413	SEMINAR	CATEGORY	L	T	P	CREDIT
		PWS	0	0	3	2

Preamble: The course ‘Seminar’ is intended to enable a B.Tech graduate to read, understand, present and prepare report about an academic document. The learner shall search in the literature including peer reviewed journals, conference, books, project reports etc., and identify an appropriate paper/thesis/report in her/his area of interest, in consultation with her/his seminar guide. This course can help the learner to experience how a presentation can be made about a selected academic document and also empower her/him to prepare a technical report.

Course Objectives:

- To do literature survey in a selected area of study.
- To understand an academic document from the literature and to give a presentation about it.
- To prepare a technical report.

Course Outcomes [COs] : After successful completion of the course, the students will be able to:

CO1	Identify academic documents from the literature which are related to her/his areas of interest (Cognitive knowledge level: Apply).
CO2	Read and apprehend an academic document from the literature which is related to her/ his areas of interest (Cognitive knowledge level: Analyze).
CO3	Prepare a presentation about an academic document (Cognitive knowledge level: Create).
CO4	Give a presentation about an academic document (Cognitive knowledge level: Apply).
CO5	Prepare a technical report (Cognitive knowledge level: Create).

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1		2	1					3
CO2	3	3	2	3		2	1					3
CO3	3	2			3			1		2		3
CO4	3				2			1		3		3
CO5	3	3	3	3	2	2		2		3		3

Abstract POs defined by National Board of Accreditation

PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

General Guidelines

- The Department shall form an Internal Evaluation Committee (IEC) for the seminar with academic coordinator for that program as the Chairperson/Chairman and seminar coordinator & seminar guide as members. During the seminar presentation of a student, all members of IEC shall be present.
- Formation of IEC and guide allotment shall be completed within a week after the University examination (or last working day) of the previous semester.
- Guide shall provide required input to their students regarding the selection of topic/paper.
- Choosing a seminar topic: The topic for a UG seminar should be current and broad based rather than a very specific research work. It's advisable to choose a topic for the Seminar to be closely linked to the final year project area. Every member of the project team could choose or be assigned Seminar topics that covers various aspects linked to the Project area.
- A topic/paper relevant to the discipline shall be selected by the student during the semester break.
- Topic/Paper shall be finalized in the first week of the semester and shall be submitted to the IEC.
- The IEC shall approve the selected topic/paper by the second week of the semester.
- Accurate references from genuine peer reviewed published material to be given in the report and to be verified.

Evaluation pattern

Total marks: 100, only CIE, minimum required to pass 50

Seminar Guide: 20 marks (Background Knowledge – 10 (The guide shall give deserving marks for a candidate based on the candidate's background knowledge about the topic selected), Relevance of the paper/topic selected – 10).

Seminar Coordinator: 20 marks (Seminar Diary – 10 (Each student shall maintain a seminar diary and the guide shall monitor the progress of the seminar work on a weekly basis and shall approve the entries in the seminar diary during the weekly meeting with the student), Attendance – 10).

Presentation: 40 marks to be awarded by the IEC (Clarity of presentation – 10, Interactions – 10 (to be based on the candidate's ability to answer questions during the interactive session of her/his presentation), Overall participation – 10 (to be given based on her/his involvement during interactive sessions of presentations by other students), Quality of the slides – 10).

Report: 20 marks to be awarded by the IEC (check for technical content, overall quality, templates followed, adequacy of references etc.).



ITD415	PROJECT PHASE I	CATEGORY	L	T	P	CREDIT
		PWS	0	0	6	2

Preamble: The course ‘Project Work’ is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Course Objectives

- To apply engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.

Course Outcomes [COs] :After successful completion of the course, the students will be able to:

CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply).
CO2	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: Apply).
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	2	1	1	1	1	2
CO2	2	2	2		1	3	3	1	1		1	1
CO3									3	2	2	1
CO4					2			3	2	2	3	2
CO5	2	3	3	1	2							1
CO6					2			2	2	3	1	1

Abstract POs defined by National Board of Accreditation			
PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

PROJECT PHASE I

Phase 1 Target

- Literature study/survey of published literature on the assigned topic
- Formulation of objectives
- Formulation of hypothesis/ design/ methodology
- Formulation of work plan and task allocation.
- Block level design documentation
- Seeking project funds from various agencies
- Preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility study
- Preparation of Phase 1 report

Evaluation Guidelines & Rubrics

Total: 100 marks (Minimum required to pass: 50 marks).

- Project progress evaluation by guide: 30 Marks.
- Interim evaluation by the Evaluation Committee: 20 Marks.
- Final Evaluation by the Evaluation Committee: 30 Marks.
- Project Phase - I Report (By Evaluation Committee): 20 Marks.

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor).

Evaluation by the Guide

INFORMATION TECHNOLOGY

The guide/supervisor shall monitor the progress being carried out by the project groups on a regular basis. In case it is found that progress is unsatisfactory it shall be reported to the Department Evaluation Committee for necessary action. The presence of each student in the group and their involvement in all stages of execution of the project shall be ensured by the guide. Project evaluation by the guide: 30 Marks. This mark shall be awarded to the students in his/her group by considering the following aspects:

Topic Selection: innovativeness, social relevance etc. (2)

Problem definition: Identification of the social, environmental and ethical issues of the project problem. (2)

Purpose and need of the project: Detailed and extensive explanation of the purpose and need of the project. (3)

Project Objectives: All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified. (2)

Project Scheduling & Distribution of Work among Team members: Detailed and extensive Scheduling with timelines provided for each phase of project. Work breakdown structure well defined. (3)

Literature survey: Outstanding investigation in all aspects. (4)

Student's Diary/ Daily Log: The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily/weekly activity diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily/weekly activity diary shall be signed after every day/week by the guide. (7)

Individual Contribution: The contribution of each student at various stages. (7)

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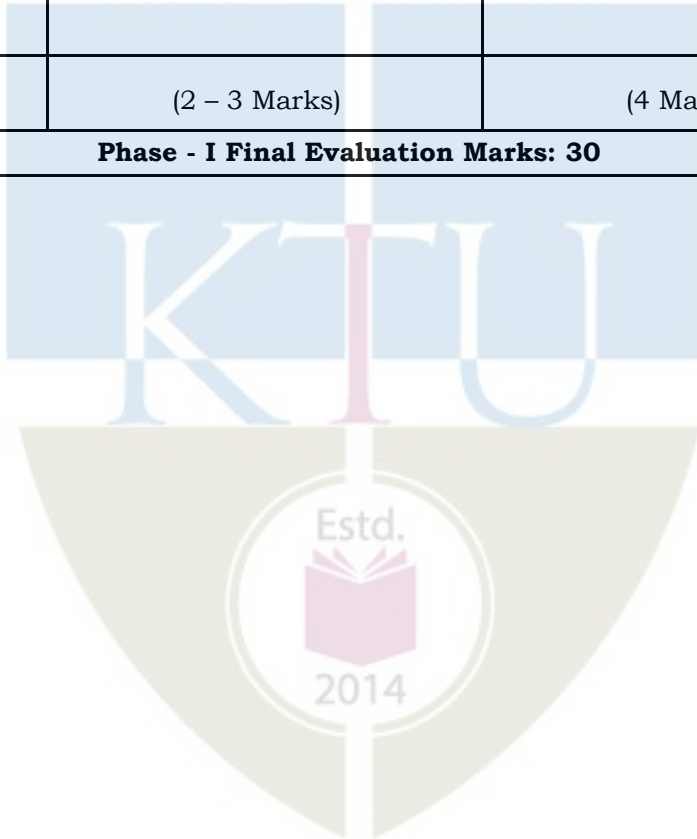
EVALUATION RUBRICS for PROJECT Phase I: Interim Evaluation						
No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
1-a	Topic identification, selection, formulation of objectives and/or literature survey. (Group assessment) [CO1]	10	The team has failed to come with a relevant topic in time. Needed full assistance to find a topic from the guide. They do not respond to suggestions from the evaluation committee and/or the guide. No literature review was conducted. The team tried to gather easy information without verifying the authenticity. No objectives formed yet.	The team has identified a topic. The originally selected topic lacks substance and needs to be revised. There were suggestions given to improve the relevance and quality of the project topic. Only a few relevant references were consulted/ studied and there is no clear evidence to show the team's understanding on the same. Some objectives identified, but not clear enough.	Good evidence of the group thinking and brainstorming on what they are going to build. The results of the brainstorming are documented and the selection of topic is relevant. The review of related references was good, but there is scope of improvement. Objectives formed with good clarity, however some objectives are not realistic enough.	The group has brainstormed in an excellent manner on what they were going to build. The topic selected is highly relevant, real world problem and is potentially innovative. The group shows extreme interest in the topic and has conducted extensive literature survey in connection with the topic. The team has come up with clear objectives which are feasible.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
1-b	Project Planning, Scheduling and Resource/ Tasks Identification and allocation. (Group assessment) [CO4]	10	No evidence of planning or scheduling of the project. The students did not plan what they were going to build or plan on what materials / resources to use in the project. The students do not have any idea on the budget required. The team has not yet decided on who does what. No project journal kept.	Some evidence of a primary plan. There were some ideas on the materials /resources required, but not really thought out. The students have some idea on the finances required, but they have not formalized a budget plan. Schedules were not prepared. The project journal has no details. Some evidence on task allocation among the team members.	Good evidence of planning done. Materials were listed and thought out, but the plan wasn't quite complete. Schedules were prepared, but not detailed, and needs improvement. Project journal is presented but it is not complete in all respect / detailed. There is better task allocation and individual members understand about their tasks. There is room for improvement.	Excellent evidence of enterprising and extensive project planning. Gantt charts were used to depict detailed project scheduling. A project management/version control tool is used to track the project, which shows familiarity with modern tools. All materials / resources were identified and listed and anticipation of procuring time is done. Detailed budgeting is done. All tasks were identified and incorporated in the schedule. A well-kept project journal shows evidence for all the above, in addition to the interaction with the project guide. Each member knows well about their individual tasks.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
Phase 1 Interim Evaluation Total Marks: 20						

Phase 1 Interim Evaluation Total Marks: 20

EVALUATION RUBRICS for PROJECT Phase I: Final Evaluation

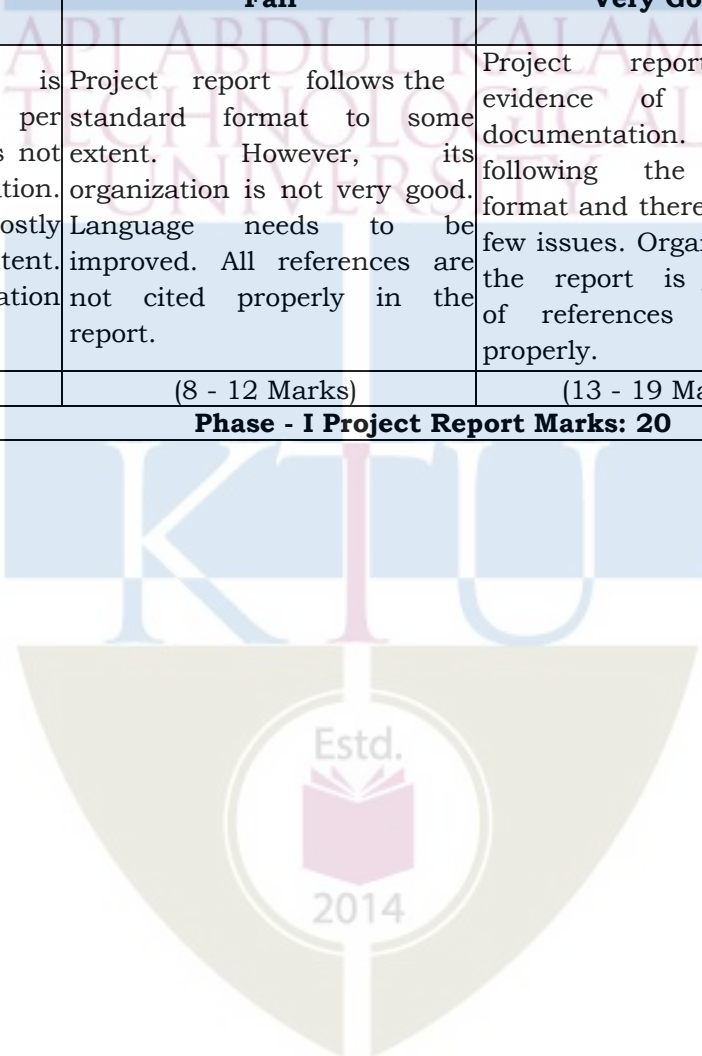
Sl. No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
1-c	Formulation of Design and/or Methodology and Progress. (Group assessment) [CO1]	5	None of the team members show any evidence of knowledge about the design procedure to be adopted, and the methodology adopted till now/ to be adopted in the later stages. The team has not progressed from the previous stage of evaluation.	The students have some knowledge on the design procedure to be adopted, and the methodologies. However, the team has not made much progress in the design, and yet to catch up with the project plan.	The students are comfortable with design methods adopted, and they have made some progress as per the plan. Their methodologies are understood to a large extent.	Shows clear evidence of having a well- defined design methodology and adherence to it. Excellent knowledge in design procedure and its adaptation. Adherence to project plan is commendable.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
1-d	Individual and Teamwork Leadership (Individual assessment) [CO3]	10	The student does not show any interest in the project activities, and is a passive member.	The student show some interest and participates in some of the activities. However, the activities are mostly easy and superficial in nature.	The student shows very good interest in project, and takes up tasks and attempts to complete them. Shows excellent responsibility and team skills. Supports the other members well.	The student takes a leadership position and supports the other team members and leads the project. Shows clear evidence of leadership.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
1-e	Preliminary Analysis/ Modeling / Simulation/ Experiment / Design/ Feasibility study [CO1]	10	The team has not done any preliminary work with respect to the analysis/modeling/ simulation/experiment/design/feasibility study/ algorithm development.	The team has started doing some preliminary work with respect to the project. The students however are not prepared enough for the work and they need to improve a lot.	There is some evidence to show that the team has done good amount of preliminary investigation and design/ analysis/ modeling etc. They can improve further.	Strong evidence for excellent progress in the project. The team has completed the required preliminary work already and are poised to finish the phase I in an excellent manner. They have shown results to prove their progress.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)

1-f	Documentation and presentation. (Individual & group assessment). [CO6]	5	The team did not document the work at all. The project journal/diary is not presented. The presentation was shallow in content and dull in appearance. The individual student has no idea on the presentation of his/her part.	Some documentation is done, but not extensive. Interaction with the guide is minimal. Presentation include some points of interest, but overall quality needs to be improved. Individual performance to be improved.	Most of the project details were documented well enough. There is scope for improvement. The presentation is satisfactory. Individual performance is good.	The project stages are extensively documented in the report. Professional documentation tools like LaTeX were used to document the progress of the project along with the project journal. The documentation structure is well-planned and can easily grow into the project report. The presentation is done professionally and with great clarity. The individual's performance is excellent.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
Total		30	Phase - I Final Evaluation Marks: 30			



EVALUATION RUBRICS for PROJECT Phase I: Report Evaluation

Sl. No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
1-g	Report [CO6]	20	The prepared report is shallow and not as per standard format. It does not follow proper organization. Contains mostly Unacknowledged content. Lack of effort in preparation is evident.	Project report follows the standard format to some extent. However, its organization is not very good. Language needs to be improved. All references are not cited properly in the report.	Project report shows evidence of systematic documentation. Report is following the standard format and there are only a few issues. Organization of the report is good. Most of references are cited properly.	The report is exceptionally good. Neatly organized. All references cited properly. Diagrams/Figures, Tables and equations are properly numbered, and listed and clearly shown. Language is excellent and follows standard styles.
			(0 - 7 Marks)	(8 - 12 Marks)	(13 - 19 Marks)	(20 Marks)
Phase - I Project Report Marks: 20						



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VII

PROGRAM ELECTIVE II



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT413	MOBILE COMPUTING	PEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates

1. To impart an understanding of basic concepts of cellular mobile communication.
2. To get an awareness of different mobile communication systems.
3. To introduce mobile network layer and mobile transport layer services.
4. To introduce support for mobility in wireless environments.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basic concepts in cellular mobile systems and its design.	Level 2: Understand
CO 2	Summarize telecommunication systems, broadcast systems, and satellite systems.	Level 2: Understand
CO 3	Compare wireless standards such as IEEE 802.11, HIPERLAN and Bluetooth.	Level 2: Understand
CO 4	Discuss mobile network layer concepts such as mobile IP, DHCP and MANET.	Level 2: Understand
CO 5	Explain the concepts of mobile transport layer and support for mobility.	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	-	-	-	-	-	-	-	-	2
CO 2	3	1	-	-	-	-	-	-	-	-	-	2
CO 3	3	2	2	-	-	-	-	-	-	-	-	2
CO 4	3	-	2	-	-	-	-	-	-	-	-	2
CO 5	3	1	1	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	35	35	70
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain cellular systems.
2. Discuss co-channel interference.
3. Define MAC.

Course Outcome 2 (CO2)

1. Compare digital audio broadcasting and digital video broadcasting.
2. List the objectives of IMT-2000.

3. Explain DECT protocol architecture.

INFORMATION TECHNOLOGY

Course Outcome 3(CO3):

1. Explain IEEE802.11 system architecture.
2. Describe WATM services.
3. Compare HIPERLAN1 and HIPERLAN 2.

Course Outcome 4(CO4):

1. Explain agent advertisement and discovery.
2. Differentiate tunnelling and encapsulation.
3. Distinguish between DSDV and DSR.

Course Outcome 5 (CO5):

1. Compare traditional TCP and improved TCP concepts.
2. Explain selective retransmission.
3. List the functions of WSP.

Model Question Paper

Course Code: ITT413

Course Name: MOBILE COMPUTING

Max. Marks :100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

- 1 Identify the need for frequency reuse.
- 2 What are dropped calls? Explain.
- 3 List the features of GEO, LEO, MEO.
- 4 Summarize mobile services in GSM.
- 5 Distinguish between FHSS and DSSS.
- 6 Describe MAC frame fields.
- 7 Discuss entities and terminologies used in mobile IP.

- 8 Explain DHCP.
- 9 Summarize approaches to support wireless access.
- 10 Detail working of snooping TCP.

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

- 11 a Compare generations of mobile networks. 10
- b Write the limitations of conventional mobile systems. 4

OR

- 12 a Differentiate FDMA and TDMA. 6
- b Explain any two types of handoffs. 8
- 13 Describe GSM system architecture. 14

OR

- 14 Explain GPRS protocol architecture. 14
- 15 a Explain infrastructure based architecture of IEEE802.11. 6
- b Describe distributed foundation wireless MAC using polling. 8

OR

- 16 a Explain Bluetooth protocol architecture. 8
- b What is WATM? Discuss its importance. 6
- 17 a Discuss the goals and requirements of mobile IP. 4
- b Illustrate IP packet delivery. 10

OR

- 18 a Identify MANET security issues. 6
- b Explain any one MANET routing algorithm. 8
- 19 Discuss traditional TCP challenges. 14

OR

- 20 a Explain WAP architecture. 9
- b List the importance, functions and advantages of WTLS. 5

Syllabus

Module 1: Introduction to Cellular Systems (7 Hours)
Introduction to mobile systems, Limitations of conventional system, Basic cellular mobile system- Analog and digital cellular systems, 1G,2G,3G,4G and 5G cellular systems, Cellular radio system design- Frequency reuse, Co-channel interference. Medium access control- MAC, SDMA, FDMA, TDMA, CDMA, Handoffs and dropped calls- Initiation of handoff, Types of handoffs- Power difference, Mobile assisted, Cell-site, Intersystem.
Module 2: Communication Systems-I (7 Hours)
Telecommunication systems: GSM, System architecture, Protocol, Localization and calling, GPRS- System architecture, Protocol architecture, DECT- System architecture, Protocol architecture, IMT-2000- Basic concepts and Objectives. Broadcast systems: Digital audio and video broadcasting. Satellite Systems: GEO, LEO, MEO.
Module 3: Communication Systems-II (7 Hours)
Wireless systems: IEEE 802.11-Architecture, Physical and MAC layer, HIPERLAN- HIPERLAN1, HIPERLAN2, WATM, Bluetooth- Architecture, protocol stack.
Module 4: Mobile Network Layer (7 Hours)
Mobile IP- Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunnelling and encapsulation, Optimizations. Dynamic Host Configuration Protocol (DHCP), Mobile Ad-hoc Networks (MANETs)- Features, Routing, Routing algorithms-DSDV, DSR, MANET Security issues.
Module 5: Mobile Transport Layer (7 Hours)
Traditional TCP, Classical TCP improvements-Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP. Support for mobility-WWW, WAP.

Text Books

1. Jochen Schiller, Mobile Communications, Pearson Education, Second Edition.

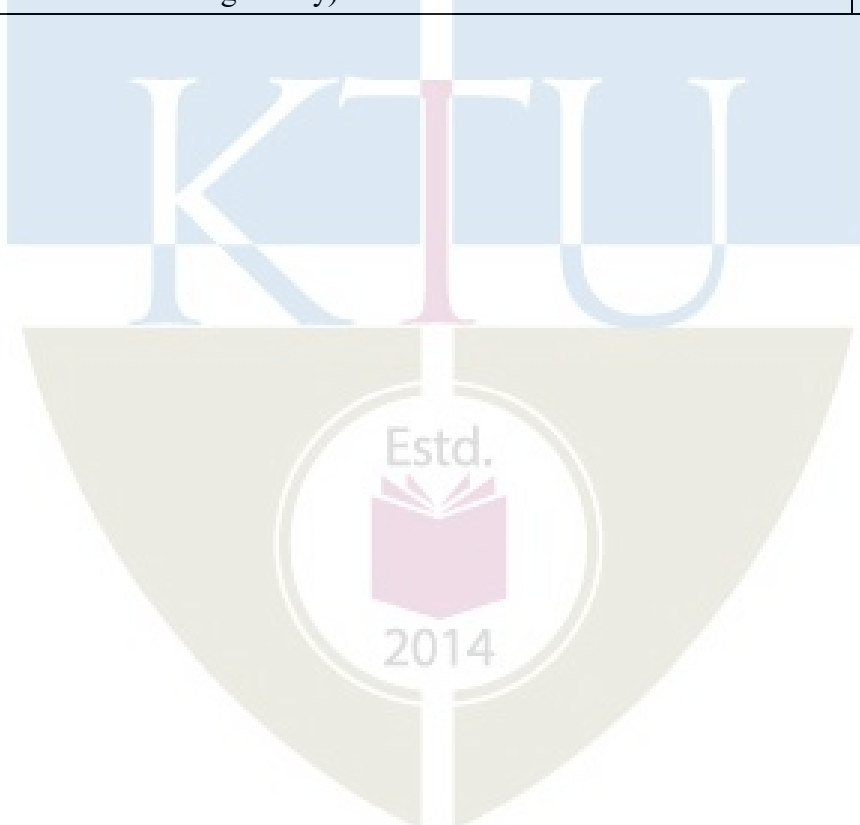
Reference Books

1. C.K.Toh, AdHoc Mobile Wireless Networks, Pearson Education, First Edition.
2. William Stallings, Wireless Communications and Networks, Pearson Education, 2e.
3. Kaveh Pahlavan, Prasanth Krishnamoorthy, Principles of Wireless Networks, Pearson Education.
4. Theodore S. Rappaport, Wireless Communications: Principles and Practice, Pearson Education, 2/e, 2010.
5. William C.Y Lee, Mobile Cellular Telecommunications, McGraw Hill International Editions, 1995.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Module1: Introduction to Cellular Systems	7 Hours
1.1	Introduction to mobile systems, Limitations of conventional system, Basic cellular mobile system.	1
1.2	Analog and digital cellular systems, 1G,2G,3G,4G and 5G cellular systems (Comparison only).	1
1.3	Cellular radio system design- Frequency reuse, Co-channel interference.	1
1.4	Medium access control- MAC.	1
1.5	SDMA, FDMA, TDMA, CDMA (Concepts and comparison).	1
1.6	Handoffs and dropped calls- Initiation of handoff, Types of handoffs- Power difference, Mobile assisted, Cell-site, Intersystem.	2
2	Module 2: Communication Systems-I	7 Hours
2.1	Telecommunication systems: GSM, System architecture, Protocol, Localization and calling.	2
2.2	GPRS- System architecture, Protocol architecture.	1
2.3	DECT- System architecture, Protocol architecture.	1
2.4	IMT-2000- Basic concepts and Objectives.	1
2.5	Broadcast systems: Digital audio and video broadcasting.	1
2.6	Satellite systems – GEO, LEO and MEO.	1
3	Module 3: Communication Systems-II	7 Hours
3.1	Wireless systems: IEEE 802.11- System architecture and Protocol architecture.	1
3.2	Physical layer-FHSS, DSSS, Infrared.	1
3.3	MAC layer-DFWMAC using CSMA/CA, RTS/CTS, Polling, MAC frames.	2
3.4	HIPERLAN-History, HIPERLAN1, HIPERLAN2 (Only comparison with HIPERLAN 1).	1
3.5	WATM-Motivation, WATM Services.	1
3.6	Bluetooth- Architecture, protocol stack.	1

4	Module 4: Mobile Network Layer	7 Hours
4.1	Mobile IP: Goals, assumptions and requirements, Entities and terminology.	1
4.2	IP packet delivery, Agent advertisement and discovery.	1
4.3	Registration, Tunnelling and encapsulation, Optimizations.	1
4.4	Dynamic Host Configuration Protocol (DHCP).	1
4.5	Mobile Ad-hoc Networks (MANETs)-Features, Routing- Routing algorithms-DSDV, DSR.	2
4.6	MANET Security issues.	1
5	Module 5: Mobile Transport Layer	7 Hours
5.1	Traditional TCP: Congestion control, slow start, Fast retransmit/fast recovery, Implications of mobility.	1
5.2	Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP.	1
5.3	Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.	2
5.4	WWW- HTML, HTTP, Wireless access approaches, Architecture.	1
5.5	WAP-Architecture, Protocols-WDP, WTLS, WTP, WSP, WAE (Its functions and advantages only).	2



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT423	ARTIFICIAL INTELLIGENCE	PEC	2	1	0	3

Preamble: Artificial Intelligence is an elective course for the IT Engineering Graduates. The syllabus is prepared with an aim to emphasize concepts of Artificial Intelligence that solves general problems with the help of search techniques, inferred knowledge, reasoning and learning in discovering decision making information from knowledgebase. It also give emphasis on neural network and expert systems to optimize human effort overall.

Prerequisite: ITT201 Data Structures, ITT304 Algorithm Analysis and Design

Course Outcomes: After the completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the fundamental foundations of artificial intelligence (AI) and familiarize with the search terminologies and uninformed search.	Level 2: Understand
CO 2	Demonstrate various informed search methods to solve AI application problems.	Level 3: Apply
CO 3	Illustrate the concepts of knowledge representation through logics, inference rules and deduce solutions using the principle of resolution.	Level 3: Apply
CO 4	Explain the concept of learning and explore uncertainty with probabilistic reasoning.	Level 2: Understand
CO 5	Describe the basics of neural network and the concepts of expert systems.	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	-	-	-	-	-	-	-	1
CO 2	3	3	3	1	-	-	-	-	-	-	-	1
CO 3	3	2	2	1	-	-	-	-	-	-	-	1
CO 4	3	2	2	2	-	-	-	-	-	-	-	1
CO 5	2	1	2	1	1	1	-	-	-	-	-	1

3/2/1: High/Medium/Low

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	20	35	60
Apply	25	10	30
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
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Continuous Internal Evaluation Pattern:

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Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. **Part A** contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. **Part B** contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Define Artificial Intelligence based on its application.
2. Mention different types of agents and its environment.
3. Explain production system and rules to solve AI problems.
4. State the search terminologies used to compare different algorithms.
5. Compare all uninformed search based on time and space complexity, optimality and completeness.
6. State the procedure to solve AI problem with the help of uninformed search.

Course Outcome 2 (CO2):

INFORMATION TECHNOLOGY

1. Explain the significance of informed search over uninformed search.
2. Apply heuristics search methods to solve game playing problems.
3. Demonstrate problem reduction with AND-OR graphs.
4. Explain constraint satisfaction problem. Solve crypt arithmetic problem.
CROSS+ROADS = DANGER
5. State the application of hill climbing algorithms.
6. Write the algorithm for the Min-Max with two play game example.
7. How alpha-beta pruning method does reduce the search for the chess game?
Demonstrate by making partial tree for the same.

Course Outcome 3 (CO3):

1. What are the different types of Knowledge?
2. Explain Knowledge Based System.
3. Consider the following facts:
 - a. X married to Y
 - b. P is Q's brother
 - c. The spouse of every married person in the club is also a member of the club.
 - d. X,P,Y,Q are all members of the club. Prove by resolution that "Elder is not married".
4. Differentiate between frames and semantic nets to represent knowledge.
5. How can we represent facts in propositional Logic?
6. State all inference rules in FOPL.
7. Give one example to convert the Wff's in to a clausal form.
8. What is forward chaining and backward chaining?

Course Outcome 4 (CO4):

1. Define Inductive learning.
2. Differentiate Learning from taking advice and learning in problem solving.
3. Explain concept learning.
4. Define version space?
5. Explain convergence in version space using Candidate Elimination algorithm.
6. Give an example of decision tree.

Course Outcome 5 (CO5):

1. What is Artificial Neural Network?
2. What are the various steps of Natural Language Processing?
3. Define Expert System and explain briefly its components.
4. What are the used to make expert system?
5. State the application of Expert system.

Model Question Paper**Course Code: ITT423****Course Name: ARTIFICIAL INTELLIGENCE****Max. Marks: 100****Duration: 3 Hrs****Part A***Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

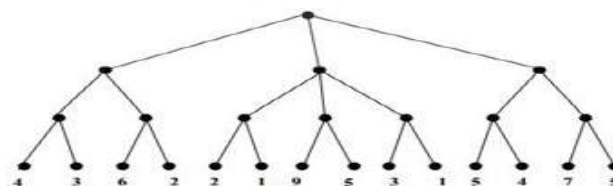
1. Explain the significance of AI applications.
2. List four search strategies used to compare AI algorithms. Give one example.
3. State two heuristic methods to solve Tic-Tac-Toe problem.
4. How simulated annealing helps to overcome the drawbacks of hill climbing?
5. Determine whether the given sentence is satisfiable, contradictory or valid.
 $S: (P \wedge Q) \vee \sim (P \wedge Q)$
6. Given formulas S1 and S2 below, show that $Q(a)$ is a logical consequence of the two.
 $S1: (\forall x) (P(x) \rightarrow Q(x))$ $S2: P(a)$
7. State the application of Rote Learning.
8. Amy has two bags. Bag I has 7 red and 2 blue balls and bag II has 5 red and 9 blue balls. Amy draws a ball at random and it turns out to be red. Determine the probability that the ball was from the bag I using the Bayes theorem.
9. Explain non-linear separable problem. Give an example.
10. List the benefits of Expert System.

Part B*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. a) State and explain seven problem characteristics of AI. 7
- b) Write down the production rules for the water jug problem with example. 7

OR

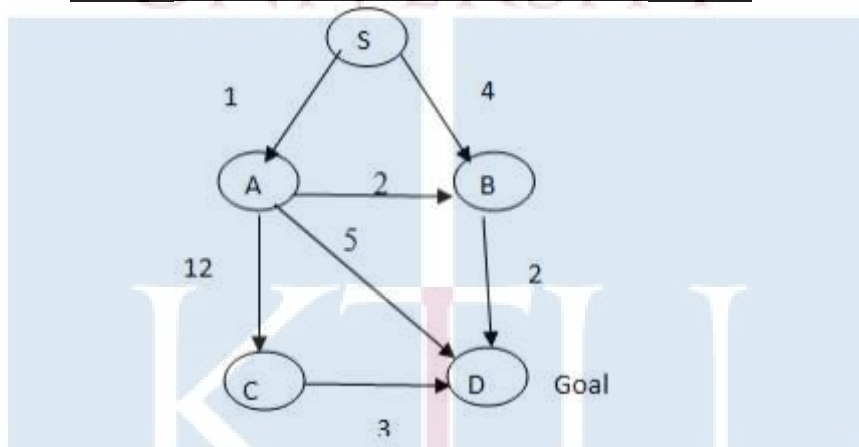
12. What is uninformed search? Compare all six uninformed search based on time and space complexity, optimality and completeness. 14
13. Compute the value of alpha at root using alpha-beta pruning. 14



OR

14. a) Write A* Algorithm. Find the best path from S to D. Given heuristic values for each nodes. 10

S	8
A	7
B	3
C	2
D	0



- b) Explain the admissibility property of A* algorithm. 4

15. a) Explain resolution principle in FOPL. 4
 b) Consider the following sentences: 10

- S1. Ashok likes all kinds of food
- S2. Apples are food.
- S3. Chicken is food.
- S4. Anything anyone eats and isn't killed by food..
- S5. Bill eats peanuts and still alive.
- S6. Sue eats everything bill eats.

Prove that "Ashok likes Peanuts" using resolution.

OR

16. a) How hypotheses formed by pure inductive inference or induction? Explain with examples. 6

- b) Convert the well-formed formula to clause form. 8

$$\forall X ((\text{Child}(X) \wedge \neg Y (\text{Takes}(X, Y) \wedge \text{Biscuit}(Y))) \rightarrow \text{Loves}(\text{john}, X)$$

17. a) Apply the Candidate Elimination algorithm with example for narrowing the version space? 10
 b) What is explanation based learning? Explain in detail with an example. 4

OR

18. What do you mean by probabilistic reasoning? Explain Bayes Theorem with example. 14

19. a) Explain Mycin and denderal. 6
 b) Explain NLP. State few tools used in Natural Language Processing. 8

OR

20. a) Explain Back propagation with example. 7
 b) What are the characteristic features of expert systems 7

Syllabus

Module 1: Overview of Artificial Intelligence (7 Hours)
Introduction: Artificial Intelligence, Agents- Environments and its types, AI Application areas. Problems, Problem space, Problem characteristics, Production systems. Search algorithm terminologies, Example problems – toy and real world, uninformed searches.
Module 2: Informed Search (7 Hours)
Informed Search: Generate and Test, Best First Search, Heuristics Search, A*, Problem reduction, AO*, Constraint Satisfaction problems, Hill climbing, Simulated annealing. Adversarial Search: Min-max search, Alpha beta cut-offs.
Module 3: Knowledge Representation (7 Hours)
Knowledge Representation: Types of Knowledge, Knowledge based system and reasoning, frames, and semantic nets. Logic and Inferences: Propositional logic (PL) and Predicate Logic (FOPL), Inference rules, Conversion to clausal form, Unification, Forward & backward Chaining, Resolution refutation proof for PL and FOPL.
Module 4: Learning and Reasoning (7 Hours)
Learning: Rote learning, Learning by Taking Advice, Learning in Problem-solving, Learning from example: induction, Explanation-based learning. Inductive Learning, Winston learning program, Version space, Candidate elimination algorithm, Decision tree. Reasoning in uncertain environments: Probabilistic reasoning, Bayes theorem.

Module 5: Neural Network and Expert System (7 Hours)

INFORMATION TECHNOLOGY

Neural Network: Basics of Neural Network, Back Propagation, Applications of Neural Networks, Natural Language Processing.

Expert system (ES) : Components of Expert System, Expert System Technology, Stages in the development of an Expert System, Expert System Tools, Benefits and Application of Expert Systems.

Text Books

1. Stuart Russell and Peter Norvig, "Artificial intelligence, A modern approach", Pearson, Third Edition, 2010. [M1],[M2], [M3], [M4]
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill Publishing Company Ltd., New Delhi, Third Edition, ISBN: 13:978-0-07-008770-5, 2010. [M1], [M2], [M3], [M4], [M5].
3. DAN W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall India Ltd., New Delhi, 2009, ISBN: 81-203-0777-1. [M2], [M4], [M5].

Reference Books

1. Deepak Khemeni, "A First course in Artificial Intelligence", Tata McGraw Hill, 2013.
2. George. F. Luger, "Artificial Intelligence- Structures and Strategies for Complex Problem Solving", Fourth Edition, Pearson Education, 2002.
3. Brachman, R. and Levesque, H. 2004. Knowledge Representation and Reasoning, Morgan Kaufmann.
4. Patrick Henry Winston, Artificial intelligence, Addison Wesley, 1992.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Overview of Artificial Intelligence	(7 Hours)
1.1	Artificial Intelligence, Agents- Environments and its types, AI Application areas	1
1.2	Problems, Problem space, Problem characteristics	1
1.3	Production systems	1
1.4	Search algorithm terminologies	1
1.5	Example problems – Toy and real world	1
1.6	Uninformed searches	1
1.7	Continue - Uninformed searches and comparison	1
2	Informed Search	(7 Hours)
2.1	Informed Search, Generate and Test, Best First Search	1
2.2	Heuristics Search, A*	1

2.3	Problem reduction, AO*	1
2.4	Constraint Satisfaction problems	1
2.5	Hill climbing its types	1
2.6	Simulated annealing, Min-max search	1
2.7	Alpha beta cut-offs	1
3	Knowledge Representation	(7 Hours)
3.1	Knowledge Representation, Types of Knowledge, Knowledge based system and reasoning	1
3.2	Frames, and semantic nets	1
3.3	Propositional logic (PL)	1
3.4	Predicate Logic (FOPL), Inference rules	1
3.5	Conversion to clausal form	1
3.6	Unification, Forward & backward Chaining	1
3.7	Resolution refutation proof for PL and FOPL	1
4	Learning and Reasoning	(7 Hours)
4.1	Rote learning, Learning by Taking Advice	1
4.2	Learning in Problem-solving, Learning from example: induction	1
4.3	Explanation-based learning	1
4.4	Inductive Learning, Winston learning program, Version space	1
4.5	Candidate elimination algorithm	1
4.6	Decision tree	1
4.7	Probabilistic reasoning, Bayes theorem.	1
5	Neural Network and Expert System (ES)	(7 Hours)
5.1	Basics of Neural Network, Applications of Neural Networks	1
5.2	Back Propagation	1
5.3	Natural Language Processing	1
5.4	Expert system, Components of Expert System, Expert System Technology	1
5.5	Stages in the development of an Expert System	1
5.6	Expert System Tool	1
5.7	Benefits and Application of Expert Systems.	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT433	OBJECT ORIENTED MODELLING AND DESIGN	PEC	2	1	0	3

Preamble: This course is intended to make the students capable of

1. To model the requirements with use cases and describe the dynamic behaviour and structure of the design.
2. To use the concept of design patterns and apply it where suitable.

Prerequisite: ITT202 Principles of Object Oriented Techniques

Course Outcomes: After completion of the course the student will be able to:

CO No.	Course Outcome (CO)	Bloom's Category Level
CO1	Identify various object oriented approaches to analyse problems and design software solutions.	Level 2: Understand
CO2	Use UML static modelling concepts and notations in Object Oriented design.	Level 3: Apply
CO3	Sketch UML interaction modelling and state modeling to solve real world problems.	Level 3: Apply
CO4	Explain system design on performance estimation, resource allocation, architectural styles and use of metrics for object oriented system model.	Level 2: Understand
CO5	Describe how design problems can be solved by design patterns efficiently and effectively.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	-	1	-	-	-	2	2	-	2
CO 3	3	3	3	-	1	-	-	-	2	2	-	2
CO 4	3	3	3	-	-	-	-	-	2	2	-	2
CO 5	3	3	3	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	20	30	50
Level 3: Apply	20	10	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Syllabus**Module 1: Introduction (7 Hours)**

Introduction-Two views of software Developments: SSAD and OOAD.
 Object Oriented Systems Development Life Cycle: Object Oriented Systems Development: A Use-Case Approach , Object Oriented Methodologies: Rumbaugh Object Modelling Technique, The Booch methodology, The Jacobson Methodology , The Unified Approach Rational Unified Process, Four Major phases: Inception, Elaboration, Construction, Transition.

Module 2: Structural Modeling (7 Hours)

INFORMATION TECHNOLOGY

Introduction to UML-Building blocks of the UML-Rules of the UML, Common Mechanism in the UML, Architecture.

Class modelling -Objects and class concepts, link and Association Concepts, Generalization and Inheritance, A Sample Class model, Advanced Object and class concepts, N-ary Associations, Aggregation, Packages. Component diagram, Deployment diagram.

Module 3: Behavioral Modeling (7 Hours)

Interaction Modeling: Use Case Models, Sequence models, Activity Models. Advanced Interaction Modeling: Use Case Relationships, Procedural Sequence Models, Special Constructs for Activity Models. State modeling: Events, States, Transition and conditions, state diagrams, state diagram behaviour. Collaboration diagram.

Module 4: -System Design (8 Hours)

System Conception: Devising a system concept, Elaborating a concept, Preparing a problem statement. System Design: Overview of System Design, Estimating performance, Making a reuse plan, Breaking system into subsystems, Identifying concurrency, Allocation of subsystems, Management of data storage, Handling Global resources ,Choosing a software control strategy · Handling boundary condition· Common Architectural style· Metrics for the Object Oriented Design Model, Class - Oriented Metrics , Operation Oriented Metrics.

Module 5: Design Patterns (6 Hours)

Introduction to design patterns - elements, catalog of design patterns, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern.

Note: UML diagrams can be drawn using any software tool. It can be given as an assignment.

Text Books

1. Ali Bahrami, Object Oriented System Development, McGraw Hill, 1999. (Module 1)
2. Grady Booch , James Rumbaugh , Ivar Jacobson , The Unified Modeling Language User Guide, Addison Wesley, First Edition, 1998. (Module 2,Module 3)
3. Michael R Blaha,James R Rumbaugh , Object-Oriented Modeling and Design with UML, Pearson,Second Edition,2005.(Module 2,Module 3, Module 4)
4. Roger S. Pressman,Software Engineering A Practitioner's Approach, McGraw Hill, Fifth edition ,2001.(Module 4)
5. Erich Gamma,Richard Helm,Ralph Johnson,John Vlissi des,Design Patterns Elements of Reusable Object-Oriented Software ,Addison Wesley, 2009.(Module 5)

Reference Books

1. Barclay K.,J. Savage, Object Oriented Design with UML and Java,Elsevier,2004.
2. James Rumbaugh, Unified Modeling Language Reference Manual, Addison-Wesley Professional, 2005.
3. Arpita Gopal and Netra Patil, Magnifying Object Oriented Analysis and Design, PHI Publication, 2010.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Describe a unified process. Write down the four major phases of unified process.
2. Explain a unified approach? Why is it needed?
3. Explain in detail about Rumbaugh and Jacobson methodologies.
4. Illustrate the steps of Micro development process of Booch Methodology.
5. List any four differences between SSAD and OOAD approaches.

Course Outcome 2 (CO 2):

1. List and explain various relationships and visibility concepts used in UML class diagram.
2. Define package. Explain visibility and importing and exporting of package.
3. Write short notes on component diagram and deployment diagram.
4. Compare association and generalization with suitable examples.
5. Draw the class diagram for a bank management system.

Course Outcome 3 (CO 3):

1. Draw the activity diagram for the reserve ticket use case for online railways reservation system.
2. Draw the sequence diagram for the use case order item for online shopping system.
3. Define State Diagrams. Explain Sample State diagram for dialling a telephone.
4. Describe the notations of UML use case diagram. Draw the use case diagram for a mobile recharging application.

Course Outcome 4 (CO 4):

1. Describe the steps involved in batch transformation and continuous transformation?
2. Explain how the subsystems can be allocated to hardware units. What are the types of relationships between subsystems?
3. Discuss about operation oriented metrics.
4. Compare the advantages of using procedure driven control and event driven control.
5. Discuss how we can identify inherent concurrency?

Course Outcome 5 (CO 5):

1. Define design pattern? Explain four essential elements of design pattern?
2. Explain how to select a design pattern?
3. List a few design problems and explain how design patterns solve them.
4. Differentiate between the important categories of design patterns.

Part A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. Define reusability.
2. Give the reasons why three layered approaches are required for software development.
3. Differentiate aggregation and composition.
4. Explain the different extensibility mechanisms in UML.
5. List the different kinds of events.
6. Explain the use of include and extend relationships in use cases with an example.
7. List a few global resources used in system design.
8. Explain the different factors used in the MOOD metrics suite.
9. Explain the term delegation.
10. Differentiate pattern and framework.

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. Describe the two views- SSAD and OOAD – of software development in detail. 14

OR

12. Explain the different Object Oriented Methodologies. 14
13. Explain the building blocks of UML. 14

OR

14. Draw the class diagram for a library management system. 14
15. List the basic elements of state diagram. Draw the state diagram for online order system . 14

OR

16. Prepare a sequence diagram and activity diagram for computing restaurant bills. There should be a charge for each delivered item. The total amount should be subject to tax and a service charge of 18% for groups of three or more. 14
17. Describe nine distinct and measurable characteristics of an Object Oriented design.(14)

OR

18. Explain the common architectural styles used in system design 14
19. Describe the elements and catalog of design patterns. 14

OR

20. Explain how to select and use design patterns. 14

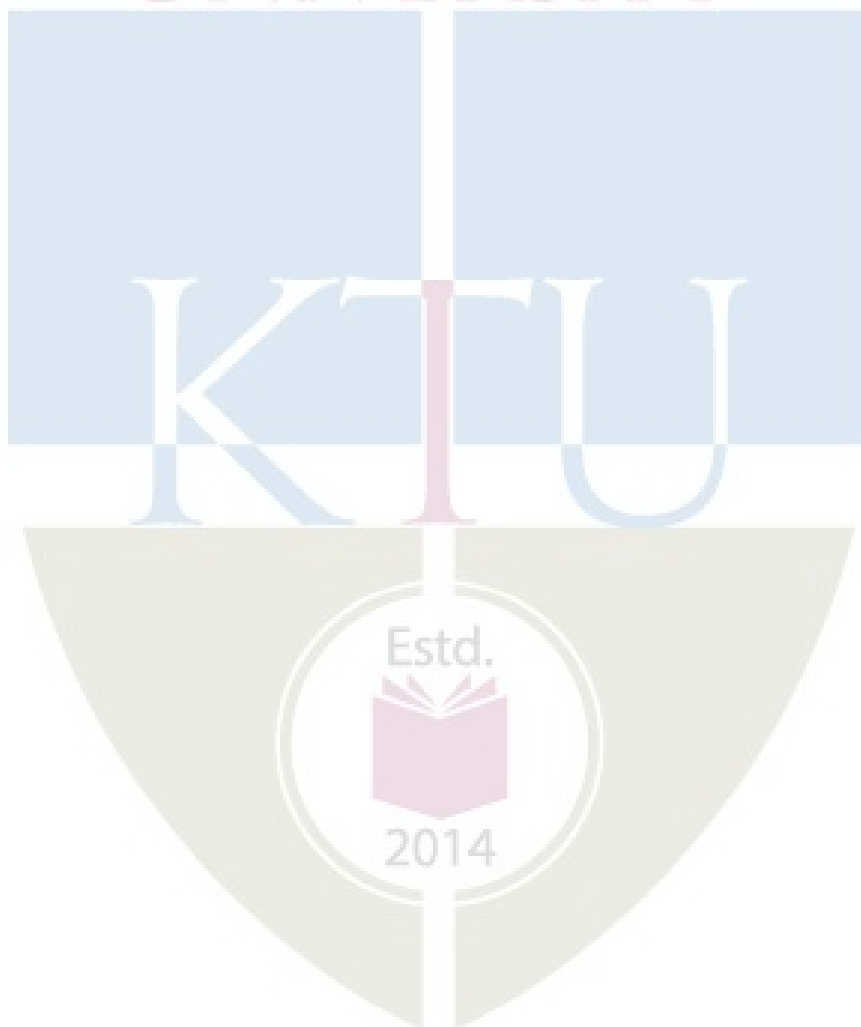
Course Contents and Lecture Schedule

INFORMATION TECHNOLOGY

(The total hours to be allocated for a subject : 3 credits- 35 hours, 4 credits- 45 hours)

Sl. No.	Topic	No. of Lectures
1	Introduction	7 Hours
1.1	Introduction-Two views of software Developments: SSAD and OOAD	1
1.2	Object Oriented Systems Development Life Cycle: Object Oriented Systems Development: A Use-Case Approach	1
1.3	Object Oriented Methodologies: Rumbaugh Object Modelling Technique, The Booch methodology	1
1.4	The Jacobson Methodology	1
1.5	The Unified Approach	2
1.6	Rational Unified Process, Four Major phases:- Inception , Elaboration, Construction, Transition.	1
2	Structural Modeling	7 Hours
2.1	Introduction to UML-Building blocks of the UML	1
2.2	Rules of the UML, Common Mechanism in the UML	1
2.3	Architecture	1
2.4	Class modeling- Objects and class concepts, link and Association Concepts	2
2.5	Aggregation, Packages	1
2.6	Component diagram, Deployment diagram	1
3	Behavioral Modeling	7 Hours
3.1	Interaction Modeling : Use Case Models	1
3.2	Sequence models, Activity Models.	1
3.3	Advanced Interaction Modeling: Use Case Relationships, Procedural Sequence Models,Special Constructs for Activity Models.	2
3.4	State modeling: Events, states, Transition and conditions	1
3.5	State diagrams, State diagram Behavior	1
3.6	Collaboration diagram.	1
4	System Design	8 Hours
4.1	System Conception: Devising a system concept , Elaborating a concept, Preparing a problem statement.	1
4.2	System Design: Overview of System Design, Estimating performance, Making a reuse plan	1
4.3	Breaking system into subsystems, Identifying concurrency, Allocation of subsystems	1
4.4	Management of data storage, Handling Global resources ,Choosing a software control strategy	1

4.5	Handling boundary condition· Common Architectural style	1
4.6	Metrics for the Object Oriented Design Model , Class - Oriented Metrics	2
4.7	Operation Oriented Metrics	1
5	Design Patterns	6 Hours
5.1	Introduction to design patterns - elements, catalog of design patterns,	2
5.2	Organizing the catalog	1
5.3	How design patterns solve design problems	1
5.4	How to select a design pattern	1
5.5	How to use a design pattern.	1



Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember		5	10
Understand	30	35	60
Apply	20	10	30
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Continuous Assessment Test (2 numbers) : 25 marks
 Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. State the advantages of keeping the data in a distributed database?
2. Explain different steps involved in distributed query processing.
3. Summarize the different data fragmentation techniques used in distributed databases? Give an example for each technique.

Course Outcome 2 (CO2):

1. Illustrate the structure of internal nodes and leaf nodes of a B⁺-tree.

2. Show how multilevel indexing improves the efficiency of searching an index with t levels.
3. Demonstrate heuristic query optimization with an example.

Course Outcome 3 (CO3):

1. List the pre-programmed functionalities that are available in a data warehouse transactional environment.
2. Differentiate clustering and classification.
3. Describe an association rule among hierarchies with examples.

Course Outcome 4 (CO4):

1. Demonstrate the implementation of insert, delete and update commands on a valid time relation.
2. With an example, illustrate how active rules can be specified.
3. Define the clausal form of formulas and Horn clauses.

Course Outcome 5 (CO5)

1. Explain any three constraints in GIS.
2. Explain the benefits and potential risks of sharding?
3. Explain the characteristics of Biological data?

Model Question paper

Course Code: ITT443

Course Name: ADVANCED DATABASE MANAGEMENT SYSTEMS

Max. Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. List the advantages and disadvantages of DDBMS.
2. When are voting and elections used in distributed databases?
3. What are the applications that can be developed using information in genomic and protomic databases?
4. Discuss briefly some of the general GIS applications?

5. How do spatial databases differ from regular databases?
6. What are deductive databases?
7. What is entropy and how is it used in building decision trees?
8. What is a data warehouse? How does it differ from a Database?
9. How is clustering index different from primary index?
10. Show *two non-canonical query trees* for the following relational algebra expression:
 $\square \text{ROLLNO, CID (COURSE} \bowtie \text{ENROLL} \bowtie \text{STUDENT))}$
 $\text{COURSE.CID}=\text{ENROLL.CNO}$
 $\text{ENROLL.ROLL\#}=\text{STUDENT.ROLLNO}$

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. a. Compare the primary site method with the primary copy method for distributed concurrency control. How does the use of backup sites affect each? 14

OR

12. a. What is a fragment of a relation in a Distributed Database? What are the main types of fragments? 8
- b. Why is fragmentation a useful concept in distributed database design? 6
13. a. Consider an EMPLOYEE file with 10000 records where each record is of size 80 bytes. The file is sorted on employee number (15 bytes long), which is the primary key. Assuming un-spanned organization, block size of 512 bytes and block pointer size of 5 bytes, compute the number of block accesses needed for retrieving an employee record based on employee number if 10
- (i) No index is used.
- (ii) Multi-level primary index is used.
- b. How does multilevel indexing improve the efficiency of searching an index file? 4

OR

14. a. Consider three tables COURSE(CNO,CNAME,CREDITS), STUDENT (ROLLNO,NAME,ADDRESS,SEM) and ENROLLMENT (CNO, ROLL NO,GRADE). Foreign keys have the *same* name as primary keys. Identify one initial canonical query tree for the following SQL expression and show the steps to optimize it using heuristics. Assume that CNAME is a candidate key.
SELECT S.NAME, S.ADDRESS, E.GRADE FROM COURSE C, STUDENT S, ENROLLMENT E
WHERE S.ROLLNO =E.ROLLNO AND C.CNO = E.CNO AND CNAME='ADBMS'. 14
15. a. Define data mining? How apriori algorithm used in data mining? 14
- OR**
16. a. Explain the steps involved in constructing a data warehouse. 14
17. a. Explain Spatial database and its data types. 14
- OR**
18. a. Explain ECA model used in Active Databases? 14
19. a. What are the characteristics of Biological data? 14
- OR**
20. a. Explain the distinction between a public and a permissioned blockchain and when each would be more desirable? 7
- b. Explain the components in a GIS system? 7

Estd.
Syllabus

Module 1: Introduction to distributed Databases. (7 Hours)

Distributed database concepts, Types of Distributed Database systems, Distributed Database Architectures, Data fragmentation, replication and allocation techniques for distributed database design, query processing and optimization in distributed databases, overview of transaction management in distributed databases, overview of concurrency control and recovery in distributed databases, distributed catalogue management.

Module 2: Database file indexing techniques. Query optimization (7 Hours)

Database file indexing techniques – types of single level ordered indexes, multilevel indexes, Dynamic multilevel indexes using B – Trees and B⁺ - trees.

Heuristic Query optimization.

Module 3: Data Mining and Data warehousing. (7 Hours)

Data Mining – concepts, association rules, classification, clustering, applications.
Data warehousing – Introduction, characteristics, modelling and building Data warehouse.
Module4: Advanced Database Models and Applications. (7 Hours)
Active database concepts and triggers, temporal database concepts, spatial Database concepts, multimedia database concepts, Introduction to Deductive Databases.
Module 5: Emerging Database Technologies and Applications. (7 Hours)
Geographic Information Systems (GIS), Biological and Genomic Databases and Emerging applications. Blockchain Databases.

Text Books

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, 6e, 2013.
2. Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 7/e, McGraw Hill, 2019.

Reference Books

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, McGrawHill Education, 3rd Edition, 2003.
2. C.J.Date, A.Kannan, S.Swamynathan, —An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to distributed Databases	7 hours
1.1	Distributed database concepts, Types of Distributed Database systems.	1
1.2	Distributed Database Architectures.	1
1.3	Data fragmentation, replication and allocation techniques for distributed database design.	2
1.4	query processing and optimization in distributed databases	1
1.5	Overview of transaction management in distributed databases,	1
1.6	Overview of concurrency control and recovery in distributed databases, Distributed catalog management.	1
2	Database files indexing techniques. Query optimization	7 hours
2.1	Types of single level ordered indexes.	2
2.2	Multilevel indexes (sample problems required).	1

2.3	Dynamic multilevel indexes using B – Trees and B ⁺ - trees (Structure only, Algorithms not required).	2
2.4	Heuristic Query optimization (sample Problems to optimize query required).	2
3	Data Mining and Data warehousing.	7 hours
3.1	Data Mining – concepts, association rules -Market-Basket model, Support and Confidence.	1
3.2	Apriori Algorithm, Sampling Algorithm.	1
3.3	Frequent-pattern tree Algorithm.	1
3.4	Classification.	1
3.5	Clustering (K- Means Clustering Algorithm), Applications of Data Mining.	1
3.6	Data warehousing – Introduction, Characteristics, Modelling and building Data warehouse.	2
4	Advanced Database Models and Applications.	7 hours
4.1	Active database concepts and triggers-generalized model, Design and implementation issues, Applications.	1
4.2	Temporal Database concepts- Time representations, Calenders, and Time Dimensions, Tuple versioning, Attribute versioning, Time series data.	2
4.3	Spatial Database Concepts- Introduction, Data types and models, Operators, Spatial data indexing, Spatial data mining, Applications of spatial data.	1
4.4	Multimedia Database Concepts- Automatic analysis of images, Object recognition in images, Semantic tagging, Analysis of audio data sources.	1
4.5	Introduction to Deductive Databases- Overview of deductive Databases, Prolog/Datalog notation, Clausal form and Horn Clauses, Interpretation of Rules, Datalog programs, Use of relational operations, Evaluation of Non recursive Datalog Queries	2
5	Emerging Database Technologies and Applications.	7 hours
5.1	Block chain Databases – Overview-, Block chain properties, Achieving Block chain properties via cryptographic hash functions.	1
	Consensus, Data management in a Block chain, Smart contracts.	1
	Performance enhancement, Applications.	1
5.2	Geographic Information Systems (GIS) – Components of GIS, Characteristics of Data in GIS, conceptual data models, GIS applications and software.	2
5.3	Biological and Genomic Databases and Emerging applications – Characteristics of Biological Data, Biological Databases, Applications.	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT453	MACHINE LEARNING	PEC	2	1	0	3

Preamble: The course introduces fundamental concepts of Machine Learning. The course includes basics of artificial neural networks, decision trees, HMM, SVM and other supervised and unsupervised learning methods.

Prerequisite: The students are expected to have basic knowledge of mathematical concepts.

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Identify machine learning applications such as learning associations, classification, regression, supervised, unsupervised learning and reinforcement Learning.	Level 2: Understand
CO 2	Explain supervised learning method such as classification, use Naive Bayes classifier and discuss classifier performance measures.	Level 3: Apply
CO 3	Use theoretical foundations of decision trees as well as describe the basics of neural networks.	Level 3: Apply
CO 4	Describe the fundamental concepts of SVM and HMM and explain how to combine multiple learners.	Level 2: Understand
CO 5	Illustrate clustering algorithms like k-means clustering, hierarchical clustering and discuss density based clustering.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	2	2	-	-	-	-	-	-	-	1
CO 3	3	2	2	2	-	-	-	-	-	-	-	1
CO 4	3	2	2	-	-	-	-	-	-	-	-	-
CO 5	3	2	2	2	1	-	-	-	-	-	-	1

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	10
Level 2: Understand	30	30	60
Level 3: Apply	10	10	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Compare supervised and unsupervised learning techniques.
2. List any three examples of machine learning applications.
3. Explain unsupervised learning with an example.

Course Outcome 2 (CO 2):

1. Describe how to measure the performance of a classifier.
2. Explain Naïve Bayes algorithm for classification.
3. State Bayes theorem and illustrate it with an example.

Course Outcome 3 (CO 3):

1. Demonstrate the use of decision tree for classification.
2. With the help of a neat diagram, explain the Perceptron model.
3. Describe any three activation functions used in neural networks.

Course Outcome 4 (CO 4):

1. Define linear separability with respect to two-class dataset.
2. Explain support vector machine for a two-class dataset.
3. Give an example for a discrete Markov process.

Course Outcome 5 (CO 5):

1. Discuss the similarity measures used for clustering.
2. Explain k-means algorithm with an example.
3. Demonstrate agglomerative hierarchical clustering.

Model Question Paper

Course Code: ITT453

Course Name: MACHINE LEARNING

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. List out any three applications of machine learning.
2. Illustrate learning association with an example
3. With the help of a neat diagram explain ROC Curves.
4. Explain learning a class from examples.
5. List the different types of decision trees.
6. Describe a perceptron model with a neat diagram.
7. Define Hidden Markov Model. What is meant by the evaluation problem and how is this solved?
8. State the significance of optimal separating hyperplane in SVM.
9. Discuss the similarity measures used for clustering.
10. Compare and contrast clustering and classification.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11 a.	Differentiate between supervised and unsupervised training. Explain with suitable examples.	7
b.	Distinguish between classification and regression with an example.	7

OR

- 12 a. Explain any two examples of machine learning applications in detail. 7
b. Differentiate between unsupervised learning and reinforcement learning. 7

- 13a. Define the terms Precision and Recall for a classification problem. 7
b. With the help of an example, illustrate classification using Naïve Bayes classifier. 7

OR

- 14a. A patient takes a lab test and the result comes back positive. It is known that the test returns a correct positive result in only 98% of the cases and a correct negative result in only 97% of the cases. Furthermore, only 0.008 of the entire population has this disease. What is the probability that this patient has cancer? What is the probability that he does not have cancer? What is the diagnosis? 7
b. Compare the different measures used for evaluating the performance of classifiers. 7

- 15a. What is a Perceptron? Explain the working of a perceptron with a neat diagram. 7
b. For the following set of training samples, find which attribute can be chosen as the root for decision tree classification. 7

Instance	Classification	a 1	a 2
1	+	T	T
2	+	T	T
3	-	T	F
4	+	F	F
5	-	F	T
6	-	F	T

OR

- 16a. State the issues involved in decision tree learning. 7
b. Discuss the steps involved in training a Back propagation neural network. 7
- 17a. Describe the terms Voting, Bagging and Boosting. 7
b. Illustrate the concept of linearly separable data. 7

OR

- 18a. Explain the basic problems associated with hidden Markov model. 7
b. Explain two class classification using SVM. 7
- 19a. Explain K means clustering algorithm. 7

- b. Suppose that the data mining task is to cluster the following eight points into three clusters. A1 (2, 10), A2 (2, 5), A3 (8, 4), B1 (5, 8), B2 (7, 5), B3 (6, 4), C1 (1, 2), C2 (4, 9). (x, y) representing location. The distance function is Euclidean distance. Suppose initially we assign A1, B1 and C1 as the center of each cluster, respectively. Use k-means algorithm to find the three cluster centers after the first round of execution. 7

OR

- 20a. Explain agglomerative hierarchical clustering method. 7
- b. Illustrate hierarchical clustering with a suitable example. 7

Syllabus

Module 1: Overview of Machine Learning (6 Hours)
Introduction to machine learning, Examples of machine learning applications - Learning associations, Classification, Regression, Supervised learning, Unsupervised learning, Reinforcement learning, Dimensionality reduction - Principle Component Analysis (Brief introduction)
Module 2: Supervised learning - Classification (7 Hours)
Classification - Learning a class from examples, Learning multiple classes. Bayes theorem, Bayesian classifier - Naive Bayes algorithm. Measuring classifier performance - Precision, Recall, ROC curves.
Module 3: Classification using decision tree and neural networks (8 Hours)
Decision tree - Example, Types of decision trees (Brief introduction). Feature selection measures - Entropy, Information gain. ID3 algorithm, Issues in decision tree learning. Neural networks - Perceptron, Activation functions, Training feed forward network by Back Propagation (Algorithm only).
Module 4: Classification using SVM and HMM (7 Hours)
Linearly separable data, Support vector machine - Optimal separating hyper plane Discrete Markov process, Hidden Markov models, Three basic problems of HMMs - Evaluation problem, Finding state sequence, Learning model parameters. Combining multiple learners, Model combination schemes - Voting, Bagging, Boosting
Module 5: Unsupervised learning (7 Hours)
Unsupervised learning - Clustering methods - K means, Similarity measures for clustering. Hierarchical clustering - Agglomerative hierarchical clustering. Density based clustering (Brief introduction)

Textbook

1. Ethem Alpaydin, Introduction to Machine Learning, The MIT Press, Cambridge, Massachusetts, 2nd Edition, 2004.

Reference Books

1. Mitchell T., Machine Learning, McGraw Hill, 1st Edition, 1997.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, 2nd Edition, Springer, 2006.

3. Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Pearson, 1st Edition, 2006.

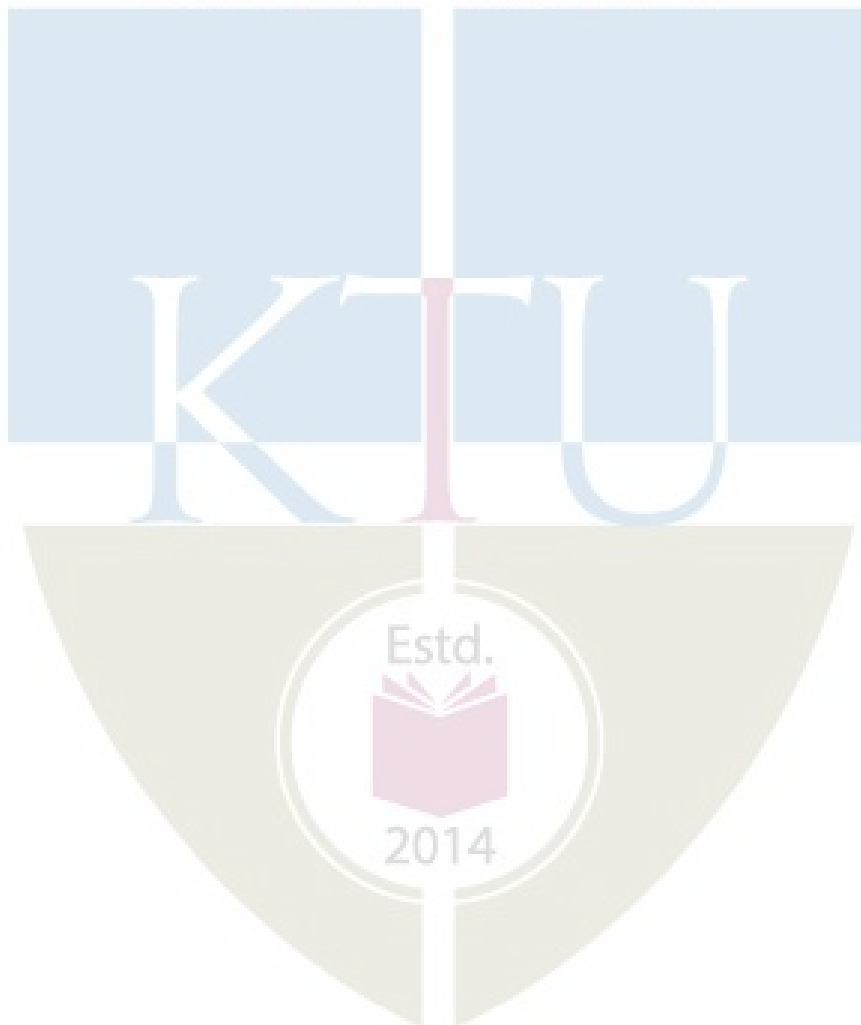
Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Machine Learning: An Artificial Intelligence Approach, Elsevier science, 1st Edition, 1983

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Overview of Machine Learning	6 Hours
1.1	Introduction to Machine Learning	1
1.2	Examples of Machine Learning Applications - Learning Associations	1
1.3	Classification	1
1.4	Regression	1
1.5	Supervised Learning, Unsupervised Learning, Reinforcement Learning	1
1.6	Dimensionality Reduction - Principle Component Analysis (Brief introduction)	1
2	Supervised learning	7 Hours
2.1	Classification - Learning a Class from Examples	1
2.2	Learning Multiple Classes	1
2.3	Bayes Theorem	1
2.4	Bayesian Classifier - Naive Bayes algorithm	2
2.5	Measuring Classifier Performance - Precision, Recall	1
2.6	ROC Curves	1
3	Classification using decision tree	8 Hours
3.1	Decision tree – Example, Types of Decision trees (brief introduction)	1
3.2	Feature Selection measures - Entropy, Information Gain	1
3.3	ID3 algorithm Issues in Decision Tree Learning	2
3.5	Neural Networks - Perceptron	1
3.6	Activation Functions	1
3.7	Training Feed Forward Network by Back Propagation (Algorithm only)	2
4	Classification using SVM and HMM	7 Hours
4.1	Linearly separable data	1
4.2	Support Vector Machine - Optimal Separating Hyper Plane	2
4.3	Discrete Markov Processes	1
4.4	Hidden Markov Models	1
4.5	Three Basic Problems of HMMs - Evaluation problem, Finding state sequence, Learning model parameters	1
4.6	Combining Multiple Learners, Model Combination Schemes - Voting, Bagging, Boosting	1
5	Unsupervised learning	7 Hours

5.1	Unsupervised Learning	1
5.2	Clustering Methods - K means	2
5.3	Similarity Measures for Clustering	1
5.4	Hierarchical clustering - Agglomerative hierarchical clustering.	2
5.5	Density based clustering (brief introduction)	1

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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT463	OPTIMIZATION AND METAHEURISTICS	PEC	2	1	0	3

Preamble: The objective of the course is to introduce the basic concepts of optimization and various metaheuristic algorithms used for solving optimization problems. It provides a background that enables students to design and implement metaheuristics to solve complex optimization problems.

Prerequisite: MAT101 Linear Algebra and Calculus
ITT304 Analysis and Design of Algorithms

Course Outcomes: After the completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO 1	Describe the main concepts of optimization problem and its solution method	Level 2: Understand
CO 2	Classify metaheuristics and focus on the design concepts of single-solution based metaheuristics	Level 2: Understand
CO 3	Explain the design and implementation of evolutionary algorithms on optimization problems	Level 3: Apply
CO 4	Solve complex optimization problems using swarm intelligence-based metaheuristics	Level 3: Apply
CO 5	Summarize the basic concepts of hybrid metaheuristics and parallel metaheuristics	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	1	-	-	-	-	-	-	-	-	2
CO 2	3	2	2	2	-	-	-	-	-	-	-	2
CO 3	3	3	2	2	-	-	-	-	-	-	-	2
CO 4	3	3	3	2	2	-	-	-	-	-	-	2
CO 5	2	2	2	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	10
Level 2: Understand	30	20	60
Level 3: Apply	10	20	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Define global optimum.
2. Explain the various representations of solutions handled by optimization algorithms.
3. Describe two different strategies for the parameter tuning of optimization algorithms.

Course Outcome 2 (CO2):

1. Illustrate the main principles of single-solution based metaheuristics.
2. List the three strategies that can be applied in the selection of a better neighbour.

3. Explain the two mechanisms employed in tabu search to deal with intensification and diversification of the search.

Course Outcome 3 (CO3):

1. Explain the rank-based selection method in evolutionary algorithms.
2. List the two replacement strategies employed in evolutionary algorithms.
3. Minimize the value of the function, $f(x) = ((a+2b+3c+4d)-30)$ using a genetic algorithm.

Course Outcome 4 (CO4):

1. Explain the various phases involved in artificial bee colony algorithm.
2. Find the minimum points of the function, $f(x, y) = 100(x^2 - y)^2 + (1-x)^2$; $-2.047 \leq a, b \leq 2.048$ using particle swarm optimization.
3. Explain the three components to be determined while designing an ant colony optimization in addition to common search components of metaheuristics.

Course Outcome 5 (CO5):

1. Describe global and partial hybrids.
2. Explain the two solution-level parallel models for metaheuristics.
3. Discuss four design questions involved by the parallel algorithmic-level model for metaheuristics.

Model Question paper

Course Code: ITT463

Course Name: OPTIMIZATION AND METAHEURISTICS

Max.Marks :100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. Explain the objective function of an optimization problem.
2. Define neighbourhood. Give an example of a neighbourhood for a permutation problem of size 3.
3. Explain the three different memories used to control the search process in tabu search algorithm.
4. Illustrate the principle of variable neighbourhood descent algorithm.

5. Explain the roulette wheel selection technique. INFORMATION TECHNOLOGY
6. List the three important points to be considered while designing mutation operators.
7. Explain the three different strategies applied for pheromone update in ant colony optimization.
8. Describe three different types of bee foragers in artificial bee colony.
9. Explain the homogeneous and heterogeneous hybrid metaheuristics.
10. List the three main reasons for employing parallel metaheuristics.

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

- 11.(a) Describe two main classification of optimization algorithms with a figure. 8
- (b) Illustrate the direct and indirect encodings for the job-shop scheduling problem. 6

OR

- 12.(a) Describe any four constraint handling strategies of optimization algorithms. 8
 - (b) Explain the main three steps to be considered for performance analysis of optimization algorithms. 6
- 13.(a) Describe local search algorithm and four different approaches that can be used to avoid local optima. 8
 - (b) Explain the three basic elements of an iterated local search algorithm. 6

OR

- 14.(a) Explain the template of a simulated annealing algorithm. 7
 - (b) Illustrate simulated annealing by maximizing the function, $f(x) = x^3 - 60x^2 + 900x + 100$ 7
- 15.(a) Explain any four crossover methods of evolutionary algorithms. 8
 - (b) Compare six features of genetic algorithms, evolution strategies, evolutionary programming and genetic programming. 6

OR

- 16.(a) Explain the main search components for designing an evolutionary algorithm. 7
- (b) Determine the maximum of a function, $f(x) = x^2$ where x value range from 0-31 using genetic algorithm. 7
- 17.(a) Explain the ant colony optimization algorithm. 7
- (b) Solve the travelling salesman problem using ant colony optimization. 7
- OR**
- 18.(a) Explain the various phases in particle swarm optimization. 7
- (b) Maximize the function, $f(x) = 1+2x-x^2$ using particle swarm optimization. 7
19. Describe low-level and high-level approaches under hierarchical classification of hybrid metaheuristics. 14
- OR**
20. Explain the parallel metaheuristic and its three design levels. 14

Syllabus

Module 1: Introduction to Optimization (7 Hours)	
Optimization Problem: Neighbourhood, Local and Global Optima – Classification of Optimization Algorithms: Exact Algorithms and Approximate Algorithms – Optimization Algorithm: Representation, Objective Function, Constraint Handling, Parameter Tuning and Performance Analysis of Optimization Algorithms	
Module 2: Metaheuristics (8 Hours)	
Classification of Metaheuristics: Single-Solution based Metaheuristics and Population-based Metaheuristics – Local Search: Neighbour Selection – Simulated Annealing: Move Acceptance and Cooling Schedule – Tabu Search – Iterated Local Search: Perturbation Method and Acceptance Criteria – Variable Neighbourhood Search: Variable Neighbourhood Descent and General Variable Neighbourhood Search	
Module 3: Evolutionary Algorithms (7 Hours)	
Common Concepts for Evolutionary Algorithms: Initial Population, Selection Methods, Mutation, Crossover and Replacement Strategies – Genetic Algorithm – Evolution Strategies – Evolutionary Programming – Genetic Programming	
Module 4: Swarm Intelligence based Metaheuristics (7 Hours)	
Characteristics of Swarm Intelligence based Metaheuristics – Ant Colony Optimization – Ant Colony Optimization for Travelling Salesman Problem – Particle Swarm Optimization – Artificial Bee Colony Algorithm	

Module 5: Advanced Metaheuristics (6 Hours)

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Hybrid Metaheuristics – Hybrid Metaheuristics Design Issues: Hierarchical Classification and Flat Classification – Parallel Metaheuristics – Design Levels of Parallel Metaheuristics: Algorithmic-Level, Iteration-Level and Solution-Level Parallel Models

Text Books

1. Talbi, El-Ghazali. *Metaheuristics: from design to implementation*. Vol. 74. John Wiley & Sons, 2009.
2. Luke, Sean. *Essentials of Metaheuristics*, Lulu, Second edition, 2013.

Reference Books

1. Gendreau, Michel, and Jean-Yves Potvin, eds. *Handbook of metaheuristics*. Vol. 2. New York: Springer, 2010.
2. Michalewicz, Zbigniew, and David B. Fogel. *How to solve it: modern heuristics*. Springer Science & Business Media, 2013.
3. Gonzalez, Teofilo F. *Handbook of approximation algorithms and metaheuristics*. CRC Press, 2007.
4. Mitchell, Melanie. *An introduction to genetic algorithms*. MIT press, 1998.
5. Christian Blum, Daniel Merkle. *Swarm Intelligence: Introduction and Applications*, Springer Verlag, 2008.
6. Eric Bonabeau, Marco Dorigo, Guy Theraulaz. *Swarm Intelligence: From Natural to Artificial Systems*, Oxford University Press, 2000.
7. Marco Dorigo, Thomas Stutzle. *Ant Colony Optimization*, MIT Press, 2004.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Introduction to Optimization	7 Hours
1.1	Optimization Problem: Neighbourhood, Local and Global Optima	1
1.2	Classification of Optimization Algorithms: Exact Algorithms and Approximate Algorithms	1
1.3	Representation: Linear, Nonlinear, Representation-Solution Mapping, Direct and Indirect Encodings	1
1.4	Objective Function, Constraint Handling: Reject Strategies, Penalizing Strategies	1
1.5	Repairing Strategies, Decoding Strategies and Preserving Strategies	1
1.6	Parameter Tuning: Offline and Online Parameter Initialization	1
1.7	Performance Analysis of Optimization Algorithms	1
2	Metaheuristics	8 Hours
2.1	Classification of Metaheuristics: Single-Solution based Metaheuristics	1
2.2	Concepts for Population-based Metaheuristics	1

2.3	Local Search: Neighbour Selection	1
2.4	Simulated Annealing: Move Acceptance and Cooling Schedule	1
2.5	Tabu Search	1
2.6	Iterated Local Search: Perturbation Method and Acceptance Criteria	1
2.7	Variable Neighbourhood Search: Variable Neighbourhood Descent	1
2.8	General Variable Neighbourhood Search	1
3	Evolutionary Algorithms	7 Hours
3.1	Common Concepts for Evolutionary Algorithms : Initial Population	1
3.2	Selection Methods	1
3.3	Mutation	1
3.4	Crossover and Replacement Strategies	1
3.5	Genetic Algorithm	1
3.6	Fundamentals of Evolution Strategies and Evolutionary Programming	1
3.7	Genetic Programming	1
4	Swarm Intelligence based Metaheuristics	7 Hours
4.1	Swarm Intelligence based Metaheuristics: Ant Colony Optimization	2
4.2	Ant Colony Optimization for Travelling Salesman Problem	1
4.3	Particle Swarm Optimization	2
4.4	Artificial Bee Colony Algorithm	2
5	Advanced Metaheuristics	6 Hours
5.1	Hybrid Metaheuristics, Design Issues: Hierarchical Classification	1
5.2	Flat Classification	1
5.3	Parallel Metaheuristics and its Design Levels	1
5.4	Algorithmic-Level Parallel Model	1
5.5	Iteration-Level Parallel Model	1
5.6	Solution-Level Parallel Model	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT473	PROBABILISTIC AND STOCHASTIC MODELLING	PEC	2	1	0	3

Preamble: This course introduces the basic concepts of probability and stochastic processes. This course helps the learner to apply the theory and applications of probability and random process in various fields of engineering.

Prerequisite: MAT 208 Probability, Statistics and Advanced Graph Theory.

Course Outcomes: After completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe the basic concepts of probability theory.	Level 2: Understand
CO 2	Identify probability distributions for various situations.	Level 2: Understand
CO 3	Discuss on problems with two random variables and calculate the joint expectations and other statistical measures.	Level 2: Understand
CO 4	Explain the concepts of random processes, its classifications, statistical properties and stationary properties.	Level 2: Understand
CO 5	Interpret random processes - Poisson process and Markov Chain.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	1	1	-	-	-	-	-	-	-	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	2
CO 3	3	2	2	1	-	-	-	-	-	-	-	2
CO 4	3	2	2	1	-	-	-	-	-	-	-	2
CO 5	3	2	2	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	40	30	65
Level 3: Apply		10	15
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. If you twice flip a balanced coin, what is the probability of getting at least one head?
2. If $P(A)=0.5$, $P(B)=0.3$ and $P(A \cap B)=0.15$. Find $P(A/\underline{B})$
3. In a colony, there are 60% men and 40% women. According to a survey taken, 8 men out of 100 and 10 women out of 100 have high blood pressure. A high B.P person is chosen at random. What is the probability that this person is male?

Course Outcome 2 (CO 2):

1. X is a discrete RV with the probability mass function $f(x) = \frac{x}{10}$, for $x = 1, 2, 3, 4$. Find
 - a) $P(X = 1 \text{ or } 2)$ b) Calculate $P(\frac{1}{2} < X < \frac{5}{2} / X > 1)$.

2. It is known that 5% of the books bound at a certain bindery have defective bindings. Find the probability that 2 of 100 books bound by this bindery will have defective bindings.
3. The weekly wages of 1000 workmen are normally distributed around a mean of Rs.500/- with a standard deviation of Rs.50/-. Estimate the number of workers, whose weekly wages will be
 - a) between Rs. 400 and Rs. 600.
 - b) less than Rs. 400.
 - c) more than Rs. 600.

Course Outcome 3 (CO 3):

1. If X and Y have the joint probability density function $(x, y) = \{K(x + 2y), \text{if } 0 < x < 2, 0 < y < 2, 0, \text{otherwise} \}$.
Find the value of K and $P(X+Y < 1)$
2. The fraction X of male runners and fraction Y of female runners who complete marathon races can be described by the joint density function $f(x, y) = \{8xy, \text{if } 0 < x < 1, 0 < y < x, 0, \text{otherwise} \}$.
Find the covariance of X and Y.
3. A random sample of size 100 is taken from a population whose mean is 80 and variance is 400. Using CLT, with what probability can we assert that the mean of the sample will not differ from $\mu=80$ by more than 6?

Course Outcome 4 (CO 4):

1. Define and classify random processes.
2. Consider a random process $X(t) = A \cos \omega t, t \geq 0$, where A is a uniform random variable over (0,1). Find the
 - a) Mean of X(t)
 - b) Autocorrelation function of X(t)
 - c) Auto covariance function of X(t) and
 - d) Variance of X(t).
3. Consider a random process X(t) defined by $X(t) = U \cos t + V \sin t$, where U and V are independent random variables each of which assumes the values -2 and 1 with probabilities 1/3 and 2/3 respectively. Show that X(t) is wide-sense stationary.

Course Outcome 5 (CO 5):

1. Queries presented in a database are following a Poisson process of rate $\lambda = 6$ queries per minute. An experiment consists of monitoring the database for m minutes and recording N(m) the number of queries presented. What is the probability of
 - a. No queries in a one minute interval?
 - b. Exactly 6 queries arriving in a one- minute interval?
 - c. Less than 3 queries arriving in a half minute interval?
2. A message transmission system is found to be Markovian with the transition probability of current message to next message as given by the matrix

$$P = [0.2 \ 0.3 \ 0.5 \ 0.1 \ 0.2 \ 0.7 \ 0.6 \ 0.3 \ 0.1].$$

The initial probabilities of the states are $p_1(0) = 0.4, p_2(0) = 0.3, p_3(0) = 0.3$. Find the probabilities of the next message.

- Describe a simple random walk with two reflecting barriers at the states 0 and 2 and compute the stationary distribution.

Model Question Paper

Course Code: ITT473

Course Name: PROBABILISTIC AND STOCHASTIC MODELLING

Max.Marks:100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

- If A and B are mutually exclusive events such that $P(A)=1/4$ and $P(B)=3/5$. Find $P(\underline{A} \cap \underline{B})$.
- A manufacturer of Airplane parts knows that the probability is 0.8 that an order will be ready for shipment of time, and it is 0.7 that an order will be ready for shipment and will be delivered on time. What is the probability that such an order will be delivered on time given that it was also ready for shipment on time?
- A continuous random variable X has a probability density function $f(x) = k(1 + x), 2 \leq x \leq 5$. Find $P(X \leq 4)$.
- If the mean and variance of a binomial variable are 12 and 4, respectively, find the distribution.
- Find the value of k if $f(x, y) = K(1 - x)(1 - y)$ for $0 < x, y < 1$ is to be joint density function of X and Y.
- The joint probability distribution of X and Y is given by $f(x, y) = \frac{2x+y}{27}, x=0,1$ and $y=0,1,2$. Are X and Y independent random variables?
- Let $X(t) = A \cos(50t + \theta)$, where A and θ are uniformly distributed in $(-\pi, \pi)$. Find the mean of $\{X(t)\}$.
- Let $X(t)$ be a WSS. Then prove that $R_{xx}(0) = E[X^2(t)]$.
- A gambler has Rs. 2/- . He bets 1 rupee at a time and wins 1 rupee with probability $\frac{1}{2}$. He stops fixing if he loses Rs. 2/- or wins Rs. 4/-. Model this problem as a Markov Chain and find the transition probability matrix.
- Find the mean of the Poisson Process and check whether it is a stationary process.

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

- Two thirds of the students in a class are boys and the rest are girls. It is known that the probability of a girl getting a first class is 0.25 and that of a boy is 0.28. Find the probability that a student chosen at random will get first class.

- b) In a certain recruitment test, there are multiple choice questions. There are 4 possible answers to each question and of which one is correct. An intelligent student knows 90% of the answer. If the intelligent student gets the correct answer, what is the probability that he is guessing? 7

OR

12. a) A box contains 5 red and 4 white balls. Two balls are drawn successively from the box without replacement and it is noticed that the second one is white. What is the probability that the first is also white? 7
- b) If A tells the truth 4 out of 5 times and B tells the truth 3 out of 4 times, What is the probability that both expressing the same fact contradict each other? 7
13. a) The length of time (in minutes) a person speaks over the phone follows an exponential distribution with mean 4. Find the probability that the person will talk for (i) more than 8 minutes (ii) between 3 and 6 minutes (iii) less than 2 minutes. 7
- b) A pair of dice is thrown 5 times. If getting a doublet is considered to be a success, use Binomial distribution to find the probability of getting (i) at least 2 successes (ii) at most 2 successes (iii) exactly 2 failures. 7

OR

14. a) The marks obtained by students in an intelligence test follow normal distribution with mean 45 and standard deviation 25. Find the percentage of students who scored marks (i) more than 80 (ii) between 30 and 70 (iii) below 35. 7
- b) Show that Poisson distribution is the limiting case of Binomial distribution as $n \rightarrow \infty, p \rightarrow 0$. 7
15. a) A random sample of size 200 is taken from a population whose mean is 50 and variance is 600. Using Central Limit theorem, find the probability that the mean of the sample $\bar{X}$ will not differ from $\mu = 50$ by more than 5. 7
- b) The joint pdf of X, Y is given by $f(x, y) = k(x + 2y), x = 1, 2, 3; y = 1, 2, 3$. Find (i) k (ii) marginal pdf of X, Y (iii) $P(X < 3, Y \geq 2)$. 7

OR

16. a) Let $X_1, X_2, \dots, X_{75}$ are independently and identically distributed random variables following Poisson distribution with parameter $\mu = 2$. Use Central Limit Theorem to estimate $P(120 \leq S_{75} \leq 160)$, where $S_{75} = X_1 + X_2 + \dots + X_{75}$. 7

- b) The joint density function of two continuous random variables X, Y is given by $f(x, y) = \begin{cases} Ke^{-2x-2y}, & x \geq 0, y \geq 0 \\ 0, & \text{otherwise} \end{cases}$. Find (i) the value of K (ii) $P(X > 1)$ (iii) the marginal distributions of X, Y and (iv) check whether X, Y are independent. 7
17. a) $\{X(t)\}$ is a random process with mean 2 and auto correlation $R(t_1, t_2) = 5 + 3e^{-0.1|t_1-t_2|}$. Find the mean, variance and the covariance of the random variables $X(4)$ and $X(6)$. 7
- b) Consider the random process $X(t)$ defined by $X(t) = A \cos(\omega t + \theta)$ where A and θ are independent and uniform random variables over $(-k, k)$ and $(-\pi, \pi)$, respectively. Find the Mean and autocorrelation function of $X(t)$. 7
- OR**
18. a) Let $\{X(t) = A \cos \omega t + B \sin \omega t, t > 0\}$ be a random process where A and B are independent random variables following normal distribution with mean 0 and variance 4. Check whether $\{X(t)\}$ is WSS. 7
- b) Define and classify random processes with examples. 7
19. a) The tpm of a Markov Chain with states 1,2,3 is $P = \begin{bmatrix} 0.2 & 0.3 & 0.5 \\ 0.1 & 0.6 & 0.3 \\ 0.4 & 0.3 & 0.3 \end{bmatrix}$ and the initial distribution is $P(0) = (0.5, 0.3, 0.2)$. Find
(i) $P(X_2) = 2$
(ii) $P(X_3 = 3, X_2 = 2, X_1 = 1, X_0 = 3)$ 7
- b) Suppose that customers arrive at a bank according to a Poisson process with mean rate of 3 per minute. Find the probability that during a time interval of 2 minutes (i) exactly 4 customers arrive (ii) more than 4 customers arrive. 7
- OR**
20. a) The tpm of a Markov Chain is $P = \begin{bmatrix} 0.5 & 0.5 & 0.1 & 0.9 \end{bmatrix}$. Find the steady state distribution of the process. 7
- b) Prove that the inter arrival time of a Poisson process with intensity λ obeys an exponential law with mean $\frac{1}{\lambda}$. 7

Syllabus

Module 1: Introduction to Probability theory (6 Hours)
Sample space, Events, Probability, Conditional probabilities, Independent events, Bayes' formula.
Module 2: Random variables (8 hours)
Random variables - Discrete and continuous random variables - statistical properties. Probability distributions - Binomial, Poisson, Exponential, Uniform and Normal probability distributions.
Module 3: Two-Dimensional random variables (7 hours)
Joint distribution of random variables, Marginal and conditional distributions, Independent random variables, Expectation and Covariance, Central limit theorem.
Module 4: Random processes (7 hours)
Classification of random processes, Mean, Correlation and Covariance functions, Stationary random processes, Autocorrelation and Cross correlation functions.
Module 5: Special random processes (7 hours)
Poisson process - Properties and applications, Markov Chain, Chapman-Kolmogorov theorem, Stationary distribution of a Markov Chain.

Text Books

1. V. Sundarapandian, "Probability, Statistics and Queueing Theory", Prentice Hall India, 2009.
2. Sheldon M. Ross, "Introduction to Probability models", Academic Press, 11th edition, 2014.

Reference Books

1. J Medhi, "Stochastic Processes", New Age International Publishers, 3rd edition, 2009
2. Kishor S. Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science Applications", Wiley, 2nd Edition, 2002.
3. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage, 8th edition, 2012.
4. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, 2005.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Introduction to Probability theory	6 Hours
1.1	Sample space, Events, Probability	1
1.2	Conditional probabilities	2
1.3	Independent events	1
1.4	Bayes' formula	2
2	Random variables	8 hours

2.1	Discrete and continuous random variables and their statistical properties	1
2.2	Discrete and continuous Probability distributions	2
2.3	Binomial Random variables	1
2.4	Poisson random variables	1
2.5	Uniform random variables	1
2.6	Exponential random variables	1
2.7	Normal random variables	1
3	Two-Dimensional random variables	7 hours
3.1	Joint distribution of random variables (Discrete and Continuous)	2
3.2	Marginal and conditional distributions, Independent random variables	2
3.3	Expectation and Covariance	2
3.4	Central limit theorem	1
4	Random processes	7 hours
4.1	Definition and Classification of random processes	1
4.2	Mean, Correlation and Covariance functions	2
4.3	Stationary random processes	2
4.4	Autocorrelation and Cross correlation functions	2
5	Special random processes	7 hours
5.1	Poisson process- Definition and probability distribution (without proof)	1
5.2	Poisson process - Properties and applications	2
5.3	Markov Chain - Definition, probability distributions	1
5.4	Chapman - Kolmogorov theorem (Without proof)	1
5.5	Stationary distribution of a Markov Chain	2



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VII

OPEN ELECTIVE



Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	1	2	
Remember	5	5	10
Understand	35	20	50
Apply	10	25	40
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have a maximum 2 subdivisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. List User Interface and Layout tools for web designing.
2. Summarize file management and transfer tools
3. Mention the various web graphics creation tools

Course Outcome 2 (CO 2):

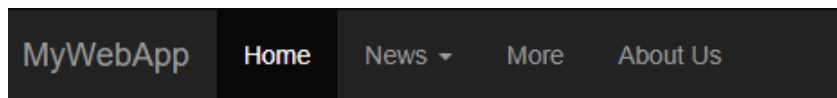
1. List out the process involved in web page design.
2. Differentiate ordered list and unordered list with example
3. Discuss Responsive image markup

Course Outcome 3 (CO 3):

1. Discuss responsive image production list.
2. Design a responsive svg image for library website
3. Create a web design for hospital management with responsive SVGs

Course Outcome 4 (CO 4):

1. Create a navigation bar in the format shown below using Cascading Style sheet and HTML:



2. Create a web site for library management with HTML, CSS.
3. How colors and background applied in above site

Course Outcome 5 (CO 5):

1. Demonstrate insertion of new list item in an HTML page utilizing DOM methods.
2. Use Ajax & JQuery to enhance the functioning of web pages
3. Design a website make use of JQuery and Ajax

Model Question Paper

Course Code: ITT415

Course Name: WEB DESIGNING

Max Marks :100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

1. Differentiate User Experience and User Interface Design
2. Discuss the anatomy of a web page.
3. What is the use of href? Give examples.
4. Illustrate the usage of alt attributes in an image tag.
5. Describe image asset strategy
6. Discuss SVG production tips.
7. What are Cascading Style Sheets?
8. Differentiate block and inline elements.
9. What is a Document Object Model?
10. Illustrate how JavaScript makes web pages more interactive.

PART B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. Discuss different web graphics creation tools. 14

OR

12. Describe progressive web design with examples. 14
13. Explain table tag and create the following table using table tag in HTML: 14

Branch	CGPA/Percentage		Salary
	UG	PG	
IT	105	12	500000

Others	200	225	400000

OR

14. Implement the following nested list in HTML:

14

▪ **Maharashtra**

○ **Pune**

I. Dighi

II. Moshi

III. Shivajinagar

○ **Mumbai**

I. Santakruiz

II. Vikroli

III. Mumbra

15. Discuss image optimization.

14

OR

16. Discuss features of SVG as XML.

14

17. Differentiate the concepts of inline, internal and external style sheets with examples.

14

OR

18. Illustrate layout and positioning elements in CSS with examples.

14

19. Explain JavaScript: Objects: Math, String, Date, and document Object with example.

14

OR

20. What are events and explain event handling with examples.

14

Syllabus

Module 1: Introduction to web designing (7 Hours)

Getting Started in Web Design: *Website creation roles:* Content wrangling - information architecture, Content strategy. All manner of Design - User Experience, interaction and User Interface Design, Visual(Graphic Design). Code Slinging - Front End Development, Back End Development, Other Roles. Gearing up for web design: Equipment, Web Production Software - Coding tools, User Interface and Layout tools, Web Graphics Creation Tools, A variety of browsers, File Management and Transfer Tools.

How the Web Works?: The internet versus the web, Serving up your information, A word about browsers, Web Page Addresses(URL), The anatomy of a web page, Putting it all together, A multitude of Devices, Sticking with the standards, Progressive Enhancement, Responsive web Design, Accessibility, Site performance.

Module 2: Html for structure (7 Hours)

Creating a simple page: A web page step by step: starting with content, Give the HTML document structure, Identifying text elements, Add an image, Change the look with a style sheet, When good page go bad, Validating your documents.

Marking up Elements: *Text:* Paragraph, Heading, Horizontal Rule, Lists, Organizing page content, Inline elements, generic elements(div and span), Character escapes, putting it all together; *Links:* href attribute, Linking to pages on web, linking within your own site, targeting a new browser window, Mail links. *Images:* image formats, img element, Adding svg elements, Responsive image markup. *Table:* how to use tables, Minimal table structure, table headers, spanning cells, Row and column groups, Wrapping up tables. *Forms:* How form works, form elements, variables and content, The great form control roundup, Form accessibility features, form layout and design. *Embedded media:* iframe, object, video and audio, canvas

Module 3: Creating web graphics (6 Hours)

Web Image Basics: Image sources, Meet the formats, Image size and resolution, image asset strategy, favicons, summing up images, saving images in web format, working with transparency, Responsive image production tips, image optimization.

SVG: Drawing with XML, Features of SVG as XML, SVG tools, SVG production tips, Responsive svgs.

Module 4: CSS for presentation (8 Hours)

Introduction to Cascading Style Sheets: The benefits of CSS, How style sheets work, The big concept, CSS units of measurement, Developer tools, moving forward with css, *Formatting text:* Basic font properties, Advanced typography with CSS3, changing text color, Selector types, text line adjustments, decorations, changing capitalization, spaced out, text shadow, changing list bullets and numbers. *Colors and backgrounds:* specifying color values, foreground color, background color, clipping the background, playing with opacity, pseudo class selectors, pseudo element selectors, attribute selectors, background images, shorthand background property, gradients, External Style sheets.

Positioning: *Thinking inside the box:* Element box, Specifying box dimensions, padding, borders, margins, assigning display types, box drop shadows; *Floating and positioning:* normal flow, floating, fancy text wrap with css shapes, positioning basics, relative positioning, Absolute positioning, fixed positioning; *CSS Layout with Flexbox and Grid:* flexible boxes with css and flexbox, CSS grid layout.

Responsive Web Design: why RWD?, The responsive recipe, choosing breakpoints, designing responsively, *Transition, Transforms and Animations:* CSS transitions, CSS transforms, Keyframe animations

Module 5: Java script for behavior (7 Hours)

Introduction to Javascript: What is javascript?, Adding javascript to a page, The anatomy of a script, The browser object, Events, Putting it all together, Meet the DOM, Polyfills, Javascript libraries

Jquery : What is jquery ?, A basic jquery example, Why use jquery ?, finding elements, jquery selection, getting element content, updating elements, changing content, inserting elements, adding new content, getting and setting attributes, getting and setting CSS properties, using .each(), events, event object, effects, animating CSS properties, using animation, traversing the DOM, working with forms, javascript libraries, jquery and Ajax

Text Books

1. Jennifer Niederst Robbins, “Learning Web Design”, 5/E O’Reilly, 2018
2. Jon Duckett , “JavaScript and JQuery : Interactive Front–End Web Development”, Wiley, 1st Edition 2014
3. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet and World Wide Web How To Program”, 5/E, Pearson Education, 2012.

Reference Books

1. Jon Duckett , “HTML and CSS: Design and Build Websites”, Wiley, 1st Edition, 2011

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	Introduction to web designing	7 Hours
1.1	Getting Started in Web Design: <i>Website creation roles:</i> Content wrangling - information architecture, Content strategy; All manner of Design - User Experience, interaction and User Interface Design, Visual(Graphic Design)	1
1.2	Code Slinging - Front End Development, Back End Development; Other Roles. Gearing up for web design: Equipment, Web Production Software - Coding tools, User Interface and Layout tools	1
1.3	Web Graphics Creation Tools, A variety of browsers, File Management and Transfer Tools	2
1.4	How the Web Works?: The internet versus the web, Serving up your information, A word about browsers, Web Page Addresses(URL),	1
1.5	The anatomy of a web page, Putting it all together, A multitude of Devices, Sticking with the standards, Progressive Enhancement, Responsive web Design, Accessibility, Site performance	2

2	HTML for structure	7 Hours
2.1	Creating a simple page: A web page step by step: starting with content, Give the HTML document structure, Identify text elements, Add an image	1
2.2	Change the look with a style sheet, When good page go bad, Validating your documents	1
2.3	Marking up Elements: <i>Text:</i> Paragraph, Heading, Horizontal Rule, Lists, Organizing page content, Inline elements, generic elements(div and span), Character escapes, putting it all together.	1
2.4	<i>Links:</i> href attribute, Linking to pages on web, linking within your own site, targeting a new browser window, Mail links.	1
2.5	<i>Images:</i> image formats, img element, Adding svg elements, Responsive image markup. <i>Table:</i> how to use tables, Minimal table structure, table headers, spanning cells, Row and column groups, Wrapping up tables.	1
2.6	<i>Forms:</i> How form works, form elements, variables and content, The great form control roundup, Form accessibility features, form layout and design; <i>Embedded media:</i> iframe, object, video and audio, canvas	2
3	Creating Web Graphics	6 Hours
3.1	Web Image Basics: Image sources, Meet the formats	1
3.2	Image size and resolution, image asset strategy, favicons	1
3.3	Summing up images, saving images in web format, working with transparency,	1
3.4	Responsive image production tips, image optimization	1
3.5	SVG: Drawing with XML, Features of SVG as XML, SVG tools,	1
3.6	SVG production tips, Responsive SVGs	1
4	CSS For presentation	8 Hours

4.1	Introduction to Cascading Style Sheets: The benefits of CSS, How style sheets work, The big concept, CSS units of measurement, Developer tools, moving forward with css	1
4.2	<i>Formatting text:</i> Basic font properties, Advanced typography with CSS3, changing text color, Selector types, text line adjustments, decorations, changing capitalization, spaced out, text shadow, changing list bullets and numbers.	2
4.3	<i>Colors and backgrounds:</i> specifying color values, foreground color, background color, clipping the background, playing with opacity, pseudo class selectors, pseudo element selectors, attribute selectors, background images, shorthand background property, gradients, External Style sheets	1
4.4	Positioning: <i>Thinking inside the box:</i> Element box, Specifying box dimensions, padding, borders, margins, assigning display types, box drop shadows.	1
4.5	<i>Floating and positioning:</i> normal flow, floating, fancy text wrap with css shapes, positioning basics, relative positioning	1
4.6	Absolute positioning, fixed positioning; <i>CSS Layout with Flexbox and Grid:</i> flexible boxes with css and flexbox, CSS grid layout	1
4.7	Responsive Web Design: why RWD?, The responsive recipe, choosing breakpoints, designing responsively, <i>Transition, Transforms and Animations:</i> CSS transitions, CSS transforms, Keyframe animations	1
5	JavaScript for behavior	7 Hours
5.1	Introduction to Javascript: What is javascript?, Adding javascript to a page, The anatomy of a script, The browser object	1
5.2	Events, Putting it all together, Meet the DOM, Polyfills, Javascript libraries	1
5.3	JQuery : What is JQuery ?, A basic JQuery example, Why use JQuery?, finding elements, JQuery selection, getting element content, updating elements, changing content, inserting elements	2
5.4	Adding new content, getting and setting attributes, getting and setting CSS properties, using .each(), events, event object, effects, animating CSS properties	2
5.5	Using animation, traversing the DOM, working with forms, JavaScript libraries, JQuery and Ajax	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT425	MULTIMEDIA TECHNIQUES	OEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn multimedia concepts and the different elements of multimedia such as text, image, sound, video and animations.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe multimedia concepts and the use of text in multimedia.	Level 2: Understand
CO 2	Demonstrate the facets of image in multimedia.	Level 2: Understand
CO 3	Choose different sound formats for multimedia applications.	Level 3: Apply
CO 4	Develop video and animations.	Level 3: Apply
CO 5	Explain stages of multimedia and future multimedia.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	1	-	-	-	-	-	-	2
CO 2	3	3	2	1	-	-	-	-	-	-	-	2
CO 3	3	3	3	2	1	-	-	-	-	-	-	2
CO 4	3	3	3	2	1	-	-	-	-	-	-	2
CO 5	2	2	2	1	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	5	5	10
Level 2: Understand	35	30	60
Level 3: Apply	10	15	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Describe different environments in which multimedia might be used, and different aspects of multimedia that provide a benefit over other forms of information presentation.
2. Define common multimedia terms such as multimedia, integration, interactive, HTML, and authoring and qualify various characteristics of multimedia: nonlinear versus linear content?
3. Discuss the importance of text and ways text can be leveraged in multimedia presentations.

Course Outcome 2 (CO 2):

1. Describe the use of colours and palettes in multimedia.

2. Discuss the difference between bitmap and vector graphics. Describe five different graphic elements you might use in a project, for example, the background, buttons, icons, or text. Would you use a vector tool or a bitmap tool for each element? Why?
3. Explain the image file formats.

Course Outcome 3 (CO 3):

1. Describe the components and measurements of sound.
2. Determine which audio file formats are frequently used in a multimedia project.
3. How to make digital audio files?

Course Outcome 4 (CO 4):

1. Illustrate the principles of animation.
2. How to create computer generated animations from multiple still images.
3. What defines the quality of a video signal? What factors affect, if the end result is going to be a postage-stamp-sized streaming video clip at 10 frames per second, why would quality matter?

Course Outcome 5 (CO 5):

1. Explain the four basic stages in a multimedia project.
2. What are the desirable features that should be included in a good 3d modelling tool?
3. Discuss the intangible elements needed to make good multimedia.

Model Question Paper

Course Code: ITT425

Course Name: MULTIMEDIA TECHNIQUES

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Define multimedia.
2. Describe the characteristics a block of text might have.
3. Describe the use of colors and palettes in multimedia.
4. How would you describe dithering?
5. How do you use the power of sound to make the difference between an ordinary multimedia presentation and a professionally spectacular one?
6. List the important steps and considerations in recording and editing digital audio.

7. How does the video work and is displayed?
8. Define codec and list an example of a codec.
9. What are the various authoring tools based on the method used for organizing multimedia elements and events? Give examples.
10. What is the need of OCR software while making multimedia?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 Discuss the problems encountered using text across computer platforms and in different languages. 14

OR

- 12 Explain hypermedia, hypertext, links, anchors, and nodes. Discuss both the potential and limitations of hypertext and hyperlinking systems. 14

- 13 Differentiate among bitmap, vector, and 3-D images and describe the capabilities and limitations of all three. 14

OR

- 14 Explain how still images are generated in a computer.

- 15 a. Describe what MIDI is, what its benefits are, and how it is best used in a multimedia project. 10

- b. Compare and contrast the use of MIDI and digitized audio in a multimedia production 4

OR

- 16 a. List the steps you would go through to record, edit, and process a set of sound files for inclusion on a web site. How would you digitally process the files to ensure they are consistent, have minimum file size, and sound their best? (10)

- b. Calculate the file size of a five-second recording sampled at 22 kHz, 16-bit if stereo two tracks are used. 4

- 17 a. How can create a simple animation of a man bowling, with the ball rolling down the alley and striking the pins? 10

i) Describe the sequence of motions in a storyboard.

ii) Discuss the various techniques and principles you might employ to accurately represent the motion of the man moving, the ball rolling, and the pins falling.

- b. i) List the steps involved in capturing video, compressing the video, and preparing it for DVD and discuss the decisions you need to make with each step regarding compromises on image quality and other limiting factors. 4

OR

- 18 a. Discuss the physical and psychological principles as to why animation works, as well as how it is usually presented. 4

- b. Answer the following questions. 10
- Discuss the consideration aspects while shooting and editing video for multimedia.
 - What techniques would you use to produce the best possible video at a reasonable cost?
 - Which of these techniques apply to all videos?
 - Which applies specifically to multimedia?
- 19 a. Describe the memory and storage devices used in making multimedia. 8
- b. Explain the features in image editing applications which are desirable to multimedia developers. 6
- OR**
- 20 a. How can we choose an authoring tool suitable for our needs? Explain the various features to be considered. 10
- b. Explain the various hardware connection methodologies helpful in making multimedia. 4

Syllabus

Module 1: Introduction to multimedia (7 Hours)	
Multimedia-Introduction, Definition, Use, Delivering.	
Text-Power of meaning-Fonts and Faces, Text in multimedia, computers and texts, font editing and design tools, Hyper media and hyper texts	
Module 2: Images and colours in multimedia (6 hours)	
Images-Still Images-Bitmap images, vector drawing, 3D drawing and rendering.	
Color-Understand natural light and color- Computerized color- Color palette-File formats.	
Module 3: Sound in multimedia (6 hours)	
Sound-Power of sounds-Digital Audio-MIDI-multimedia system sounds-Audio file formats-Vaughan's Law of multimedia minimums, Adding sounds to your project.	
Module 4: Video and animation (8 hours)	
Animation-The power of motion-principle of animation- animation by computer-making animations -creating an animated scene.	
Video- How video works and is displayed-Digital video containers-obtaining video clips-shooting and editing	
Module 5: Making multimedia (8 hours)	

Making Multimedia-The stages of a multimedia project-What you need-Intangibles, hardware, software, authoring systems. -Future multimedia

Text Books

1. Tay Vaughan, Multimedia: Making It Work, Ninth Edition, McGraw-Hill, 2014

Reference Books

1. Ashok Banerjee, Anand Mohan Ghosh, Multimedia Technologies, McGraw-Hill, 2009
2. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of multimedia, Springer, 2/e.
3. Chopra Raiv, Computer graphics with an introduction to multimedia, S Chand and company Ltd, 2017 4/e.

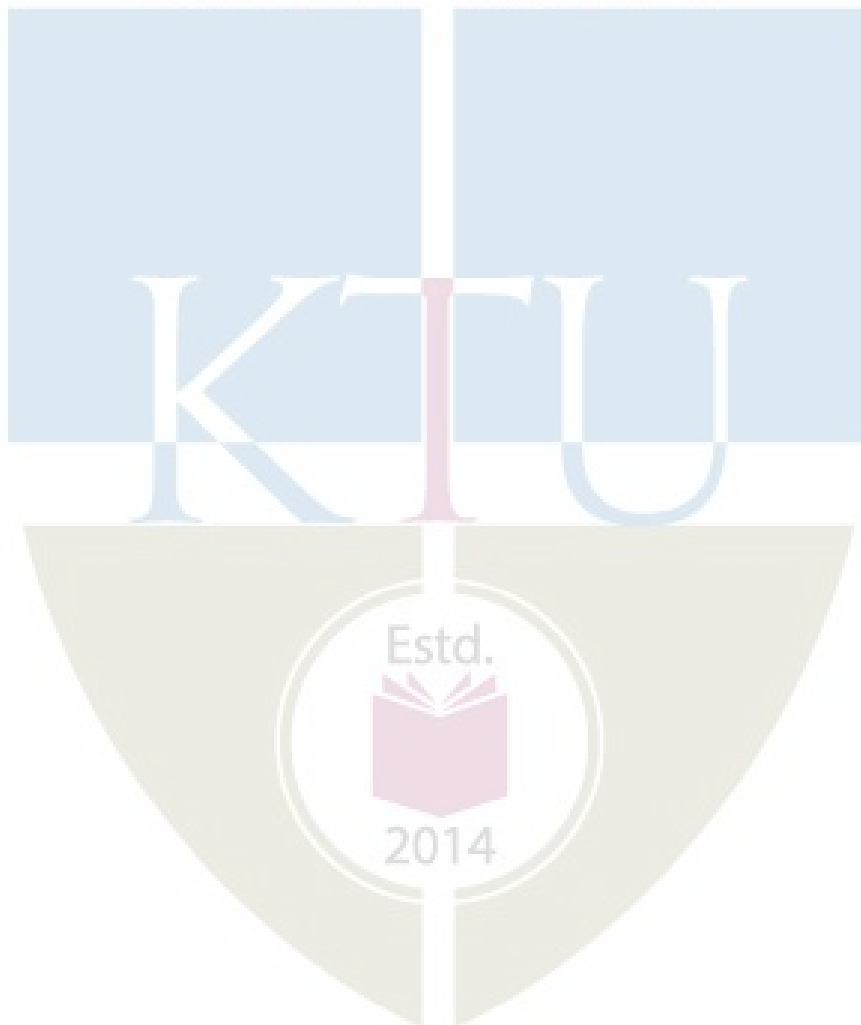
Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Introduction to multimedia	7 Hours
1.1	Multimedia- Introduction, definition.	1
1.2	Use, delivering.	1
1.3	Text-Power of meaning-Fonts and Faces.	1
1.4	Text in multimedia.	1
1.5	Computers and texts.	1
1.6	Font editing and design tools	1
1.7	Hyper media and hyper texts.	1
2.	Images and colours in multimedia	6 Hours
2.1	Images-Still images-Bitmap images, vector drawing.	2
2.2	3D drawing and rendering.	1

2.3	Color –understand natural light and color	1
2.4	Computerized color	1
2.5	Color palette-file formats.	1
3	Sound in multimedia	6 Hours
3.1	Sound-Power of sounds-Digital Audio	1
3.2	MIDI	1
3.3	Multimedia system sounds-Audio file formats	1
3.4	Vaughan's Law of multimedia minimums, Adding sounds to your project-Space consideration, Audio recording.	2
3.5	Adding sounds to your project- Keeping track of your sounds, Audio CDs, Sound for your mobile, Sound for the internet.	1
4	Video and animation	8 Hours
4.1	Animation-The power of motion-Principle of animation	1
4.2	Animation by computer	1
4.3	Making animations - examples, Creating an animated scene.	1
4.4	Video- How video works and is displayed	2
4.5	Digital video containers	1
4.6	Obtaining video clips-shooting and editing	2
5	Making multimedia	8 Hours
5.1	Making Multimedia-The stages of a multimedia project-What you need-Intangibles.	1
5.2	What you need - Hardware	2

5.3	What you need-software	INFORMATION TECHNOLOGY
5.4	What you need-authoring systems	2
5.5	Future multimedia	1

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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT435	FREE AND OPEN SOURCE SOFTWARE	OEC	2	1	0	3

Preamble: To provide the concepts of free open source software and enable the students to learn Linux OS environment and Python programming

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Outline the basic concepts of FOSS & its development	Level 2: Understand
CO 2	Explain and summarize the salient features of the Linux operating system.	Level 2: Understand
CO 3	Demonstrate basics Shell programming.	Level 2: Understand
CO 4	Outline basic concepts of version control.	Level 2: Understand
CO 5	Develop programs using the open source programming language Python.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	-	-	1	-	-	-	-	-	-	1
CO 2	2		-	-	1	-	-	-	-	-	-	1
CO 3	2	2	2	-	2	-	-	-	-	-	-	1
CO 4	2			-	1	-	-	-	-	-	-	-
CO 5	3	3	3	1	3	-	-	-	-	-	-	1

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	5	10
Level 2: Understand	40	30	70
Level 3: Apply		15	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Define FOSS.
2. What is the difference between free software and open software ?
3. Describe how to start a FOSS project.

Course Outcome 2 (CO 2):

1. Illustrate the layout of a Linux file system.
2. Explain different type of process in Linux
3. Compare data partition with swap partition.

Course Outcome 3 (CO 3):

1. How to define functions in shell programming ?
2. Describe with an example the I/O redirection in shell programming.

3. How to initialize Variables in Shell Scripting?

Course Outcome 4 (CO 4):

1. Define version control.
2. How does the distributed nature of gits help to improve the working environment of developers in projects?.
3. Describe the branching in Gits.

Course Outcome 5 (CO 5):

1. Develop a Python program to check whether a given number is an Armstrong number
2. Write a Python program to find the factorial of a number. Use function to calculate the factorial.
3. Demonstrate the data type conversion in Python.

Model Question Paper

Course Code: ITT435

Course Name: FREE AND OPEN SOURCE SOFTWARE

Max.Marks :100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

1. In security aspects, FOSS systems are superior to proprietary systems. Justify.
2. List the shortcomings of FOSS.
3. How does an interactive process differ from an automated process?
4. Describe boot process.
5. What is backtick in shell programming ?
6. Compare modified and staged state of file in Git.
7. Write syntax of conditional expression in Python.
8. Differentiate between x/y and $x//y$.
9. Describe dictionary operations.
10. How to select an element from a list?

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

- 11 a. Explain technical infrastructure needed for FOSS. 9
b. Describe (i) candidate release (ii) security release. 5

OR

- 12 a. Compare Free Software Foundation(FSF) philosophy and the Open Source Initiative (OSI) philosophy. 6
b. Explain major release numbering conventions. 8
- 13 a. What is the purpose of partitioning the Linux file system ? 9
b. Compare absolute path and relative path in file system. 5

OR

- 14 a. List and explain any five commands related to the process. 10
b. Describe filters in Linux ? 4
- 15 a. Write a shell program to find the largest of three numbers. 6
b. Illustrate basic branching and merging of Git. 8

OR

- 16 a. Write a shell program to find the factorial of a number using function. 7
b. Explain Git Repository. 7
- 17 a. What is recursion ? Write a Python program to generate n terms of Fibonacci sequences using recursion. 8
b. Let fruit ='apples' be a string. What will be the output of the following expressions: 6
i) len(s1) ii) s1[0:4] iii) s1[6] iv) s1[-4]

OR

- 18 a. Write a Python program to find sum of digits of a number. 6
b. Differentiate between break and continue statement with proper examples? 8
- 19 a. Write a Python program to input a list of 'n' numbers. Calculate and display the average of numbers. Also display the cube of each value in the list. 8
b. Explain class and object with an example. 6

OR

- 20 a. Write a Python program to create a dictionary of roll numbers and names of 5 students. Display the contents of the dictionary in alphabetical order of names. 8
b. Compare List and Tuple with suitable examples? 6

Syllabus

Module 1: Introduction to FOSS(5 Hours)
The FOSS philosophy- The FOSS development method, Why FOSS, benefits of FOSS, shortcomings of FOSS, Intellectual Property Rights and Licensing, Localization and Internationalization, Starting open source project, Technical infrastructure for FOSS, Packaging and releasing of FOSS.
Module 2: Open Source Operating System (LINUX) (7 Hours)
Introduction, user interface, properties, Linux Flavours, Linux file system, Process, Linux I/O redirection, Text editors in Linux, Installing new software.
Module 3: Introduction to shell programming and version control (7 Hours)
Shell, Shell scripting, creating and executing shell script, variables, basic operators, control statement, I/O redirection, shell functions. Introduction to Version Control Systems, introduction to gits, git branching, distributed git, github.
Module 4: Python Programming -Part 1 (8 Hours)
Introduction, values and variables, expression and arithmetic operators, conditional execution, iteration, functions.
Module 5: Python Programming Part 2 (8 Hours)
Strings and Lists, tuples, dictionaries – operations and examples. files, exceptions. Introduction to classes and objects.

Text Books

1. Karl Fogel, Producing Open Source Software How to Run a Successful Free Software Project, Producingoss, 2018 ,
2. Machtelt Garrels, Introduction to Linux A Hands on Guide, Linux Documentation Project collection , 2014.
3. Richard Blum ,Linux Command Line and Shell Scripting Bible, Wiley Publishing, Third Edition, 2015.
4. Richard L. Halterman, Fundamentals of Python Programming, Southern Adventist University, 2018 .
5. Scott Chacon and Ben Straub , Pro Git book, Apress (Version 2.1.225, 2020-05-13).

Reference Books

1. Kenneth Wong, Phet Sayo, Free/open source software : a general introduction, United Nations Development Programme's Asia-Pacific Development Information Programme, 2010
2. Richard Petersen, "Linux complete reference "Tata McGraw-Hill Education , Sixth Edition 2010.

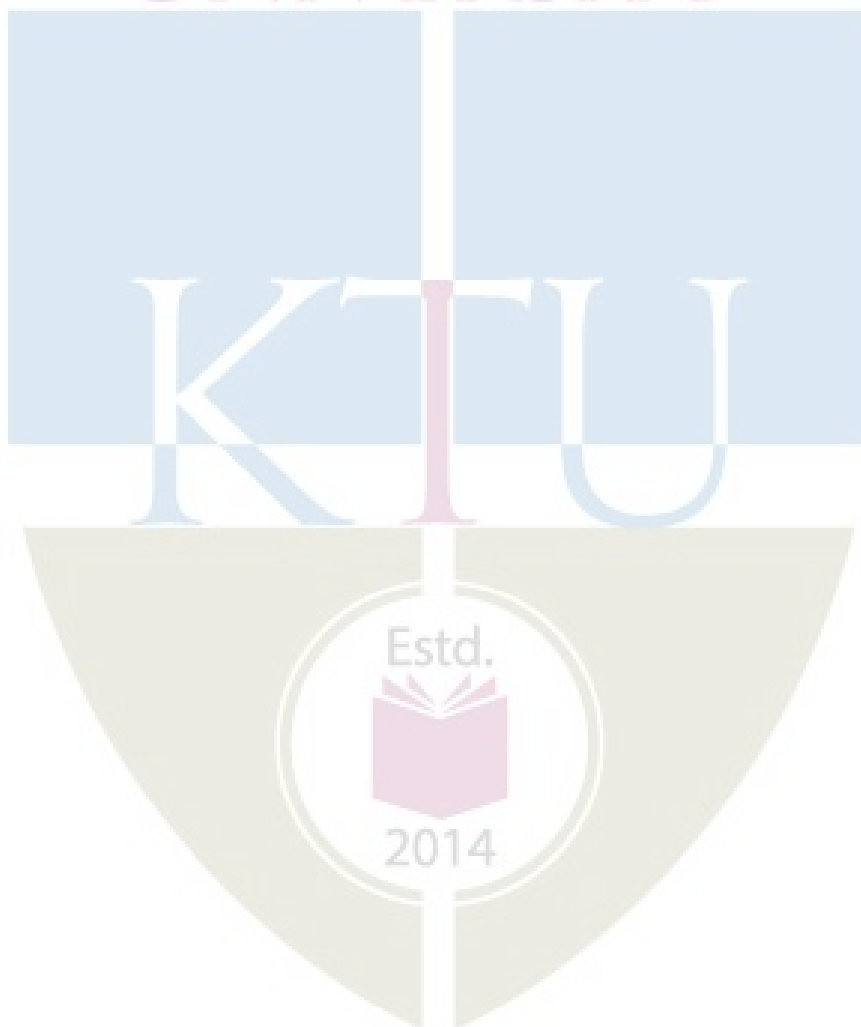
Course Contents and Lecture Schedule

INFORMATION TECHNOLOGY

Sl. No.	Topic	No. of Lectures
1	Introduction to FOSS -(Refer textbook No.1 “Producing Open Source Software How to Run a Successful Free Software Project”)	5 Hours
1.1	The FOSS philosophy, The FOSS development method.	1
1.2	Why FOSS, benefits of FOSS, shortcomings of FOSS, Intellectual Property Rights and Licensing.	1
1.3	Localization and Internationalization.	1
1.4	Starting open source project, Technical infrastructure for FOSS .	1
1.5	Packaging and releasing of FOSS .	1
2	Open Source Operating System (LINUX) -(Refer textbook No.2 “Introduction to Linux A Hands on Guide”)	7 Hours
2.1	Introduction, user interface, properties, Linux Flavours.	1
2.2	Linux file system.	1
2.3	Process.	2
2.4	Linux I/O redirection.	2
2.5	Text editors in Linux, Installing new software.	1
3	Introduction to shell programming and version control (Refer textbook No 3, Linux Command Line and Shell Scripting Bible, Text No 5 Pro Git book)	7 Hours
3.1	Introduction Shell, Shell scripting, creating and executing shell script.	1
3.2	Variables, basic operators .	1
3.3	Control statement , I/O redirection.	1
3.4	Shell functions .	1
3.5	Introduction to Version Control Systems, introduction to gits.	1
3.6	git branching,	1
3.7	Distributed git, github.	1
4	Python Programming (Refer text book No .4 Fundamentals of Python Programming)	8 Hours
4.1	Introduction, values and variables.	1
4.2	Expression and arithmetic operators.	1
4.3	Conditional execution.	2
4.4	Iteration.	2
4.5	Functions.	2
5	Python Programming (Refer text book No.4 Fundamentals of Python Programming)	8 Hours

5.1	Strings and Lists.	1
5.2	Tuples.	1
5.3	Dictionaries – operations and examples.	1
5.4	Files.	2
5.5	Introduction to classes and objects.	1
5.6	Exceptions.	2

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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT445	MOBILE APPLICATION DEVELOPMENT	OEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in mobile applications for real world applications. A person should have knowledge about the basic concepts about how an application is developed for a mobile phone, thereby they will be equipped to work in the industry.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basic concepts of mobile networks, architecture and operating systems	Level 2: Understand
CO 2	Explain different android app architectures and Android Studio	Level 2: Understand
CO 3	Describe the basics of Kotlin and familiarize basic Hello World App	Level 2: Understand
CO 4	Discuss about the Android Architecture and databases	Level 2: Understand
CO 5	Explain the basic concepts of cross platform development and Flutter	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	1	-	-	-	-	-	-	-	-	-
CO2	2	-	1	-	2	-	-	-	-	-	-	2
CO3	2	-	1	-	2	-	-	-	-	-	-	2
CO4	2	-	1	-	2	-	-	-	-	-	-	2
CO5	2	-	1	-	2	-	-	-	-	-	-	2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	30	30	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Compare the platform architecture of iOS and Android.
2. What are the advantages of ARM architecture?
3. Differentiate between Base sensor and Composite Sensor

Course Outcome 2 (CO2)

1. Compare between MVC, MVP and MVVM architectures.
2. Give a brief description of components in Android Application Architecture.
3. Give examples of an Activity.

Course Outcome 3 (CO3):

- 1 How is variable declaration in Kotlin different from Java?
2. What kind of applications can be built on Kotlin?
3. Is Kotlin a statically typed programming language. Justify your answer.
4. What are the steps involved in creating a project in Kotlin?

Course Outcome 4 (CO4):

1. Describe the Lifecycle of a View model.
2. Describe the advantages of using LiveData.
3. What are the advantages of Room database over SQLite?

Course Outcome 5 (CO5):

1. What is the importance of widget in Flutter?
2. Describe the advantages of using Flutter for cross platform development
3. Give an overview about the architectural layers of Flutter.

Model Question paper**Course Code: ITT445****Course Name: MOBILE APPLICATION DEVELOPMENT****Max Marks :100****Duration: 3 Hrs****PART A***Answer all questions. Each question carries three marks(10*3=30 marks)*

1	Describe features of Swift Language	3
2	Describe the characteristics of Composite Sensors with an example	3
3	What is an App Component? What is its importance?	3

4	Describe the advantages of MVP architecture.	3
5	How do you declare variables in Kotlin? How does the declaration differ from the Java counterpart?	3
6	Give the basic structure of a function in Kotlin with an example	3
7	What are the differences between SQLite and Room database?	3
8	Describe the advantages of using Live Data.	3
9	List out the features for Flutter.	3
10	What are the existing solutions for cross platform development?	3

PART B

*Answer all questions. Each question carries 14 marks (5*14=70 marks)*

11	a	Describe any three different type of composite sensors	10.5
	b	What are the features of Swift programming language that makes it unique?	3.5

OR

12		Draw the architecture of iOS and explain each of its components	14
13	a	Compare the different mobile application architectures by giving the advantages and disadvantages of each of them	6
	b	What is a Project and Module in Android Studio? Describe the distinct types of module offered by Android studio?	8

OR

14		Write short notes on four different types of app components	14
15	a	What are functions in Kotlin? Write a function in Kotlin to find sum of two numbers	6
	b	What are the features of Kotlin that makes it unique?	8

OR

16	a	Illustrate with an example the use of when expression	7
	b	Illustrate the concept of Properties in Kotlin with an example	7
17		What are the advantages of using Live Data? What are the steps to work with Live Data objects?	14

OR

18	What are the major components in a Room database? Explain each one briefly. List out the benefits of Room database	14
19	a What do you mean by cross platform development? What are the available cross platform development solutions? Why is Flutter considered to be one of the best solutions	7
	b What is a widget? Give the differences between a stateful widget and a stateless widget	7
OR		
20	a With a figure explain each layer in the architecture of Flutter architecture	7
	b Summarize the features of user interfaces of Flutter	7

Syllabus

Module 1: Device Hardware, Peripheral and Platform Architecture (7 hours):
Device hardware - ARM processors. Sensors - Base sensors, Composite Sensors, Peripherals - Audio and Custom Accessories. Mobile Operating systems (no details required). Platform Architecture: iOS and Android. Development languages: Swift for iOS, Kotlin for Android.
Module 2 : Mobile Application Architecture and Introduction to Android(7 hours)
Mobile application architectures - MVC, MVP, MVVM. Introduction to Android Studio IDE- Project structure, User interface, Gradle build system, Project overview – Modules, Project files, Project Structure settings. Android App Components - Activities, Services, Notifications, Broadcast Receivers, Content Providers.
Module 3:Introduction to Kotlin (7 hours)
Basic elements – Basic types ,Functions and Variables, Classes and Properties, Conditions and Loops. Familiarization of basic apps using Kotlin by a Hello World Project
Module 4 :Android Architecture Components and Database(7 hours)
Android Architecture Components – ViewModel- Overview, Implementation, Lifecycle, Sharing Data with fragments, Replacing Loaders with View Model, LiveData-Overview, Advantages, Work with LiveData Objects Database – SQLite-Defining a schema, Create a database, Insertion, Deletion and Updation of Data, Room- Overview, Primary components, Sample Implementation
Module 5 : Cross Platform Development (7 hours)
Introduction to Flutter, Why Flutter, Other options , Native Solutions, Flutter App Architecture Layer, Reactive User Interfaces, Widgets, Rendering model

Textbooks

1. Lyla B Das, Embedded Systems an Integrated Approach, Pearson,2013 (page number 335 -344)
2. Varun Nagpal, Android Sensor Programming By Example -PACKT Publishing, 1st edition ,2016 (Chapter 1)
3. Dmitry Jemerov and Svetlana Isakova , Kotlin in Action ,Hanning, MEAP Edition, February 2017 (Part 2)
4. Bill Philips, Android Programming: The Big Nerd Ranch Guide ,3rd Edition,2017 (Chapter 14)
5. Josh Skeen, Kotlin Programming: The Big Nerd Ranch Guide (Big Nerd Ranch Guides) 1st Edition,2018 (Chapter 1- Your first Kotlin Application)
6. Rap Pyne,” Beginning App Development with Flutter: Create Cross-Platform Mobile Apps”,APress,2019 (Chapter 1)

References

1. Ian Darwin, “Android Cookbook”, O’Reilly, 2nd edition, 2017.
- 2.Micheal Burton,”Android Application Development For Dummies”,October 2012
- 3.Dawn Griffiths, David Griffiths, ”Head First Kotlin”, O’Reilly Media, Inc., February 2019
- 4.[Marco L. Napoli](#),”Beginning Flutter: A Hands on Guide for App Development”,Wiley, October 2019.

Web Resources

- Android Sensors and Peripheral: <https://source.android.com/devices/sensors/sensor-types>
- Mobile OS list: <https://www.g2.com/articles/mobile-operating-systems>
- iOS Platform Architecture: <https://cs4720.cs.virginia.edu/slides/CS4720-MAD-iOSArchitecture.pdf>
- Android Platform Architecture: <https://developer.android.com/guide/platform>
- Swift: <https://docs.swift.org/swift-book/>
- Kotlin for Android: <https://developer.android.com/kotlin/first>
- Architectures: <https://blog.mindorks.com/mvc-mvp-mvvm-architecture-in-android>
- Android Studio : <https://developer.android.com/studio/intro>
- Android Project Overview: <https://developer.android.com/studio/projects>

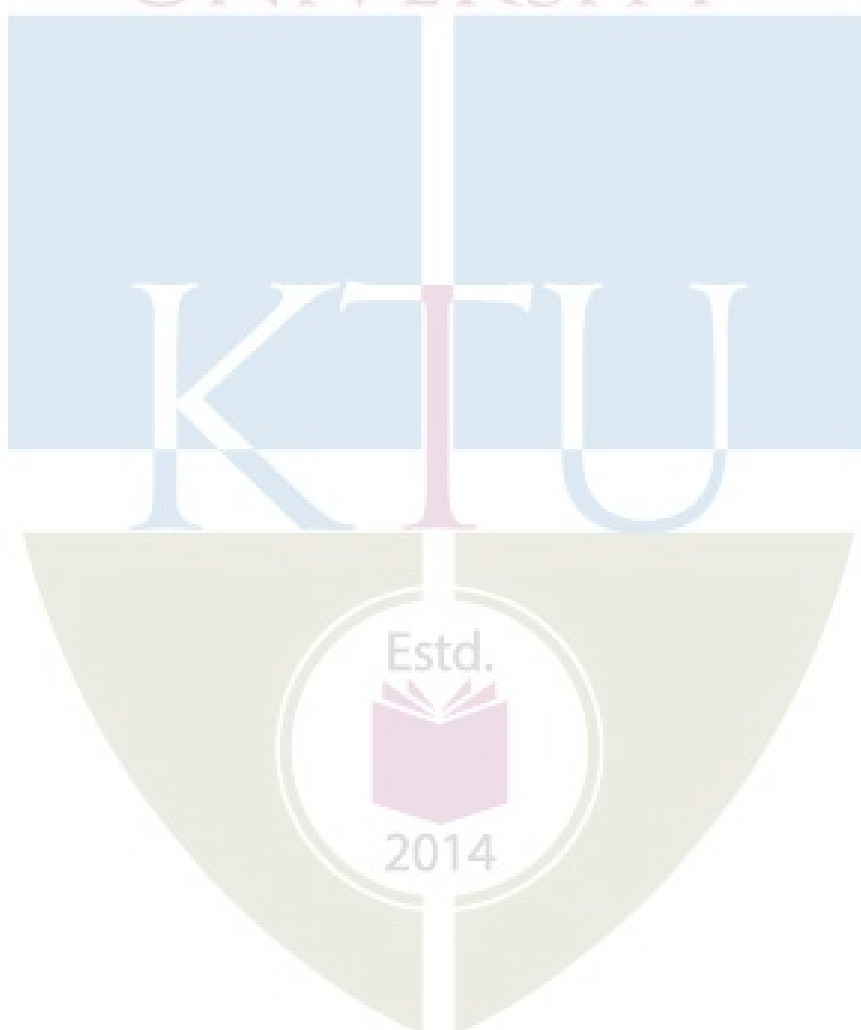
- Android App
Components: <https://developer.android.com/guide/components/fundamentals>
- Kotlin basics: <https://kotlinlang.org/docs/reference/basic-syntax.html>
- Kotlin basic types: <https://kotlinlang.org/docs/basic-types.html>
- Kotlin condition and loops: <https://kotlinlang.org/docs/control-flow.html>
- Google Codelabs for app development:
<https://codelabs.developers.google.com/android-kotlin-fundamentals/>
- Android Architecture Components:
<https://developer.android.com/topic/libraries/architecture>
- Live Data: <https://developer.android.com/topic/libraries/architecture/livedata>
- View Model: <https://developer.android.com/topic/libraries/architecture/viewmodel>
- Location tracking: <https://developer.android.com/training/location>
- SQLite-<https://developer.android.com/training/data-storage/sqlite>
- Room Database: <https://developer.android.com/topic/libraries/architecture/room>
- Flutter architecture: <https://flutter.dev/docs/resources/technical-overview>
- Flutter codelab: <https://flutter.dev/docs/codelabs>
- Flutter Tutorials: <https://flutter.dev/docs/reference/tutorials>

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction	7 hours
1.1	ARM Processor	1
1.2	Sensors, Peripherals	2
1.3	Mobile Operating Systems	1
1.4	Platform Architecture -iOS and Android	2
1.5	Developmental Languages- Swift,Kotlin	1
2	Android	7 hours
2.1	Mobile Application Architectures-MVC,MVP,MVVM	1
2.2	Introduction to Android studio	2
2.3	Project Overview	2
2.4	Android app components	2
3	Kotlin	7 hours
3.1	Introduction to Kotlin, Basic elements-Type	2
3.2	Basic elements -Functions and Variables	1
3.3	Classes and Properties	1
3.4	Conditional expressions and Loop	1
3.5	Hello World Project	2
4	Architecture Components and Database	7 hours
4.1	Android Architecture Components-View model	2
4.2	Android Architecture Components-Live data	2
4.3	SQLite data base	2
4.4	Room	1

5	Cross Platform Development	7 hours
5.1	Introduction to Flutter, Why Flutter, Native solutions	1
5.2	Flutter architecture	1
5.3	Reactive user interface	1
5.4	Widgets	2
5.5	Rendering model	2

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SEMESTER VII

MINOR



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITD481	MINIPROJECT	PWS	0	0	3	2

Preamble: This course is designed for enabling the students to apply the knowledge to address the real-world situations/problems and find solutions. The course is also intended to estimate the ability of the students in transforming theoretical knowledge studied as part of the curriculum so far in to a working model of a software system. The students are expected to design and develop a software/hardware project to innovatively solve a real-world problem.

Prerequisites: Subjects studied up to sixth semester.

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Make use of acquired knowledge within the selected area of technology for project development.	Level 3: Apply
CO 2	Identify, discuss and justify the technical aspects and design aspects of the project with a systematic approach.	Level 3: Apply
CO 3	Interpret, improve and refine technical aspects for engineering projects.	Level 3: Apply
CO 4	Associate with a team as an effective team player for the development of technical projects.	Level 3: Apply
CO 5	Report effectively the project related activities and findings.	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	3	3	3	3	-	-	-	3
CO 2	3	3	3	3	3	-	2	3	-	3	2	3
CO 3	3	3	3	3	3	2	3	3	-	2	3	3
CO 4	3	3	2	2	-	-	-	3	3	3	3	3
CO 5	3	-	-	-	2	-	-	3	2	3	2	3

3/2/1: high/medium/low

Assessment Pattern

The End Semester Evaluation (ESE) will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a 3-member committee appointed by Head of the Department comprising HoD or a senior faculty member, academic coordinator for that program and project guide/coordinator. The Committee will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, working knowledge and involvement.

The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the mini project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systems under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution. The review committee should assess the extent to which the implementation reflects the proposed design. A well coded, assembled and completely functional product is the expected output at this stage. The final CIE mark is the average of 1st and 2nd review marks.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest or problem domain or conduct open brain storming sessions for innovative ideas. Zeroth review will not be a part of the CIE evaluation process.

Marks Distribution

Total Marks	CIE	ESE
150	75	75

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Marks awarded by Guide : 15 marks
 Project Report : 10 marks
 Evaluation by the Committee : 40 Marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks.

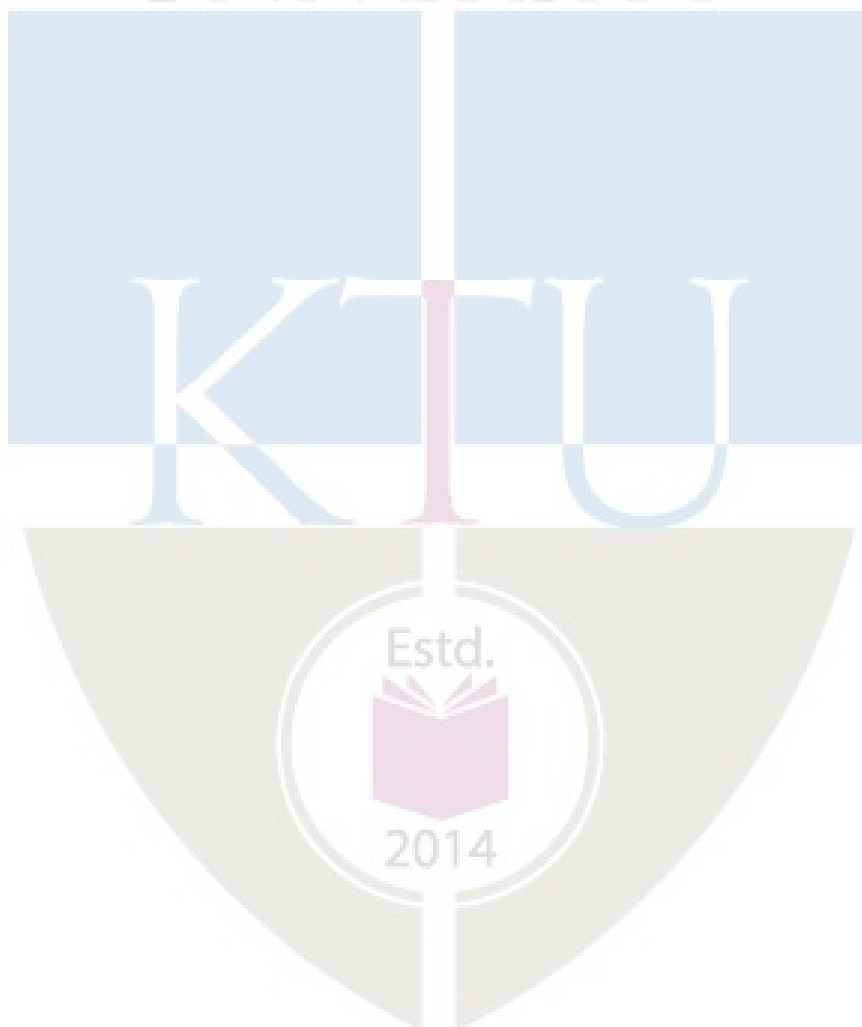
- (a) Demonstration : 50 Marks
- (b) Project report : 10 Marks
- (d) Viva voce : 15marks

Course Plan

In this course, each group consisting of three/four members is expected to design and develop a moderately complex software/hardware system with practical applications. This should be a working model. The basic concept of product design may be taken into consideration.

Students should identify a topic of interest in consultation with Faculty-in-charge of miniproject/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews.

The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight.



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SEMESTER VII

HONOURS



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT495	ENTERPRISE NETWORKS	VAC	3	1	0	4

Preamble: This course aims to provide a basic idea about the design and management of data center networks.

Prerequisites: ITT292 Mathematical Foundation For Networking,
ITT393 Wireless Communication,
ITT394 Design And Analysis Of Networks

Course Outcomes: After the completion of the course the student will be able to

CO#	Course Outcomes	Bloom's Category
CO 1	Identify the various cloud computing models and services and understand the basic concepts about cloud data centers and networking.	Level 2: Understand
CO 2	Describe the various cloud data center networking topologies.	Level 2: Understand
CO 3	Explain the Data center networking standards and concepts of server virtualization.	Level 2 : Understand
CO 4	Experiment with network virtualization in various data center environments and understand the working of Storage Networks.	Level 3: Apply
CO 5	Describe the concept of Software Defined Networking and its role in Cloud data center management.	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	-	-	-	-	-	-	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	2
CO 3	3	2	2	-	-	-	-	-	-	-	-	2
CO 4	3	2	3	1	-	-	-	-	-	-	-	2
CO 5	3	2	2	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	5	15
Understand	40	35	70
Apply	0	10	15
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have a maximum of 2 subdivisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe the various Cloud Computing models.
2. Advances in virtualization technology have resulted in improvement in data center networking also. Justify.
3. Explain the evolution of data centers from early mainframes.

Course Outcome 2 (CO2)

1. What is the difference between ToR and EoR switches? What are the topologies used for both?
2. How does the use of fabric extenders reduce cabling costs?
3. Describe the role of Network function virtualization in data centers.

Course Outcome 3 (CO3):

1. How has the data center bridging networking standard helped in avoiding the high latency variations?
2. Explain the process of virtual switching.
3. Equal cost multipath routing provides improved bandwidth when compared to the Spanning tree approach. Justify.

Course Outcome 4 (CO4):

1. Compare and contrast the traditional networking tunneling protocols with VXLAN and NVGRE.
2. Explain how innovations in storage technologies have affected data center networking.
3. How is storage in cloud data centers different from traditional enterprise data centers?

Course Outcome 5 (CO5):

1. How is Software Defined Networking implemented in data centers?
2. Explain the use of Ethernet Fabric as an alternative to a traditional switch network.
3. Differentiate between Open SDN and overlays.

Model Question Paper

Course Code:ITT495

Course Name: ENTERPRISE NETWORKS

Max.Marks :100

Duration: 3 Hrs

PART A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. Differentiate between public and private clouds.
2. Ethernet technology has helped in the development of data centers. Justify.
3. What is a virtual switch?
4. Describe the 2 methods to interconnect microserver modules?
5. Briefly explain the following fields in the VLAN tag indicate?
 - a. Priority Code Point
 - b. Drop Eligible Indicator

c. VLAN Identifier

6. How does Virtual machine device queues improve the server and VM performance levels?
7. What is meant by network attached storage?
8. Why do cloud data centers implement erasure coding to provide data protection for their storage systems?
9. Describe the networking components of OpenStack?
10. How is SDN implemented at the network edge?

PART B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. Describe SONET/SDH and Asynchronous Transfer Mode. 14

OR

12. a) Explain the evolution of data centers. 8
- b) Differentiate between enterprise data center networks and cloud data center networks. 6
13. With the help of a diagram explain the architecture of traditional multitiered enterprise data center networks. What are the cost factors and performance factors associated with them? 14

OR

14. a) Explain the traffic flow in a flat data center network. 8
- b) What are the differences between ToR switches and Core switches? 6
15. Discuss the methods of improving network bandwidth. 14

OR

16. Explain the single root IO virtualization (SR-IOV) and multi root IO virtualization (MR-IOV) standards in PCI Express. 14
17. How is load balancing implemented in networks using Hash-based algorithms and Equal cost multipath routing? 14

OR

18. Explain the following storage communication protocols: 14
- a. SCSI
 - b. SATA
 - c. SAS
 - d. Fibre channel

19. Explain the Open flow architecture.

OR

20. How can the current limitation of traditional networks be overcome using SDN? 14

Syllabus

Module 1: Introduction To Cloud Computing & Cloud Datacentres (9 hours)
Cloud computing-Definition, Public, Private and Hybrid Clouds. Cloud Service Models-Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS).
Cloud Data Center, Cloud Networking, Characteristics of Cloud Networking - Ethernet usage, Virtualization, Convergence, Scalability, Software.
The Data Center Evolution, Computer Networks, Ethernet, Enterprise versus Cloud Data Centers, Movement to the Cloud.
Module 2: Cloud Data Center Networking Topologies (8 hours)
Traditional Multitiered Enterprise Networks - Cost Factors, Performance Factors. Data Center Network Switch Types - Virtual switch, ToR Switch, EoR Switch, Fabric Extenders, Aggregation and core switches.
Flat Data Center Networks - Data Center Traffic Patterns, ToR Switch Features, Core Switch Features. Rack Scale Architectures - Disaggregation of Resources, Microservers. Network Function Virtualization.
Module 3: Data Center Networking Standards And Server Virtualization (10 hours)
Data Center Networking Standards - Ethernet Data Rate Standards, Virtual Local Area Networks, Data Center Bridging, Improving Network Bandwidth, Remote Direct Memory Access.
Server Virtualization and Networking - VM Overview, Virtual Switching, PCI Express, Edge Virtual Bridging, VM Migration.
Module 4: Network Virtualization & Storage Networks (10 hours)
Network Virtualization- Multi-tenant Environments, Traditional Network Tunneling Protocols, VXLAN, NVGRE, Tunnel Locations, Load Balancing.
Storage Networks - Storage Background, Advanced Storage Technologies, Storage Communication Protocols, Network Convergence, Software-Defined Storage, Storage in Cloud Data Centers.
Module 5: SDN In Data Centers (8 hours)

Software-Defined Networking- Data Center Software Background, OpenStack, OpenFlow, Network Function Virtualization, SDN Deployment.

INFORMATION TECHNOLOGY

SDN Use Cases in the Data Center, Ethernet Fabrics in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations.

Text Books

1. Gary Lee, "Cloud Networking - Understanding Cloud-based Data Center Networks", Elsevier, 2014

References

1. Kai Hwang , Geoffrey C Fox, Jack J Dongarra : "Distributed and Cloud Computing – From Parallel Processing to the Internet of Things" , Morgan Kaufmann Publishers – 2012.
2. Paul Göransson Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufman.
3. William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008
4. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006
5. Kumar Reddy, Victor Moreno, "Network virtualization", Cisco Press, July, 2006

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Module 1: Introduction To Cloud Computing & Cloud Datacentres	9 hours
1.1	Cloud computing- Definition, Public, Private and Hybrid Clouds	1 Hr
1.2	Cloud Service Models - Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS)	1 Hr
1.3	Cloud Data Center, Cloud Networking, Characteristics of Cloud Networking	2 Hrs
1.4	The Data Center Evolution	1 Hr
1.5	Computer Networks, Ethernet	2 Hrs
1.6	Enterprise versus Cloud Data Centers, Movement to the Cloud	2 Hrs
2	Module 2: Cloud Data Center Networking Topologies	8 hours
2.1	Traditional Multitiered Enterprise Networks - Cost Factors, Performance Factors	1 Hr
2.2	Data Center Network Switch Types - Virtual switch, ToR Switch, EoR Switch	2 Hrs
2.3	Fabric Extenders, Aggregation and core switches	1 Hr
2.4	Flat Data Center Networks - Data Center Traffic Patterns, ToR Switch Features, Core Switch Features	2 Hrs
2.5	Rack Scale Architectures - Disaggregation of Resources, Microservers	1 Hr
2.6	Network Function Virtualization	1 Hr

3	Module 3: Data Center Networking Standards And Server Virtualization	10 hours
3.1	Data Center Networking Standards - Ethernet Data Rate Standards, Virtual Local Area Networks	2 Hrs
3.2	Data Center Bridging	1 Hr
3.3	Improving Network Bandwidth, Remote Direct Memory Access	2 Hrs
3.4	Server Virtualization and Networking - VM Overview, Virtual Switching	2 Hrs
3.5	PCI Express, Edge Virtual Bridging	2 Hrs
3.6	VM Migration	1 Hr
4	Module 4: Network Virtualization & Storage Networks	10 hours
4.1	Network Virtualization- Multi-tenant Environments, Traditional Network Tunneling Protocols, VXLAN, NVGRE	2 Hrs
4.2	Tunnel Locations, Load Balancing	2 Hrs
4.3	Storage Networks - Storage Background, Advanced Storage Technologies	2 Hrs
4.4	Storage Communication Protocols, Network Convergence	2 Hrs
4.5	Software-Defined Storage, Storage in Cloud Data Centers	2 Hrs
5	Module 5: SDN In Data Centers	8 hours
5.1	Software-Defined Networking- Data Center Software Background, OpenStack	2 Hrs
5.2	OpenFlow	1 Hr
5.3	Network Function Virtualization, SDN Deployment	2 Hrs
5.4	SDN Use Cases in the Data Center	1 Hr
5.5	Ethernet Fabrics in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations	2 Hrs

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT497	WEB SECURITY	VAC	3	1	0	4

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in Web Security, and to familiarise mechanisms for handling Web security threats.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basic concepts of Web Security	Level 2: Understand
CO 2	Summarise the basics of Web Application Hacking	Level 2: Understand
CO 3	Apply penetration testing and Ethical Hacking Principles	Level 3: Apply
CO 4	Summarise malware analysis and protection mechanisms	Level 2: Understand
CO 5	Differentiate methods for protecting web applications	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	2	-	-	-	-	-	-	2
CO 2	3	2	2	2	3	-	-	-	-	-	-	2
CO 3	3	3	3	3	3	-	-	-	-	-	-	3
CO 4	3	2	2	2	2	-	-	-	-	-	-	2
CO 5	3	2	2	2	2	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	30	30	70
Apply	10	10	20
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. Explain the key challenges related to modern day web security.
2. Discuss the structure of modern day web applications.
3. Differentiate Modern and Legacy Web Applications
4. Mention dictionary attacks.

Course Outcome 2 (CO 2):

1. Explain Distributed DoS attack.
2. Define DOM-Based XSS attack.
3. Differentiate between Stored XSS and reflected XSS.
4. Explain regex DoS.

Course Outcome 3 (CO 3):

1. Describe the tools and steps you would use if you have to check for vulnerability in a network.
2. Differentiate various Reconnaissance tools in Kali Linux
3. Describe the method for Remote password cracking.
4. Discuss port scanning for finding vulnerabilities.

Course Outcome 4 (CO 4):

1. Describe the goals of malware analysis.
2. Differentiate packed and obfuscated malwares.
3. Discuss the steps involved in packet sniffing with wireshark.
4. Explain the step for viewing the process with process explorer.

Course Outcome 5 (CO 5):

1. What are the steps involved in comprehensive code review?
2. Define Secure coding anti patterns.
3. List out different ways of securing modern web applications
4. Define Archetypical vulnerabilities.

Model Question Paper

Course Code: ITT497

Course Name: WEB SECURITY

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Discuss browser's built in network analysis tools.
2. Explain Web application mapping with examples.
3. Explain Query parameter tampering with examples
4. Differentiate Direct XXE and Indirect XXE
5. Discuss the three way handshake protocol.
6. Explain reconnaissance using Google Directives.
7. List out different types of malwares
8. Describe the working of credential stealers.
9. Differentiate Archetypical Vulnerabilities and Custom Logic Bugs
10. Explain the importance of reviewing code for security.

Part B

INFORMATION TECHNOLOGY

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. List structure and various new features of modern web applications. 14

OR

12. a. List the methods for web application reconnaissance 5

b. Discuss various methods for finding subdomains as part of reconnaissance. 9

13. Illustrate various Cross Site Scripting attacks. 14

OR

14. Differentiate various Injection attacks with examples. 14

15. List Out the different phases of penetration testing with examples. 14

OR

16. a. Discuss different reconnaissance tools for penetration testing. 9

b. Discuss the method of extracting information from DNS 5

17. List different malware analysis techniques with examples. 14

OR

18. Discuss basic dynamic analysis for malwares. 14

19. a. Explain Secure Socket Layer and Transport Layer Security 8

b. Discuss various methods for vulnerability management in a web application. 6

OR

20. Explain different ways for securing modern web applications with examples. 14

2014

Syllabus

INFORMATION TECHNOLOGY

Module 1: Basics of Web Application Security (9 Hours)
Web Application Security Basics:- Introduction to Web Application Reconnaissance- Information Gathering, Web Application Mapping. The Structure of a Modern Web Application- Modern vs Legacy Web Applications, REST API, Javascript Object Notation, SPA Framework, Authentication and authorization Systems, Client side Data stores. Finding SubDomains- Browser's built in network analysis tools, Taking advantage of public records, Search Engine Caches, Social Snapshots, Zone transfer attacks, Brute forcing sub domains, Dictionary Attacks.
Module 2: Hacking Web Applications (10 Hours)
Introduction to Hacking Web Applications:- The Hacker's mindset, Cross Site Scripting - Stored XSS, Reflected XSS, DOM-Based XSS, Mutation Based XSS. Cross-Site Request Forgery (CSRF) - Query Parameter Tampering, Alternate Get Payloads, CSRF against POST Endpoints. XML External Entity (XXE) - Direct XXE, Indirect XXE. Injection - SQL Injection, Code Injection, Command Injection. Denial of Service(DoS) - regex DoS (ReDoS), Logical DoS Vulnerabilities, Distributed DoS.
Module 3: Penetration Testing (10 Hours)
Penetration Testing:- What is penetration Testing?, Introduction to Kali tools, Phases of Penetration testing. Reconnaissance- HTRACK, Google Directives, The harvester, whois, netcraft, Extracting information from DNS. Scanning- Pings and Ping Sweeps, Port Scanning, The three way handshake, vulnerability scanning. Exploitation- Medusa, Metasploit, Remote Password cracking
Module 4: Malware Forensics (8 Hours)
Malware Analysis:- The goals of malware analysis, Malware analysis techniques, Types of malware, Basic static techniques - antivirus scanning, hashing, Finding strings, Packed and obfuscated malwares. Basic dynamic analysis- sandboxes, running malware, viewing process with process explorer, packet sniffing with wireshark. Malware Behavior - backdoors, credential stealers, Privilege escalation.
Module 5: Securing Web Applications (8 Hours)
Securing Modern Web Applications:- Defensive Software Architecture, Comprehensive Code Reviews, Vulnerability Discovery, Vulnerability analysis, Vulnerability Management, Regression Testing, Mitigation Strategies Secure Application Architecture:- Analyzing Feature Requirements, Authentication and Authorization: Secure Sockets Layer and Transport Layer Security, Secure Credentials, Hashing Credentials, PBKDF2, PII and Financial Data. Reviewing Code For Security:- How to start a code review?, Archetypical Vulnerabilities Versus Custom Logic Bugs, Where to Start a Security Review, Secure-Coding Anti-Patterns.

Text Books

1. Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", O'reilly 1st Edition, March 2020
2. Patrik Engebretson, "The basics of Hacking and Penetration Testing", Syngress, 1st Edition, 2011
3. Michael Sikorski, Andrew Honig, "Practical Malware Analysis", No Starch Press 1st Edition, 2012

Reference Books

1. Justin Clarke, "SQL Injection Attacks and Defense", Syngress Publication, 1st Edition, 2009
2. Stuart McClure Joel, ScambRay, George Kurtz, "Hacking Exposed 7: Network Security Secrets & Solutions", The McGraw-Hill Companies Seventh Edition, 2012

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Module 1: Basics of Web Application Security	9 Hours
1.1	Web Application Security Basics:- Introduction to Web Application Reconnaissance-Information Gathering	1
1.2	Web Application Mapping, The Structure of a Modern Web Application- Modern vs Legacy Web Applications	1
1.3	REST API, Javascript Object Notation, SPA Framework	1
1.4	Authentication and authorization Systems, Client side Data stores	1
1.5	Finding SubDomains- Browser's built in network analysis tools	1
1.6	Taking advantage of public records, Search Engine Caches	1
1.7	Social Snapshots	1
1.8	Zone transfer attacks	1
1.9	Brute forcing sub domains, Dictionary Attacks.	1
2	Hacking Web Applications	10 Hours
2.1	Introduction to Hacking Web Applications:- The Hacker's mindset	1
2.2	Cross Site Scripting - Stored XSS, Reflected XSS	1
2.3	DOM-Based XSS, Mutation Based XSS	1
2.4	Cross-Site Request Forgery (CSRF) - Query Parameter Tampering	1
2.5	Alternate Get Payloads, CSRF against POST Endpoints	1
2.6	XML External Entity (XXE) - Direct XXE	1
2.7	Indirect XXE. Injection - SQL Injection, Code Injection	1
2.8	Command Injection. Denial of Service(DoS) - regex DoS (ReDoS)	1

2.9	Logical DoS Vulnerabilities	1
2.10	Distributed DoS.	1
3	Penetration Testing	10 Hours
3.1	Penetration Testing:- What is penetration Testing?	1
3.2	Introduction to Kali tools	1
3.3	Phases of Penetration testing	1
3.4	Reconnaissance- HTTRACK, Google Directives, The harvester	1
3.5	whois, netcraft, Extracting information from DNS.	1
3.6	Scanning- Pings and Ping Sweeps	1
3.7	Port Scanning, The three way handshake	1
3.8	vulnerability scanning	1
3.9	Exploitation- Medusa, Metasploit	1
3.10	Remote Password cracking	1
4	Malware Forensics	8 Hours
4.1	Malware Analysis:- The goals of malware analysis	1
4.2	Malware analysis techniques, Types of malware	1
4.3	Basic static techniques - antivirus scanning, hashing, Finding strings,	1
4.4	Packed and obfuscated malwares.	1
4.5	Basic dynamic analysis- sandboxes, running malware	1
4.6	viewing process with process explorer, packet sniffing with wireshark	1
4.7	Malware Behavior - backdoors	1
4.8	credential stealers, Privilege escalation.	1
5	Securing Web Applications	8 Hours
5.1	Securing Modern Web Applications:- Defensive Software Architecture,	1
5.2	Comprehensive Code Reviews, Vulnerability Discovery, Vulnerability analysis	1
5.3	Vulnerability Management, Regression Testing, Mitigation Strategies	1
5.4	Secure Application Architecture:- Analyzing Feature Requirements,	1
5.5	Authentication and Authorization: Secure Sockets Layer and Transport Layer Security, Secure Credentials	1
5.6	Hashing Credentials, PBKDF2, PII and Financial Data.	1
5.7	Reviewing Code For Security:- How to start a code review?, Archetypical Vulnerabilities Versus Custom Logic Bugs	1
5.8	Where to Start a Security Review, Secure-Coding Anti-Patterns.	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT499	ROBOTICS AND AUTOMATION	VAC	3	1	0	4

Preamble: This course aims at imparting knowledge about robotics as well as automation. This will include basics of robot technology as well as robot programming and Robot Wireless sensor Networks.

Prerequisite: ITT398 Embedded Systems

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe the fundamentals of robot sensors, actuators, technology and application.	Level 2: Understand
CO 2	Demonstrate the facets of Robot Technology.	Level 2: Understand
CO 3	Acquire proficiency in Robot programming.	Level 3: Apply
CO 4	Explain AI and Fuzzy logic for robotics.	Level 2: Understand
CO 5	Outline Robot process automation, RWSN and future of Robots.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	2	-	-	-	-	2	-	2
CO 2	3	3	2	1	2	-	-	-	-	2	-	2
CO 3	3	3	3	3	3	1	-	-	-	2	-	2
CO 4	3	3	3	2	3	1	-	-	-	2	-	2
CO 5	3	3	3	3	3	1	1	-	-	2	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	5	5	10
Level 2: Understand	35	35	70
Level 3: Apply	10	10	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. What is a Robot?
2. Define 'the laws of Robots'
3. Discuss different applications of Industrial robots?
4. Explain the different internal and external sensors that can be used in designing a robot arm

Course Outcome 2 (CO 2):

1. Define forward and inverse kinematics.
2. How to model and control a Single Jointed Robot?
3. Explain the common kinematic arrangements of robots based on various coordinate Systems.

Course Outcome 3 (CO 3):

1. Describe the features of generation of Robot languages.
2. Write a Python program which might be able to determine if one object is on top of another. Assume you are given the location of two objects in the form of list(x,y,z) for each object. Assume that if x and y are equal for both parts and z is greater for one than the other, that one is on the top. Use CAR and CDR to get the individual x,y,z values and then perform comparison.
3. Why task-level programming is difficult?
4. Explain advanced machine learning and artificial intelligence applications in service robot

Course Outcome 4 (CO 4):

1. Illustrate any two search techniques.
2. How to create various type of knowledge which may require representation.
3. Explain the Fuzzy Logic-Neural Computing for robotics.

Course Outcome 5 (CO 5):

1. What are the effects of the implementation of Robotic Process Automation in companies?
2. What are the types of processors that are suitable for Robotic Process Automation?
3. Discuss the Robotic Wireless Sensor Network components.

Model Question Paper**Course Code: ITT499****Course Name: ROBOTICS AND AUTOMATION****Max. Marks :100****Duration: 3 Hrs****Part A*****Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)***

1. What do you mean by the term Degree of Freedom(DOF) in robot motion ?
2. Give the requirements of an actuator for robotic application.
3. Explain different types of controller.
4. Draw the block diagram that corresponds to the spring-mass-damper system represented by $M s^2 Y(s) + K s Y(s) + K_s Y(s) = K_s X(s)$
5. What are the advantages and disadvantages of online programming?
6. Explain advanced machine learning concept of a service robot.
7. What are Frames? Set up frames for the following
 - i. Dogs
 - ii. Cars
 - iii. Professors
8. Explain Evolutionary Computation based algorithms for the control of robots.
9. What are the benefits of Robotic Process Automation?
10. Illustrate a Robotic wireless sensor.

Part B***Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)***

- 11 . You are required to design a robot that can pick up an object of arbitrary shapes from a table and place it inside a box. 14
 - i. What is the minimum number of degree of freedom it should have?
 - ii. List all the possible arm configurations.
 - iii. Draw their corresponding work volumes.

OR

- 12 . Differentiate External and Internal sensors with example. Why the term internal and external used to classify sensors? Is there any advantage of external sensors over internal type? Explain any two velocity sensors. 14
- 13 . A stepping motor is to be used to actuate one joint of a robot arm in a light duty pick-up—place application. The step angle of the motor is 10° . For each pulse received from pulse train source and motor rotates through a distance of one step angle. 14
- What is the resolution of the stepping motor?
 - Rate this value to the definition of control resolution, spatial resolution and accuracy.
- OR**
- 14 . What is a Jacobian of a robot systems? Calculate the Jacobian of two link planar arm when $\Theta_1=45^\circ$ and $\Theta_2=20^\circ$. 14
- 15 a. Explain the structure of robot programming language 6
- b. Artificial Intelligence in robotics deals with the connection between the three primitives of sense, plan and act. In each of the given application, Explain how you would connect the primitives to design a controller. 8
- A mobile robot has to wander around and explore its environment without hitting obstacles
 - A mobile robot has to reach a goal point in the shortest time and also avoid hitting obstacles.
- OR**
- 16 . Explain a self driving car's program model and algorithm. 14
- 17 . Explain advanced techniques for representing knowledge. 14
- OR**
- 18 . Explain the Neural Computing and Evolutionary Computation based algorithms for the control of robots 14
- 19 . What are the effects of the implementation of Robotic Process Automation and the impact on the job design of involved within large companies?. 14
- OR**
- 20 . Explain localization in RWSN and describe an unified system architecture for RWSN with help of a diagram? 14

Module 1: Basic Concept (10 hours) Fundamentals of Robotics- Classification, Automation, Robot Anatomy. Sensors in Robotics-Sensor Classification, Internal sensors, External sensors, Vision, Sensor selection. Actuators and Grippers- Electric, Hydraulic, Pneumatic, selection of motors, grippers. Robot Applications- medical, mining, space, defence, security, domestic, entertainment, Industrial Applications-Material handling, welding, Spray painting, Machining. (T1:Chapter 1,2,,6,7 R1: Chapter 1,2,3,4)
Module 2: Robot Technology (10 hours) The robot and its peripherals- Control Systems and components -models-Mathematical model, Transfer functions, Block diagrams, Characteristics Equations, Controllers. Modelling and control of a Single joint robot. Manipulator Kinematics- Position Representations, Forward and reverse transformation of 2-Degree of Freedom Arm, adding Orientation, A 3- Degree of Freedom Arm in Two Dimensions, A 4-Degree of freedom Manipulator in Three Dimensions. Jacobian Computation. (T1:Chapter 3,4 R1:Chapter 6)
Module 3: Robot Programming (10 hours) Robot Languages-different languages, Generation, Structure, Requirements, Problems. Robot Programming-Online Programming, Offline Programming, VAL Programming-commands for movement, speed control, End-effectors, Sensor commands, Robot oriented programming, Task level programming. Robot Programming with Python and C. ROS (Robotic Operating System basics only). Advanced Machine learning and Artificial intelligence applications in service robot. Integrated deep learning for self-driving robotic car. (T1: Chapter 8,9 R1:Chapter 13 R2: Chapter 10 R3:Chapter 7,8)
Module 4: Artificial Intelligence for Robotics (6 hours) Artificial Intelligence and Robotics - Robotics Paradigms ,Goals of AI Research, AI Technique- Knowledge Representation, Problem Representation and Problem solving, Search Techniques in problem solving. Ethics and risks of artificial intelligence in robotics. Fuzzy Logic-Neural Computing and Evolutionary Computation based algorithms for the control of robots. (T1:Chapter 10 ,R8)

Module 5: Robotic Wireless Sensors Networks (9 hours)

Robot Process Automation (RPA) and Its Future-Properties-RPA Applied to the Digital Process.

Robotic Wireless sensor networks-RWSN-System Components- Localization-RWSN Network Stack Layer Analysis- Unified System Architecture.

Robot and Drone Localization in GPS- Denied Areas, Robot and Drones, Visual Localization and Navigation, Mobile robot navigation.

Multi Robot Systems-MRS Middleware-Design Goal – Applications.

Future of Robots –AI, Autonomy, Humanoids, Haptic Intelligence in Robot.

(T2:Part VI R5- chapter 21)

Text Books

1. M.P Groover, Mitchel weiss, Roger N Nagel, Nicholoas G Odrey, Ashish Dutta ” Industrial Robotics-Technology, Programming and Applications” 2e , McGraw-Hill ISBN-13: 978-1-25-900621-0, ISBN-10: 1-25-900621-2
2. Habib M.Ammari “Mission-Oriented Sensor Networks and Systems: Art and Science” Volume 2: Advances, Springer ISSN 2198-4182 ISBN 978-3-319-9238-3

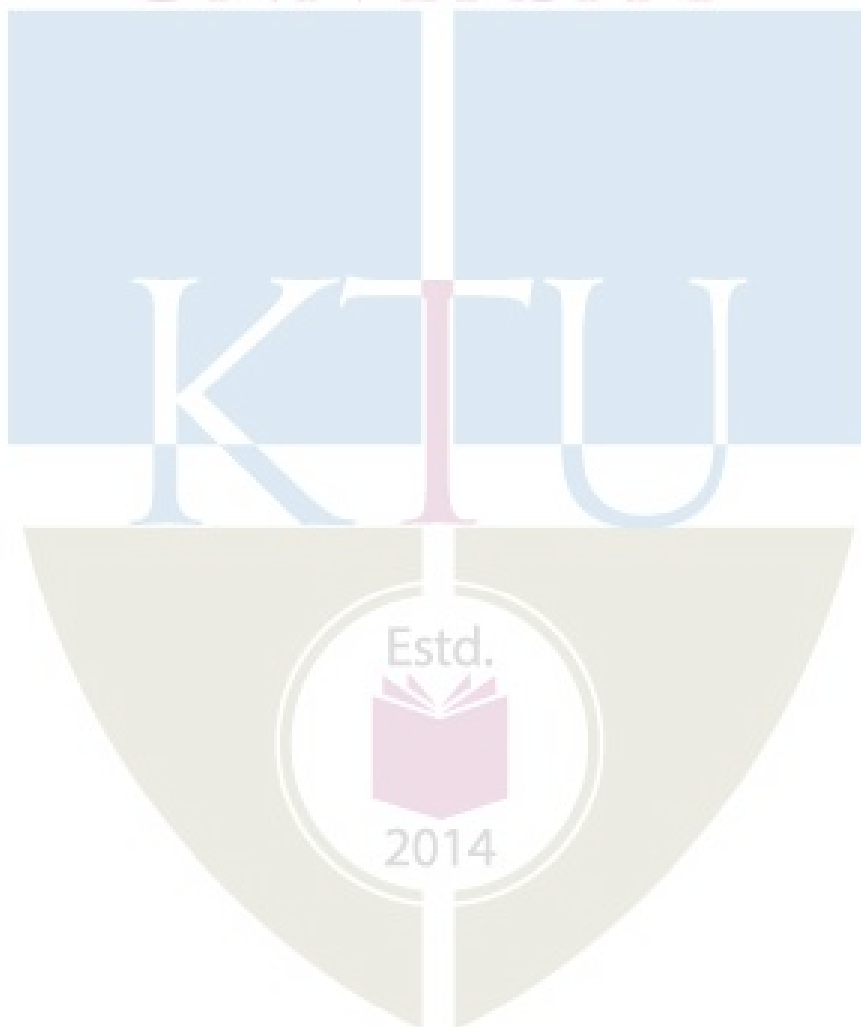
References

1. S K Saha “Introduction to Robotics” Second Edition McGraw-Hill ISBN-13: 978-93-329-0280-0, ISBN-10: 93-329-0280-1
2. Dr. Jisu Elsa Jacob and Manjunath N, “Robotics Simplified” ,BPB Publishers, 2022.
3. <https://www.sciencedirect.com/book/9780323854986/artificial-intelligence-for-future-generation-robotics>
4. Introduction to Mobile Robot Control; S.G. Tzafestas; Elsevier; ISBN:0124170498, 9780124170490
5. Robot Process Automation (RPA) and Its Future <https://www.researchgate.net/publication/338302068>, 2nd Edition, John Wiley & sons, Inc, 2007.
6. Stuart Russell, Peter Norvig, “Artificial Intelligence: A modern approach”, Pearson Education, India 2003.
7. David Jefferis, “Artificial Intelligence: Robotics and Machine Evolution”, Crabtree Publishing Company, 1992.
8. Fuzzy Logic Combined With Neural Algorithm to control Industrial Robot <https://www.researchgate.net/publication/265164491>
9. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005
10. John J. Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.

Sl. No.	Topic	No. of Lectures
1	Basic Concept	10 Hours
1.1	Fundamentals of Robotics- Classification Automation, Robot Anatomy	2
1.2	Sensors in Robotics- sensor classification	1
1.3	Internal sensors, External sensors	1
1.4	Vision	1
1.5	Sensor Selection	1
1.6	Actuators - Electric, Hydraulic, Pneumatic, selection of motors	1
1.7	Grippers	1
1.8	Robot Applications- medical, mining, space, defence, security, domestic, entertainment, Industrial Applications-Material handling, welding, Spray painting, Machining.	2
2.	Robot Technology	10 Hours
2.1	The robot and its peripherals- Control Systems and components	1
2.2	Models- Mathematical model- Transfer functions- Block diagrams- Characteristics Equations	2
2.3	Controllers	1
2.4	Modelling and control of a Single joint robot.	2
2.5	Manipulator Kinematics- Position Representations, Forward and reverse transformation of 2-Degree of Freedom Arm	1
2.6	Adding Orientation- A 3- Degree of Freedom Arm in Two Dimensions, A 4-Degree of freedom Manipulator in Three Dimensions.	1

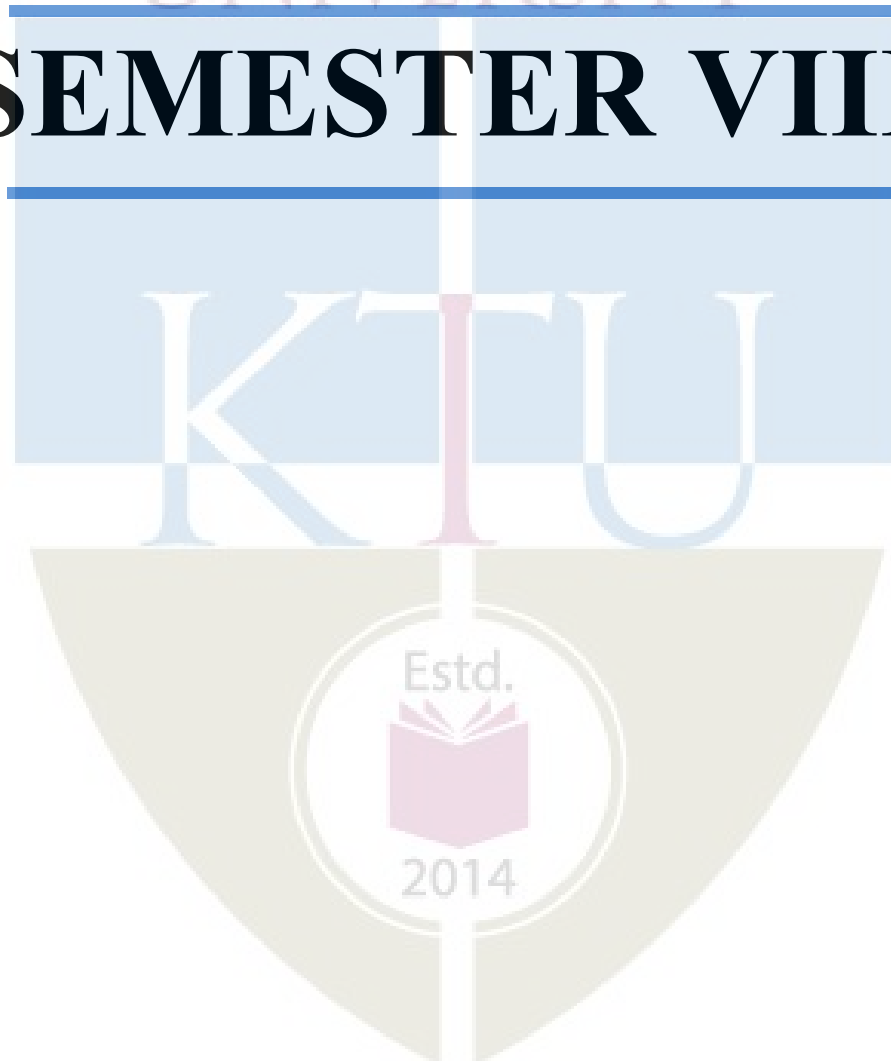
2.7	Jacobian Computation	2
3	Robot Programming	10 Hours
3.1	Robot Languages-different languages, Generation, Structure, Requirements, Problems.	2
3.2	Robot Programming-Online Programming, Offline Programming.	2
3.3	Robot oriented programming, Task level programming.	1
3.4	ROS (Robotic Operating System)- Basics only	1
3.5	Advanced Machine learning and Artificial intelligence applications in service robot.	2
3.7	LISP Programming fundamentals.	2
4	Artificial Intelligence for Robotics	6 Hours
4.1	Artificial Intelligence and Robotics - Robotics Paradigms	1
4.2	Goals of AI Research, AI Technique- Knowledge Representation	1
4.3	Problem Representation and Problem solving	1
4.4	Search Techniques in problem solving	1
4.5	Ethics and risks of artificial intelligence in robotics.	1
4.6	Fuzzy Logic-Neural Computing and Evolutionary Computation based algorithms for the control of robots	1
5	Robotic Wireless Sensors Networks	9 Hours
5.1	Robot Process Automation (RPA) and Its Future-Properties-RPA Applied to the Digital Process.	1
5.2	Robotic Wireless sensor networks-RWSN-System Components	1
5.3	Localization-RWSN Network Stack Layer Analysis	1

5.4	Unified System Architecture	1
5.5	Robot and Drone Localization in GPS- Denied Areas, Robot and Drones, Visual Localization and Navigation, Mobile robot navigation	2
5.6	Multi Robot Systems-MRS Middleware-Design Goal – Applications.	1
5.7	Future of Robots –AI, Autonomy, Humanoids, Haptic Intelligence in Robot.	2



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VIII



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT402	CRYPTOGRAPHY AND NETWORK SECURITY	PCC	2	1	0	3

Preamble: Cryptography is essentially important for secure communication in digital form and to provide security services in today's internet environment. The syllabus is prepared with a view to provide the Engineering Graduates a better foundation in cryptography and network security.

Prerequisite: MAT203 Discrete Mathematical Structures, ITT305 Data Communication and Networking

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Apply the concepts of number theory in designing crypto systems	Level 3: Apply
CO 2	Explain various network security aspects, cryptanalytic attacks and classical cryptosystems	Level 2: Understand
CO 3	Describe various symmetric key cryptosystems, hash and message authentication functions.	Level 2: Understand
CO 4	Apply the principles of asymmetric key cryptosystems and digital signature.	Level 3: Apply
CO 5	Discuss various protocols to ensure Email Security and Network Security.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	2	-	-	-	-	-	-	-	-	1
CO 2	1	1	2	-	-	-	-	-	-	-	-	-
CO 3	1	-	-	-	-	-	-	-	-	-	-	1
CO 4	3	-	-	-	1	-	-	-	-	-	-	1
CO 5	1	2	1	-	2	-	-	-	-	-	-	1

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
BL 1: Remember	10	10	20
BL 2: Understand	30	30	60
BL 3: Apply	10	10	20
BL 4: Analyse			
BL 5: Evaluate			
BL 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Using Euclid's algorithm, obtain the greatest common divisor of the (42, 105, 91).
2. Find $33^{100} \bmod 40$ (use Euler's theorem).
3. Compute the value of x for the set of congruence given using Chinese Remainder Theorem. $x \equiv 4 \bmod 5$, and $x \equiv 10 \bmod 11$.
4. Define Fermat's theorem and list out its applications.

Course Outcome 2 (CO 2):

1. Describe the three security goals of Information Security.
2. Explain with examples some of the attacks threatening confidentiality and integrity.
3. Encrypt the message "beware of strangers" using Vigenere cipher with key "dollars". Ignore the space between words. Decrypt the message to get the plain text.
4. Compare stream cipher and block cipher with example.

Course Outcome 3 (CO 3):

1. Summarize the key generation process in DES.
2. With suitable examples, explain the significance of hash function for message authentication.
3. List and briefly describe the design objectives of HMAC.
4. Explain the single round operation of SHA-512.

Course Outcome 4 (CO 4):

1. Perform encryption and decryption using RSA algorithm for the following. $P=7$; $q=11$; $e=13$; $M=8$.
2. Identify the possible threats for the RSA algorithm and list their countermeasures.
3. Demonstrate man in the middle attack on Diffie Hellman key exchange algorithm.
4. Explain the digital signature algorithm with suitable diagrams.

Course Outcome 5 (CO 5):

1. Describe the various ways to distribute public keys in cryptography.
2. Sketch and explain the transmission and reception of PGP Messages.
3. Give the format of Authentication Header in IPSec.
4. Explain the features of any two types of firewalls.

Model Question Paper

Course Code: ITT402

Course Name: CRYPTOGRAPHY AND NETWORK SECURITY

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks ($10 * 3 = 30$ Marks)

1. Identify the number of primes less than 1,000,000.
2. Compute $33^{100} \pmod{40}$ (use Euler's theorem).
3. With an example, explain the encryption and decryption process of Caesar Cipher.
4. Compare stream cipher and block cipher with example.
5. "The decryption mode of DES is inverse of its encryption mode". Justify the above statement with your comments.
6. Compare the round keys in DES and AES. In which cipher is the size of the round key the same as the size of the block?
7. Consider a Diffie Hellman scheme with a common prime $q = 11$ and primitive root $\alpha = 2$. If user A has public key $Y_A = 9$ and user B has public key $Y_B = 3$, estimate A's private key and the shared secret key K between A and B.
8. Explain the steps for the verifying process in RSA digital signature scheme.
9. Discuss about the various types of firewalls.
10. Distinguish between Direct DDoS and Reflector DDoS.

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 a. Compute $\gcd(85, 289)$.
Using Euclid's extended algorithm, obtain x and y such that
 $85x + 289y = \gcd(85, 289)$. 7
- b. Find the particular and general solutions to the equation $21x + 14y = 35$. 7

OR

- 12 a. Solve the system of simultaneous congruences using Chinese remainder theorem

$$\begin{aligned} x &\equiv 6 \pmod{11} \\ x &\equiv 13 \pmod{16} \\ x &\equiv 9 \pmod{21} \\ x &\equiv 19 \pmod{25} \end{aligned}$$
 8
- b. Using Fermat theorem evaluate the following:

$$\begin{aligned} 6^{10} \pmod{11} \\ 3^{12} \pmod{11} \\ 5^{984} \pmod{7} \end{aligned}$$
 6
- 13 a. List and explain the security mechanisms defined by X.800. 8
- b. Illustrate the encryption of given message using Playfair cipher with the keyword "GUIDANCE".
Message: MEET ME AT THE TOGA PARTY 6

OR

- 14 a. Describe the various cryptanalytic attacks on cryptosystems. 10
- b. Consider the encryption key in a transposition cipher is $(3, 2, 6, 1, 5, 4)$.
Determine the corresponding decryption key. 4
- 15 a. Demonstrate the single round operation in the DES algorithm. 10
- b. List and briefly describe the design objectives of HMAC. 4
- OR**
- 16 a. Outline the following round operations in AES cipher: 10
- Substitute Bytes Transformation
 - Shift Rows Transformation
 - Mix Columns Transformation
 - Add Round Key Transformation
- b. Distinguish between HMAC and CMAC. 4
- 17 a. Illustrate in detail about the message authentication code and its requirements. 7
- b. Alice and Bob agreed to use RSA algorithm for the secret communication. 7
Alice securely chooses two primes, $p=5$ and $q=11$ and a secret key $d=7$. Find the corresponding public key. Bob uses this public key and sends a cipher text 18 to Alice. Obtain the plain text.

OR

- 18 a. Consider an ElGamal scheme with a common prime $p=71$ and a primitive

root $x = 7$.

1. If Bob has public key $y = 3$ and Alice chose the random integer $k = 2$, Find the ciphertext of $M = 30$.
 2. If Alice now chooses a different value of k , so that the encoding of $M = 30$ is $C = (59, C_2)$, determine the integer C_2 . 8
 - b. Describe signing and verification in Digital Signature Algorithm. 6
 - 19 a. Explain the sequence of steps involved in the message generation and reception in Pretty Good Privacy (PGP) with block diagrams. 10
 - b. Sketch and explain IPsec ESP Format. 4
- OR**
- 20 a. Illustrate the working of Secure Electronic Transaction (SET) in detail. 7
 - b. Summarize any two techniques proposed for the distribution of public keys. 7

Syllabus

Module 1: Basics of Algebra and Number Theory (7 Hours)	
Integer Arithmetic -Divisibility - Greatest Common Divisor - Extended Euclidean Algorithm- Linear Diophantine equation, Modular Arithmetic - Modulo Operator - Congruence - Addition and multiplicative inverse, Algebraic structures - Field - Finite fields of the form $GF(p)$ and $GF(2^n)$ - Polynomial arithmetic, Prime Numbers - Fermat's and Euler's Theorem - Prime Factorization by Trial Division Method - Chinese Remainder Theorem.	
Module 2: Introduction to Security (8 Hours)	
Security Goals, Security Services-Confidentiality -Integrity - Authentication- Non-repudiation- Access control, Security Mechanisms-Encipherment- Data Integrity-Signature-Authentication Exchange-Traffic Padding- Routing Control- Notarization- Access Control, Introduction to Cryptography -Classification of Cryptosystems, Cryptanalytic attacks, CipherProperties - Confusion- Diffusion. Classical Cryptosystems - Substitution Techniques - Monoalphabetic Cipher - Caesar Cipher- AffineCipher, Polyalphabetic Ciphers - Autokey Cipher- Playfair Cipher-Hill Cipher-VigenereCipher- One Time Pad Cipher, Stream and Block Ciphers, Modern Secret Key Ciphers - Substitution Box-Permutation Box-Product Ciphers.	
Module 3: Private Key Cryptography and Hash Function (7 Hours)	
Data Encryption Standard - DES - Structure of DES - DES Attacks - 2-DES - 3-DES, Advanced Encryption Standard - AES - Structure-Analysis, Cryptographic Hash Functions - Properties - Secure Hash Algorithm - SHA-512 Logic - SHA-512 Round Function, Message Authentication Code -Hash-based Message Authentication Code -HMAC - Cipher-based Message Authentication Code - CMAC.	
Module 4: Public Key Cryptography and Digital Signature (7 Hours)	
Public Key Cryptosystems -PKC - Types of PKC - Trapdoor - One-way functions, RSA Cryptosystem -Key Generation – Encryption- Decryption,ElGamal Cryptosystem - Key Generation – Encryption-Decryption, Diffie-Hellman Key Exchange Protocol- Man in the Middle attack on Diffie-Hellman Protocol. Digital Signature- Signing - Verification, Digital signature forgery-Existential forgery- Selective forgery- Universal forgery, RSA Digital Signature Scheme -ElGamal Signature Scheme.	

Module 5: Key Distribution and Network Security (6Hours)

Symmetric Key Distribution using Symmetric and Asymmetric Encryption - Distribution of public keys -Public announcement- Public available directory-Public-key authority- Public-key Certificates.

Electronic Mail Security -Pretty Good Privacy- PGP message format - Transmission and Reception of PGP Messages, IP Security Overview - IP Authentication Header - Encapsulating Security Payload - Distributed Denial of Service attacks, Secure Electronic Transaction - PaymentProcessing - Dual Signature, Firewalls - Firewall Design Principles.

Text Books

1. Stallings W., Cryptography and Network security: Principles and Practice, 7/e, Pearson Education Asia, 2017.
2. Stallings W., Cryptography and Network security: Principles and Practice, 4/e, Pearson Education Asia, 2006.
3. Behrouz A Forouzan&DebdeepMukhopadhyay, "Cryptography and Network. Security", Second Edition, Tata McGraw Hill Education Pvt Ltd Publication, 2010.

Reference Books

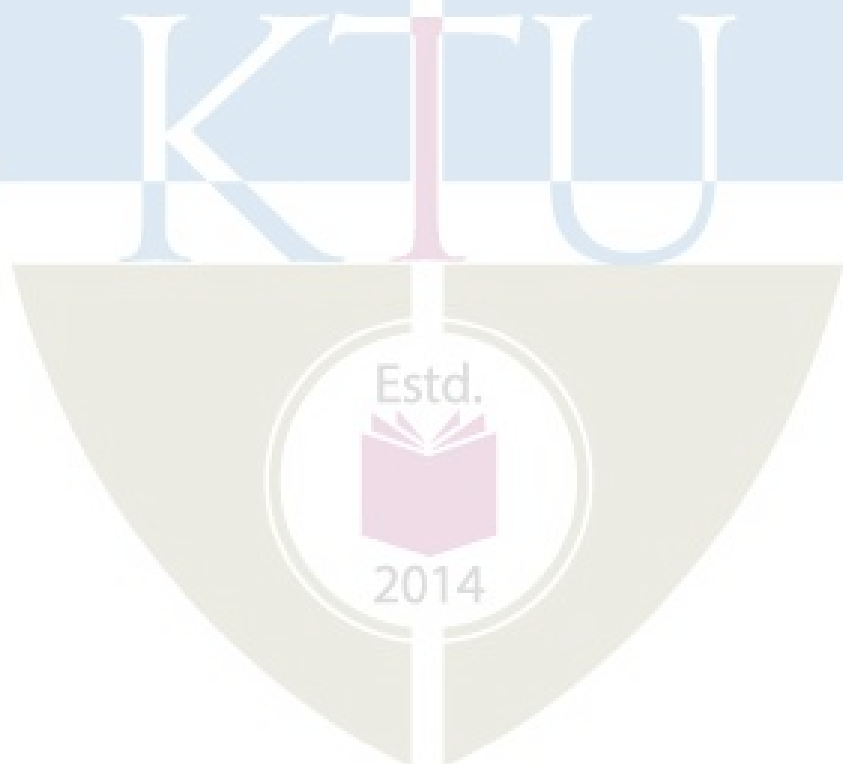
1. AtulKahate, "Cryptography and Network Security, 4e", Tata McGraw Hill,2019.
2. Bernard Menezes, Network Security and Cryptography-Cengage Learning India, 2011
3. Thomas Mowbray, "Cybersecurity: Managing Systems Conducting Testing, and Investigating Intrusions", John Wiley, 2014
4. Charles P. Pleege, Shari Lawrence Pleege, "Security in Computing", Pearson Education Asia, 5thEdition, 2018.
5. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Pearson Education India, 2016.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Basics of Algebra and Number Theory	7Hours
1.1	Integer Arithmetic - Divisibility - Greatest Common Divisor	1
1.2	Extended Euclidean Algorithm	1
1.3	Linear Diophantine equation	1
1.4	Modular Arithmetic - Modulo Operator - Congruence - Addition and multiplicative inverse	1
1.5	Algebraic structures - Field - Finite fields of the form $GF(p)$ and $GF(2^n)$ - Polynomial arithmetic	1
1.6	Prime Numbers - Fermat's and Euler's Theorem- Prime Factorization by Trial Division Method	1
1.7	Chinese Remainder Theorem	1

2	Introduction to Security	8 Hours
2.1	Security Goals, Security Services - Confidentiality- Integrity- Authentication- Non-repudiation- Access control, Security Mechanisms - Encipherment- Data Integrity - Signature- Authentication Exchange-Traffic Padding- Routing Control - Notarization-Access Control	1
2.2	Introduction to Cryptography -Classification of Cryptosystems, Cryptanalytic attacks, Cipher Properties-Confusion- Diffusion.	1
2.3	Classical Cryptosystems - Substitution Techniques - Monoalphabetic Cipher	1
2.4	Caesar Cipher- Affine Cipher	1
2.5	Polyalphabetic Ciphers - Autokey Cipher- Playfair Cipher	1
2.6	Hill Cipher- Vigenere Cipher- One Time Pad Cipher	2
2.7	Stream and Block Ciphers, Modern Secret Key Ciphers- Substitution Box-Permutation Box-Product Ciphers	1
3	Private Key Cryptography and Hash Function	7 Hours
3.1	Data Encryption Standard -DES- Structure of DES- DES Attacks - 2-DES - 3-DES	2
3.2	Advanced Encryption Standard -AES -Structure-Analysis	2
3.3	Cryptographic Hash Functions - Properties	1
3.4	Secure Hash Algorithm - SHA-512 Logic - SHA-512 Round Function	1
3.5	Message Authentication Code - Hash-based MessageAuthentication Code -HMAC - Cipher-based Message Authentication Code - CMAC	1
4	Public Key Cryptography and Digital Signature	7 Hours
4.1	Public Key Cryptosystems -PKC - Types of PKC - Trapdoor - One-way functions- RSA Cryptosystem -Key Generation-Encryption- Decryption	2
4.2	ElGamal Cryptosystem - Key Generation – Encryption-Decryption	2
4.3	Diffie-Hellman Key Exchange Protocol- Man in the Middle attack on Diffie-Hellman Protocol.	1
4.4	Digital Signature- Signing - Verification, Digital signature forgery- Existential forgery- Selective forgery- Universal forgery	1

4.5	RSA Digital Signature Scheme - ElGamal Signature Scheme.	1
5	Key Distribution and Network Security	6 Hours
5.1	Symmetric Key Distribution using Symmetric and Asymmetric Encryption	1
5.2	Distribution of public keys -Public announcement- Public available directory-Publickey authority- Publickey Certificates	1
5.3	Electronic Mail Security - Pretty Good Privacy- PGP message format - Transmission and Reception of PGP Messages	1
5.4	IP Security Overview - IP Authentication Header - Encapsulating Security Payload,Distributed Denial of Service attacks	1
5.5	Secure Electronic Transaction- Payment Processing -Dual Signature	1
5.6	Firewalls - Firewall Design Principles	1



ITT404	COMPREHENSIVE COURSE VIVA	CATEGORY	L	T	P	CREDIT
		PCC	1	0	0	1

Preamble: The objective of this Course viva is to ensure the basic knowledge of each student in the most fundamental core courses in the curriculum. The viva voce shall be conducted based on the core subjects studied from third to eighth semester. This course helps the learner to become competent in placement tests and other competitive examinations.

Guidelines

1. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed in the curriculum.
2. The viva voce will be conducted by the same three member committee assigned for final project phase II evaluation. It comprises of Project coordinator, expert from Industry/research Institute and a senior faculty from a sister department.
3. The pass minimum for this course is 25.
4. The mark will be treated as internal and should be uploaded along with internal marks of other courses.
5. Comprehensive Viva should be conducted along with final project evaluation by the three member committee.

Mark Distribution

Total marks: 50, only CIE, minimum required to pass : 25 Marks



ITD416	PROJECT PHASE II	CATEGORY	L	T	P	CREDIT
		PWS	0	0	12	4

Preamble: The course ‘Project Work’ is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Course Objectives

- To apply engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.

Course Outcomes [COs]: After successful completion of the course, the students will be able to:

CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply).
CO2	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: Apply).
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	2	1	1	1	1	2
CO2	2	2	2		1	3	3	1	1		1	1
CO3									3	2	2	1
CO4					2			3	2	2	3	2
CO5	2	3	3	1	2							1
CO6					2			2	2	3	1	1

Abstract POs defined by National Board of Accreditation			
PO #	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO0	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

PROJECT PHASE II

Phase 2 Targets

- In depth study of the topic assigned in the light of the report prepared under Phase - I;
- Review and finalization of the approach to the problem relating to the assigned topic.
- Preparing a detailed action plan for conducting the investigation, including teamwork.
- Detailed Analysis/ Modeling / Simulation/ Design/ Problem Solving/Experiment as needed.
- Final development of product/ process, testing, results, conclusions and future directions.
- Preparing a paper for Conference Presentation/ Publication in Journals, if possible.
- Presenting projects in Project Expos conducted by the University at the cluster level and/ or state level as well as others conducted in India and abroad.
- Filing Intellectual Property Rights (IPR) if applicable.
- Preparing a report in the standard format for being evaluated by the Department Assessment Board.
- Final project presentation and viva voce by the assessment board including the external expert.

Evaluation Guidelines & Rubrics

Total: 150 marks (Minimum required to pass: 75 marks).

- Project progress evaluation by guide: 30 Marks.
- Two interim evaluations by the Evaluation Committee: 50 Marks (25 marks for each evaluation).
- Final evaluation by the Final Evaluation committee: 40 Marks
- Quality of the report evaluated by the evaluation committee: 30 Marks

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor. The final evaluation committee comprises of Project coordinator, expert from Industry/research/academic Institute and a senior faculty from a sister department).

Evaluation by the Guide

INFORMATION TECHNOLOGY

The guide/supervisor must monitor the progress being carried out by the project groups on regular basis. In case it is found that progress is unsatisfactory it should be reported to the Department Evaluation Committee for necessary action. The presence of each student in the group and their involvement in all stages of execution of the project shall be ensured by the guide. Project evaluation by the guide: 30 Marks. This mark shall be awarded to the students in his/her group by considering the following aspects:

Project Scheduling & Distribution of Work among Team members: Detailed and extensive Scheduling with timelines provided for each phase of project. Work breakdown structure well defined. (5)

Literature survey: Outstanding investigation in all aspects. (4)

Student's Diary/ Daily Log: The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily/weekly activity diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily/weekly activity diary shall be signed after every day/week by the guide. (7)

Individual Contribution: The contribution of each student at various stages. (9)

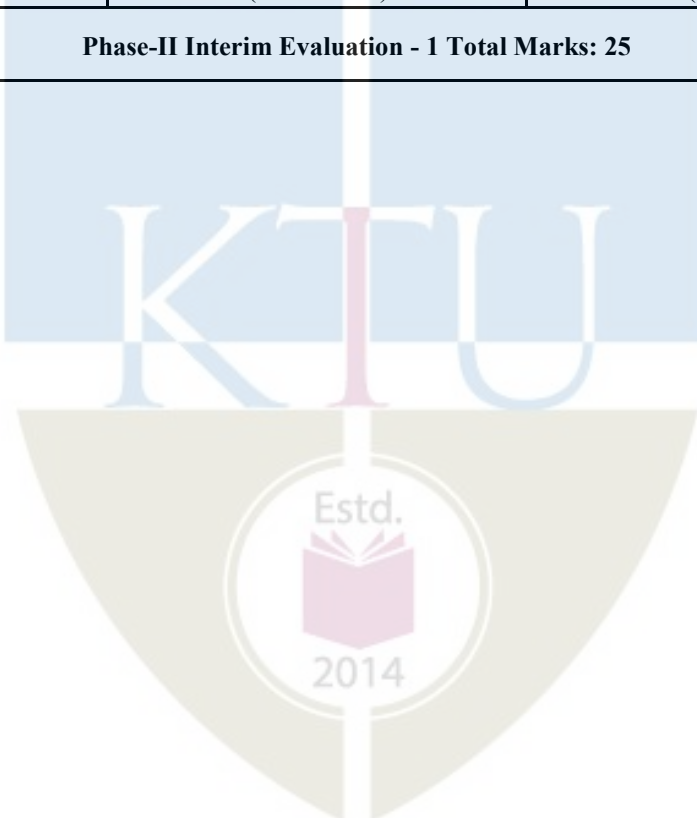
Completion of the project: The students should demonstrate the project to their respective guide. The guide shall verify the results and see that the objectives are met. (5)



EVALUATION RUBRICS for PROJECT Phase II: Interim Evaluation - 1

No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
2-a	Novelty of idea, and Implementation scope [CO5] [Group Evaluation]	5	The project is not addressing any useful requirement. The idea is evolved into a non-implementable one. The work presented so far is lacking any amount of original work by the team.	Some of the aspects of the proposed idea can be implemented. There is still lack of originality in the work done so far by the team. The project is a regularly done theme/topic without any freshness in terms of specifications, features, and/or improvements.	Good evidence of an implementable project. There is some evidence for the originality of the work done by the team. There is fresh specifications/features/improvements suggested by the team. The team is doing a design from fundamental principles, and there is some independent learning and engineering ingenuity.	The project has evolved into incorporating an outstandingly novel idea. Original work which is not yet reported anywhere else. Evidence for ingenious way of innovation which is also Implementable. Could be a patentable / publishable work.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
2-b	Effectiveness of task distribution among team members. [CO3] [Group Evaluation]	5	No task distribution of any kind. Members are still having no clue on what to do.	Task allocation done, but not effectively, some members do not have any idea of the tasks assigned. Some of the tasks were identified but not followed individually well.	Good evidence of task allocation being done, supported by project journal entries, identification of tasks through discussion etc. However, the task distribution seems to be skewed, and depends a few members heavily than others. Mostly the tasks are being followed by the individual members.	Excellent display of task identification and distribution backed by documentary evidence of team brainstorming, and project journal entries. All members are allocated tasks according to their capabilities, and as much as possible in an equal manner. The individual members are following the tasks in an excellent manner.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
2-c	Adherence to project schedule. [CO4] [Group Evaluation]	5	Little or no evidence of continued planning or scheduling of the project. The students did not stick to the plan what they were going to build nor plan on what materials / resources to use in the project. The students do not have any idea on the budget required even after the end of phase - I. No project journal kept or the journal.	There is some improvement in the primary plan prepared during phase I. There were some ideas on the materials /resources required, but not really thought out. The students have some idea on the finances required, but they have not formalized a budget plan. Schedules were not prepared. The project journal has no useful details on the project.	Good evidence of planning done and being followed up to a good extent after phase I. Materials were listed and thought out, but the plan wasn't followed completely. Schedules were prepared, but not detailed, and needs improvement. Project journal is presented but it is neither complete nor updated regularly.	Excellent evidence of enterprising and extensive project planning and follow-up since phase I. Continued use of project management/version control tool to track the project. Material procurement if applicable is progressing well. Tasks are updated and incorporated in the schedule. A well-kept project journal showed evidence for all the above, in addition to the interaction with the project guide.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)

2-d	Interim Results. [CO6] [Group assessment]	5	There are no interim results to show.	The team showed some interim results, but they are not complete / consistent to the current stage, Some corrections are needed.	The interim results showed were good and mostly consistent/correct with respect to the current stage. There is room for improvement.	There were significant interim results presented which clearly shows the progress.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-e	Presentation [Individual assessment]	5	Very poor presentation and there is no interim results. The student has no idea about the project proposal.	Presentation is average, and the student has only a feeble idea about the team work.	Good presentation. Student has good idea about the team's project. The overall presentation quality is good.	Exceptionally good presentation. Student has excellent grasp of the project. The quality of presentation is outstanding.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
Phase-II Interim Evaluation - 1 Total Marks: 25						



EVALUATION RUBRICS for PROJECT Phase II: Interim Evaluation – 2

No	Parameters	Marks	Poor	Fair	Very Good	Outstanding
2-f	Application of engineering knowledge [CO1] [Individual Assessment]	10	The student does not show any evidence of applying engineering knowledge on the design and the methodology adopted. The student's contribution in application of engineering knowledge in the project is poor.	The student appears to apply some basic knowledge, but not able to show the design procedure and the methodologies adopted in a comprehensive manner.	The student is able to show some evidence of application of engineering knowledge in the design and development of the project to good extent.	Excellent knowledge in design procedure and its adaptation. The student is able to apply knowledge from engineering domains to the problem and develop solutions.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
2-g	Involvement of individual members [CO3] [Individual Assessment]	5	No evidence of any Individual participation in the project work.	There is evidence for some amount of individual contribution, but is limited to some of the superficial tasks.	The individual contribution is evident. The student has good amount of involvement in core activities of the project.	Evidence available for the student acting as the core technical lead and has excellent contribution to the project.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-h	Results and inferences upon execution [CO5] [Group Assessment]	5	None of the expected outcomes are achieved yet. The team is unable to derive any inferences on the failures/ issues observed. Any kind of observations or studies are not made.	Only a few of the expected outcomes are achieved. A few inferences are made on the observed failures/issues. No further work suggested.	Many of the expected outcomes are achieved. Many observations and inferences are made, and attempts to identify the issues are done. Some suggestions are made for further work.	Most of the stated outcomes are met. Extensive studies are done and inferences drawn. Most of the failures are addressed and solutions suggested. Clear and valid suggestions made for further work.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-i	Documentation and presentation. [CO6] [Individual assessment]	5	The individual student has no idea on the presentation of his/her part. The presentation is of poor quality.	Presentation's overall quality needs to be improved.	The individual's presentation performance is satisfactory.	The individual's presentation is done professionally and with great clarity. The individual's performance is excellent.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)

Phase-II Interim Evaluation - 2 Total Marks: 25

EVALUATION RUBRICS for PROJECT Phase II: Final Evaluation						
No	Parameters	Marks	Poor	Fair	Very Good	Outstanding
2-j	Engineering knowledge. [CO1] [Group Assessment]	10	The team does not show any evidence of applying engineering knowledge on the design and the methodology adopted.	The team is able to show some of the design procedure and the methodologies adopted, but not in a comprehensive manner.	The team is able to show evidence of application of engineering knowledge in the design and development of the project to good extent. There is scope for improvement.	Excellent knowledge in design procedure and its adaptation. The team is able to apply knowledge from engineering domains to the problem and develop an excellent solution.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
2-k	Relevance of the project with respect to societal and/or industrial needs. [Group Assessment] [CO2]	5	The project as a whole do not have any societal / industrial relevance at all.	The project has some relevance with respect to social and/or industrial application. The team has however made not much effort to explore further and make it better.	The project is relevant to the society and/or industry. The team is mostly successful in translating the problem into an engineering specification and managed to solve much of it.	The project is exceptionally relevant to society and/or industry. The team has made outstanding contribution while solving the problem in a professional and/or ethical manner.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-i	Innovation / novelty / Creativity [CO5] [Group Assessment]	5	The project is not addressing any useful requirement. The idea is evolved into a non-implementable one. The work presented so far is lacking any amount of original work by the team.	Some of the aspects of the proposed idea appears to be practical. There is still lack of originality in the work done. The project is a regularly done theme/topic without any freshness in terms of specifications, features, and/or improvements.	Good evidence of an implementable project. There is some evidence for the originality of the work done by the team. There is fresh specifications/features/improvements suggested by the team. The team is doing a design from fundamental principles, and there is some independent learning and engineering ingenuity. Could be translated into a product / process if more work is done.	The project has evolved into incorporating an outstandingly novel idea. Original work which is not yet reported anywhere else. Evidence for ingenious way of innovation which is also Implementable. Could be a patentable publishable work.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-m	Quality of results / conclusions / solutions. [CO1] [Group Assessment]	10	None of the expected outcomes are achieved. The team is unable to derive any inferences on the failures/issues observed. Any kind of observations or studies is not made.	Only a few of the expected outcomes are achieved. A few inferences are made on the observed failures/issues. No further work suggested.	Many of the expected outcomes are achieved. Many observations and inferences are made, and attempts to identify the issues are done. Some suggestions are made for further work.	Most of the stated outcomes are met. Extensive studies are done and inferences drawn. Most of the failures are addressed and solutions suggested. Clear and valid suggestions made for further work.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)

2-n	Presentation - Part I Preparation of slides. [CO6] [Group Assessment].	5	The presentation slides are shallow and in a clumsy format. It does not follow proper organization.	Presentation slides follow professional style formats to some extent. However, its organization is not very good. Language needs to be improved. All references are not cited properly, or acknowledged. Presentation slides needs to be more professional.	Presentation slides follow a good style format and there are only a few issues. Organization of the slides is good. Most of references are cited properly. The flow is good and team presentation is neatly organized. Some of the results are not clearly shown. There is room for improvement.	The presentation slides are exceptionally good. Neatly organized. All references cited properly. Diagrams/Figures, Tables and equations are properly numbered, and l i s ted. Results/ inferences clearly highlighted and readable.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
	Presentation - Part II: Individual Communication [CO6] [Individual Assessment].	5	The student is not communicating properly. Poor response to questions.	The student is able to explain some of the content. The student requires a lot of prompts to get to the idea. There are language issues.	Good presentation/ communication by the student. The student is able to explain most of the content very well. There are however, a few areas where the student shows lack of preparation. Language is better.	Clear and concise communication exhibited by the student. The presentation is outstanding. Very confident and tackles all the questions without hesitation. Exceptional traits of communicator.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
Phase-II Final Evaluation, Marks: 40						



EVALUATION RUBRICS for PROJECT Phase II: Report Evaluation

Sl. No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
2-o	Report [CO6]	30	The prepared report is shallow and not as per standard format. It does not follow proper organization. Contains mostly unacknowledged content. Lack of effort in preparation is evident. References are not cited. Unprofessional and inconsistent formatting.	Project report follows the standard format to some extent. However, its organization is not very good. Language needs to be improved. All references are not cited properly in the report. There is lack of formatting consistency.	Project report shows evidence of systematic documentation. Report is mostly following the standard style format and there are only a few issues. Organization of the report is good. Mostly consistently formatted. Most of references/sources are cited, acknowledged properly.	The report is exceptionally good. Neatly organized. All references cited properly. Diagrams/Figures, Tables and equations are properly numbered, and listed and clearly shown. Language is excellent and follows professional styles. Consistent formatting and exceptional readability.
			(0 - 11 Marks)	(12 - 18 Marks)	(19 - 28 Marks)	(29 - 30 Marks)
Phase - II Project Report Marks: 30						



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VIII

PROGRAM ELECTIVE III



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT414	COMPUTER VISION	PEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in data communication and computer networking, and to fine-tune performance parameters used in data transmission

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain the foundations of Computer Vision	Level 2: Understand
CO 2	Evaluate the different feature extraction techniques and develop an object recognition system using handcrafted features and classifiers.	Level 3: Apply
CO 3	Discuss the concepts of neural networks, logistic regression and develop an image classification system using minimal neural network	Level 3: Apply
CO 4	Explain the fundamentals of Convolutional Neural Network (CNN) and develop an image classification system using CNN	Level 3: Apply
CO 5	Develop an image classification/object detection system using pre-trained models or auto-encoders	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	1
CO 3	3	3	2	-	-	-	-	-	-	-	-	1
CO 4	3	3	2	-	-	-	-	-	-	-	-	1
CO 5	3	2	2	1	-	-	-	-	-	-	-	1

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10		10
Level 2: Understand	25	25	55
Level 3: Apply	15	25	35
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. Compare and contrast the Image Processing vs Computer Vision.
2. What are the different types of color spaces?
3. Mention the various geometric transforms.
4. Give a comparative analysis of different kinds of image filtering.
5. Mention the various color transforms.
6. Compare and contrast the functionalities of basic image operations.

Course Outcome 2 (CO 2):

1. Differentiate between SIFT and SURF..

2. Explain Image pyramids and Fourier transform
3. Differentiate between FLANN and RANSAC.
4. Explain the process of Backpropagation
5. Develop a solution for Coin Detection problem.

Course Outcome 3 (CO 3):

1. Explain the steps in image classification
2. Develop an Image Classification using minimal neural network as second part of assignment1.
3. Explain how logistic regression is performed in the neural network
4. Explain the role of softmax in the neural network
5. Define Stochastic Gradient Descent

Course Outcome 4 (CO 4):

1. Explain the Building Blocks of CNN
2. Explain the role of Batch Normalization and Dropout in CNN
3. Define Hyperparameter Tuning
4. Develop an Image Classification using CNN as the first part of assignment2.

Course Outcome 5 (CO 5):

1. Develop an Object detection using SSD/YOLO as the second part of assignment2.
2. Explain Generative Adversarial Network (GAN)
3. Explain the steps in Human Pose Estimation
4. Explain the steps in action recognition in video

Model Question Paper

Course Code: ITT414

Course Name: COMPUTER VISION

Max.Marks :100

Duration: 3 Hrs

**Estd.
Part A**

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Explain the different components of a vision system.
2. Compare and contrast the functionalities of basic image operations.
3. Explain Thresholding, Erosion and Dilation.
4. Explain Advanced Histogram Equalization(CLAHE)
5. Explain LBP features.
6. Describe the different steps in image classification with a neat diagram.
7. Describe the steps in Auto encoders.
8. Explain the role of Batch Normalization and Dropout in CNN.
9. What is meant by a pose?

10. Explain the different steps involved in object detection.

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

- 11 Compare and contrast the Image Processing VS Computer Vision and mention 14
different applications of Computer vision.

OR

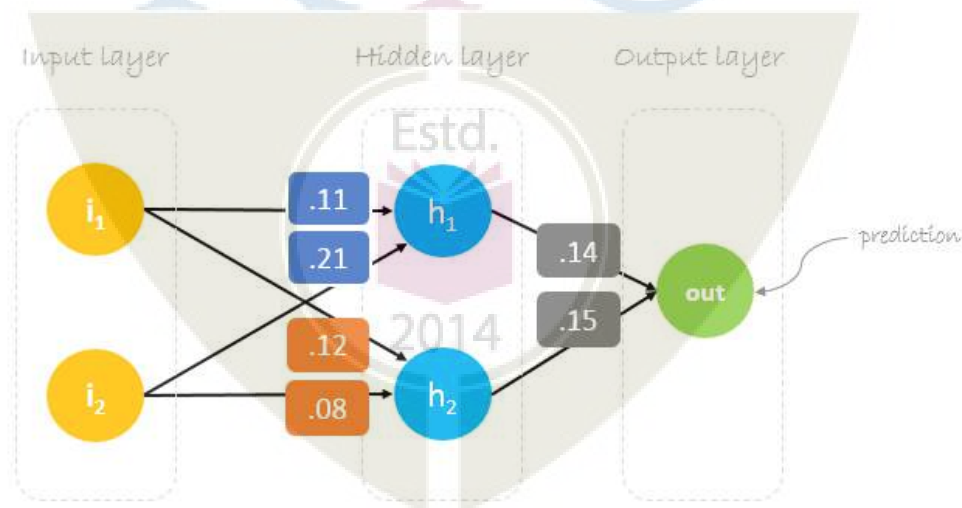
- 12 a Differentiate between Contrast Enhancement and Brightness Enhancement. 9
b Describe the basic image operations 5

- 13 Perform histogram equalization on the following 8 X8 image. The grey level 14
distribution of the image is given below

Gray level(rk)	0	1	2	3	4	5	6	7
No. of pixel(pk)	8	10	10	2	12	16	4	2

OR

- 14 a Differentiate between First Order Derivative Filters and Second Order 10
Derivative Filters
b Why smoothing is important before Gradient? 4
- 15 Explain back propagation for the following network for the inputs=[2, 3] and 14
output=[1]



OR

- 16 a Differentiate between Affine Transform and Hough Transforms 10
b Explain in detail about Image pyramids and Fourier transform 4

- 17 a List and explain the issues in training a CNN 10
b Explain the different layers of CNN 4

OR

- 18 a Explain the best practices in transfer learning and describe the advantages and disadvantages of transfer learning 10
b Explain the relu activation function in CNN 4
- 19 a Explain object detection in detail 10
b Differentiate between YOLO and SSD 4

OR

- 20 a Explain in detail about action recognition and GAN 10
b Explain Video classification 4

Syllabus

Module 1: Overview of Computer Vision (6 Hours)	
Introduction to Computer Vision -Image Processing VS Computer Vision Problems in Computer Vision. Introduction to images- How images are formed, Digital Image, Image as a Matrix, Manipulating Pixels, Color Image, Image Channels, Splitting and Merging Channels, Manipulating Color pixels, Images with Alpha Channel Basic image operations- Cropping an image Section, Resizing an image, Creating an image mask, Mathematical operations on images- Data Type Conversion, Contrast Enhancement, Brightness Enhancement.	
Module 2: Image Processing and Enhancements(7 Hours)	
Thresholding, Overview on Erosion and Dilation, Overview on Opening and Closing, Connected Component Analysis, Contour Analysis, Blob Detection, Color Spaces- RGB Color Space, HSV Color Space, Other Color Space, Color Transforms-Histogram Equalization, Advanced Histogram Equalization(CLAHE), Image Filtering- Box Blur, Gaussian Blur, Median Blur, Bilateral Filtering, Introduction to Image Gradients First Order Derivative Filters, Why smoothing is important before Gradient, Second Order Derivative Filters, Convolution	
Module 3: Image transforms and Features (8 Hours)	
Geometric Transforms- Affine Transform, Homography,Hough Transforms, Image pyramids and Fourier transform, Image Inpainting, Image Features-ORB, SIFT, SURF, HOG, WLD, LBP, Feature Matching-Brute-Force Matcher,FLANN,RANSAC, Neural Networks – Stochastic Gradient Descent – Backpropagation – Logistic Regression – Softmax. Implementation:Image Classification using minimal neural network	

Module 4: Deep Learning(7 Hours)
Convolutional Neural Networks: Building Blocks – Hyperparameter Tuning – Learning – Visualizing CNNs – Batch Normalization and Dropout – Deconvnets. Implementation: Simple Image classification using CNN. Transfer Learning – Pre-trained Models – Autoencoders. Implementation: Image Classification using Pre-trained models/Autoencoders
Module 5: Object detection (7 Hours)
Generative Adversarial Network (GAN), Object Detection- Single Shot Multibox Detector(SSD), You Only Look Once Detector(YOLO) Application: Video Classification- Streaming CNN for action recognition-3D convolution for temporal learning– Segmenting and captioning videos. Human Pose Estimation

Text Books

1. Rafael C. Gonzalez, Richard E.Woods, Digital Image Processing, Pearson Education,4/e,2018
2. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer, 1st Ed., 2010.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning, The MIT Press, 2017

References

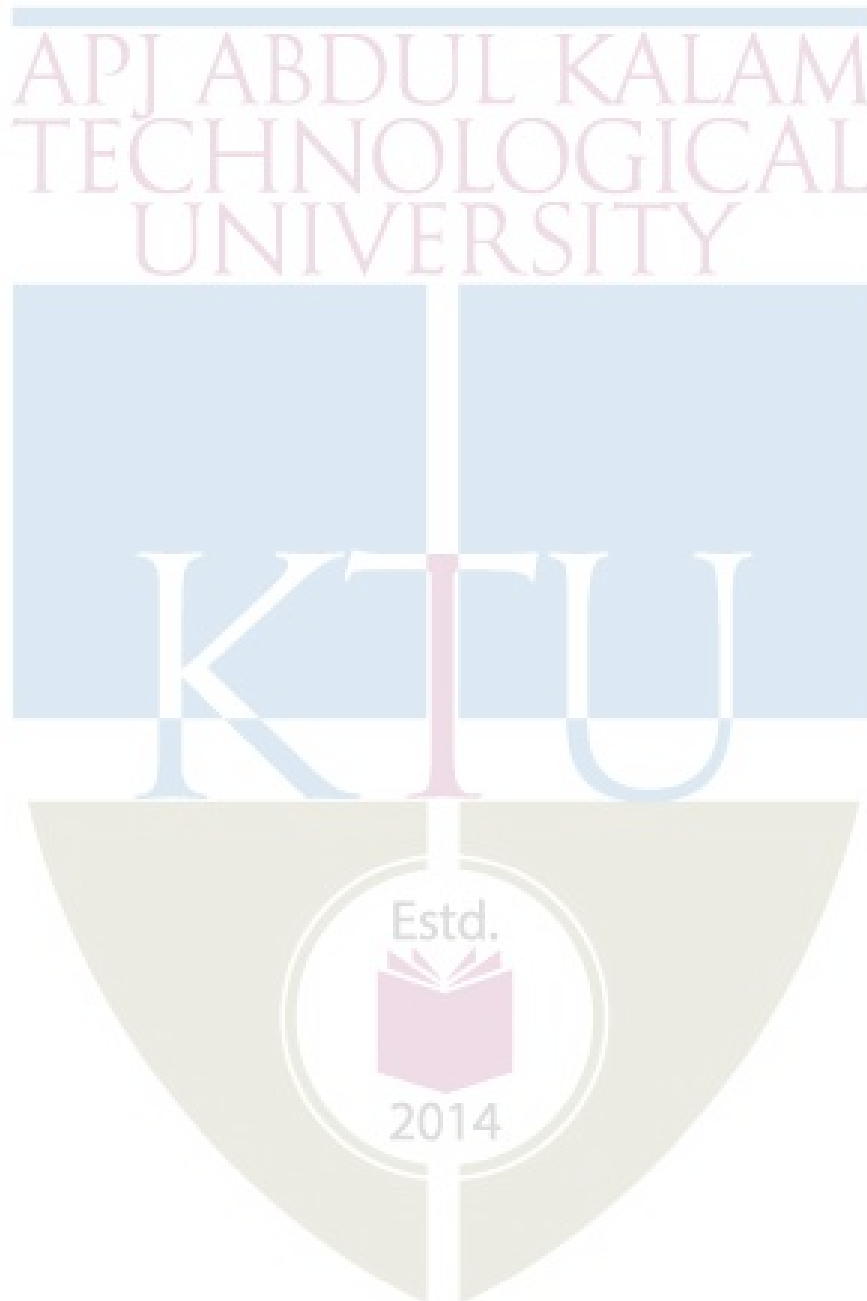
1. Linda G. Shapiro, George C. Stockman, “Computer Vision”, Prentice Hall, 1st Ed., 2001.
2. Charu C Aggarwal. Neural Networks and Deep Learning, Springer, 2018
3. Eugene Charniak. Introduction to Deep Learning, The MIT Press, 2019
4. David A. Forsyth, Jean Ponce, “Computer Vision: A Modern Approach”, 2nd Ed., 2011.
5. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 1st Ed., 2012.
6. Ramesh Jain, Rangachar Kasturi, Brian G. Schunck, “Machine Vision”, McGraw-Hill, 1st Ed., 1995

Course Contents and Lecture plan

Sl.No.	Topic	Number of Lectures
1	Introduction to Computer Vision	(5 Hours)
1.1	Image Processing vs Computer Vision, Problems in Computer Vision.	1
1.2	Introduction to images- How images are formed, Digital Image, Image as a Matrix, Manipulating Pixels.	1
1.3	Color Image, Image Channels, Splitting and Merging Channels, Manipulating Color pixels, Images with Alpha Channel.	1
1.4	Basic image operations- Cropping an image Section, Resizing an image, Creating an image mask.	1

1.5	Mathematical operations on images- Data Type Conversion, Contrast Enhancement, Brightness Enhancement.	1
2	Image Processing and Enhancements	(7 Hours)
2.1	Thresholding, Overview on Erosion and Dilation, Overview on Opening and Closing, Connected Component Analysis, Contour Analysis, Blob Detection.	1
2.2	Color Spaces- RGB Color Space, HSV Color Space, Other Color Space.	1
2.3	Color Transforms-Histogram Equalization, Advanced Histogram Equalization (CLAHE).	1
2.4	Image Filtering- Box Blur, Gaussian Blur.	1
2.5	Median Blur, Bilateral Filtering.	1
2.6	Introduction to Image Gradients, First Order Derivative Filters, Why smoothing is important before Gradient.	1
2.7	Second Order Derivative Filters, Convolution	1
3	Image transforms and Features	(8 Hours)
3.1	Geometric Transforms- Affine Transform.	1
3.2	Homography, Hough Transforms.	1
3.3	Image pyramids and Fourier transform.	1
3.4	Image Inpainting, Image Features-ORB, SIFT, SURF, HOG, WLD, LBP.	1
3.5	Feature Matching-Brute-Force Matcher.	1
3.6	Neural Networks – Stochastic Gradient Descent.	1
3.7	Back-propagation.	1
3.8	Logistic Regression – Softmax. Implementation:Image Classification using minimal neural network.	1
4	Deep Learning	(8 Hours)
4.1	Convolutional Neural Networks	1
4.2	Hyperparameter Tuning – Learning.	1
4.3	Visualizing CNNs – Batch Normalization and Dropout	1
4.4	Deconvnets.	1
4.5	Implementation: Simple Image classification using CNN	1
4.6	Transfer Learning	1
4.7	Pre-trained Models	1
4.8	Implementation: Image Classification using Pre-trained models/Autoencoders	1
5	Object detection	(7 Hours)
5.1	Generative Adversarial Network (GAN)	1
5.2	Object Detection- Single Shot Multibox Detector(SSD)	1

5.3	You Only Look Once Detector(YOLO) Application	1
5.4	Video Classification- Streaming CNN for action recognition	1
5.5	3D convolution for temporal learning.	1
5.6	Segmenting and captioning videos	1
5.7	Human Pose Estimation	1



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT424	CYBER AND NETWORK FORENSICS	PEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn the basics of Windows, Linux, Network and Cyber forensics. At the end of the course students will understand various elements associated in digital forensics.

Prerequisite: Knowledge in Operating Systems and Computer Networks.

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain the concepts in cyber forensics and forensics investigation process	Level 2: Understand
CO 2	Explain the elements in the Windows forensics, including malwares and its effects	Level 2: Understand
CO 3	Explain the elements in the Linux operating system, and Linux distribution assisting in cyber forensic	Level 2: Understand
CO 4	Illustrate the various challenge that cyber forensic experts encounter with the modern cybercriminals	Level 3: Apply
CO 5	Show networking-related digital evidence by monitoring, recording, analysing, and interpreting of network traffic.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	-	-	1	-	1	-	-	-	2
CO 2	1	2	1	-	-	-	-	1	-	-	-	2
CO 3	1	2	1	-	-	-	-	1	-	-	-	2
CO 4	1	2	2	2	-	1	-	1	-	-	-	2
CO 5	2	2	2	2	-	1	-	1	-	-	-	2

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	40	30	60
Level 3: Apply		10	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Show the forensics investigation process
2. Discuss the various types of cybercrimes
3. Write notes on recent cybersecurity trends
4. Explain cyber forensic tools.

Course Outcome 2 (CO 2):

1. Compare the volatile evidence artifacts and non-volatile artifacts in Windows.
2. Outline Windows file system.

3. Demonstrate Autopsy Tool used in Windows Forensics
4. Illustrate Malware Forensics.

Course Outcome 3 (CO 3):

1. Outline Linux File System concepts.
2. Explain the Linux distributions used in forensic analysis.
3. Interpret Windows and Linux from a forensics perspective.
4. Show Linux partitions and memory with the forensic tools.

Course Outcome 4 (CO 4):

1. Identify anti-forensic practices.
2. Examine Spoofing and Data Modification
3. Make use of anti-forensics detection techniques.
4. Examine the affected files in an attack with various tools.

Course Outcome 5 (CO 5):

1. Make use of network forensic artifacts
2. Examine the network traffic with forensic tools
3. Identify various attacks in web and computer networking
4. Examine email forensic investigation

Model Question Paper

Course Code: ITT424

Course Name: CYBER AND NETWORK FORENSICS

Max.Marks :100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)*

1. Explain cyber forensics.
2. Write notes on digital evidence.
3. Explain how a malware affects Windows ecosystem
4. Write notes on any tool used in Windows to detect the tampering of data
5. List and explain any 3 Linux distributions available in the market now.
6. Differences Between Windows and Linux from a forensics perspective.
7. Write notes on any tool used for anti-forensics detection.
8. Explain the Steganography process.
9. Write short note on Phishing.
10. Explain the need of Wireshark in Network Forensics.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11	a.	Explain the various types of cybercrimes	7
	b.	Explain the challenges in Cyber Forensics	7

OR

12	a.	List and explain the four characteristics of digital evidence	5
	b.	Explain the forensics investigation process	9
13	a.	Explain the Non-volatile Artifacts in Windows affecting a forensic investigation.	14

OR

14	a.	Discuss Windows File System in detail	9
	b.	Explain the challenges associated with Malware analysis	5
15	a.	Describe Forensic Process for Linux Systems in detail	14

OR

16	b.	Describe Linux File System in detail	14
17	a.	Explain Degaussing	5
	b.	Explain the different Anti-forensic Practices in detail.	9

OR

18	a.	Describe the tools and techniques used for manipulation of evidence to mislead the investigation	14
19	a.	List any five Top 10 Risks listed in Open Web Application Security Project	5
	b.	Examine Intrusion Forensics in detail	9

OR

20	a.	Explain Two-Factor Authentication	4
	b.	Examine network artifacts, that provide evidence or insights into network communication.	10

Syllabus

INFORMATION TECHNOLOGY

Module 1: Introduction to Cyber Forensics (7 Hours)
Introduction to Cyber Forensics, Cyber Forensics, Forensics Investigation Process - Forensic Protocol for Evidence Acquisition - Digital Forensics Standards and Guidelines - Digital Evidence - Cybercrime, Types of Cybercrimes - Recent Data Breaches - Recent Cybersecurity Trends - Case Study: Sim Swapping Fraud, ATM Card Cloning, Hacking email for money, Google Nest Guard. Challenges in Cyber Forensics, Skills Required to Become a Cyber Forensic Expert, Cyber Forensic Tools
Module 2: Windows Forensics (7 Hours)
Digital Evidence in Windows: Volatile Evidence Artifacts, Non-volatile Artifacts, Master File Table (MFT), MBR, Windows Registry, Event Logs, Configuration Files, Temporary Files, SWAP Files, Unallocated Space – File System: FAT32, NTFS -Rootkits and Rootkit Detection: Rootkits, Rootkit Detection - Case Study: Autopsy Tool. Malware Forensics: Types of Malware, Malware Analysis: Static Analysis, Dynamic Analysis, Tools for Analysis, Case Study: Windows Malware Analysis of Data Stealing Malware
Module 3: Linux Forensics (7 Hours)
Linux Distributions, File System, Forensic Artifacts, Special Artifacts, Linux Distributions Used for Forensic Analysis: Kali, DEFT - Live Response: Prepare the Target Media, Format the Drive, Gather Volatile Information, Acquiring the Image - Differences Between Windows and Linux from a Forensics Perspective, Case Study: Listing Partitions, Memory Acquisition of Linux System, SysScout Tool, Raw Image Analysis.
Module 4: Anti-forensic(6 Hours)
Anti-forensic Practices - Data Wiping and Shredding: Data Remanence, Degaussing, Case Study: USB Oblivion, Eraser - Trail Obfuscation: Spoofing, Data Modification, Case Study: Timestomp – Encryption, Case Study: VeraCrypt, Data Hiding: Steganography and Cryptography, Case Study: SilentEye, Anti-forensics Detection Techniques, Case Study: Stegdetect
Module 5: Network Forensics (8 Hours)
The OSI Model, Forensic Footprints, Seizure of Networking Devices, Network Forensic Artifacts, ICMP Attacks, Drive-By Downloads, Network Forensic Analysis Tools, Case Study: Wireshark. Web Attack Forensics: OWASP Top 10, Web Attack Tests, Intrusion Forensics, Database Forensics, Log Forensics, Content Analysis, File Metadata Analysis, Email Crimes, Phishing, Types of Phishing, Case Study: Bypassing Two-Factor Authentication, Spam, Email Forensics, Steps of an email forensic investigation

Text Books

1. Niranjana Reddy, “Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations”, Apress, 2019

Reference Books

1. Harlan Carvey, "Windows Forensic Analysis DVD Toolkit", 2 Ed., Syngress Publishing, 2009 (Module 2, Rootkits and Rootkit Detection)
2. Chris Pogue, Cory Altheide, Todd Haverkos, "UNIX and Linux Forensic Analysis DVD Toolkit", Syngress Publishing, 2008 (Module 3, Live Response)
3. Gerard Johansen, "Digital forensics and incident response", 2 Ed., Packt Publishing, 2020
4. Stuart McClure, Joel Scambray, George Kurtz, "Hacking Exposed 7: Network Security Secrets & Solutions", 7 Ed., McGraw-Hill, 2012

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Introduction to Cyber Forensics	7 Hours
1.1	Introduction to Cyber Forensics, Forensics Investigation Process	1
1.2	Forensic Protocol for Evidence Acquisition, Digital Forensics Standards and Guidelines	1
1.3	Digital Evidence - Cybercrime, Types of Cybercrimes	1
1.4	Recent Data Breaches - Recent Cybersecurity Trends	1
1.5	Case Study: Sim Swapping Fraud, ATM Card Cloning	1
1.6	Case Study: Hacking email for money, Google Nest Guard	1
1.7	Challenges in Cyber Forensics, Skills Required to Become a Cyber Forensic Expert, Cyber Forensic Tools	1
2	Windows Forensics	7 Hours
2.1	Digital Evidence in Windows: Volatile Evidence Artifacts, Non-volatile Artifacts, Master File Table (MFT), MBR	1
2.2	Windows Registry, Event Logs, Configuration Files	1
2.3	Temporary Files, SWAP Files, Unallocated Space, File System: FAT32, NTFS	1
2.4	Rootkits and Rootkit Detection: Rootkits, Rootkit Detection	1
2.5	Case Study: Autopsy Tool	1
2.6	Malware Forensics: Types of Malwares, Malware Analysis: Static Analysis, Dynamic Analysis, Tools for Analysis	1
2.7	Case Study: Windows malware analysis of data stealing malware	1
3	Linux Forensics	7 Hours
3.1	Linux Distributions, File System, Forensic Artifacts, Special Artifacts	1
3.2	Linux Distributions Used for Forensic Analysis: Kali, DEFT	1
3.3	Challenges, Differences Between Windows and Linux from a Forensics Perspective	1
3.4	Live Response: Prepare the Target Media, Format the Drive, Gather Volatile Information, Acquiring the Image	1
3.5	Case Study: Listing Partitions,	1

3.6	Case Study: Memory Acquisition of Linux System.	1
3.7	SysScout Tool, Raw Image Analysis	1
4	Anti-forensic	6 Hours
4.1	Anti-forensic Practices - Data Wiping and Shredding: Data Remanence, Degaussing,	1
4.2	Case Study: USB Oblivion, Eraser	1
4.3	Trail Obfuscation: Spoofing, Data Modification	1
4.4	Case Study: Timestamp	1
	Encryption, Case Study: VeraCrypt	1
4.5	Data Hiding: Steganography and Cryptography, Case Study: SilentEye	1
4.6	Anti-forensics Detection Techniques, Case Study: Stegdetect	1
5	Network Forensics	8 Hours
5.1	The OSI Model, Forensic Footprints, Seizure of Networking Devices	1
5.2	Network Forensic Artifacts ICMP Attacks, Drive-By Downloads	1
5.3	Network Forensic Analysis Tool, Case Study: Wireshark	1
5.4	Web Attack Forensics: OWASP Top 10, Web Attack Tests	1
5.5	Intrusion Forensics, Database Forensics, Log Forensics, Content Analysis, File Metadata Analysis	1
5.6	Email Crimes, Phishing, Types of Phishing, Case Study: Bypassing Two-Factor Authentication, Spam,	1
5.7	Email Forensics, Steps of an email forensic investigation	2

All case studies listed in the syllabus can be demonstrated in the class by students and treated as their assignments.



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT434	CLOUD COMPUTING	PEC	2	1	0	3

Preamble: This is an elective course and the syllabus is prepared with a view to provide the students an overview on the cloud computing concepts, cloud computing technologies, computing in the cloud, cloud management and security in the cloud.

Prerequisite: Knowledge of Operating Systems and Networking

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the fundamentals of cloud computing	Level 2: Understand
CO 2	Outline virtualization and cloud computing technologies.	Level 2: Understand
CO 3	Explain the computing in cloud.	Level 2: Understand
CO 4	Describe different ways of managing cloud.	Level 2: Understand
CO 5	Summarize the security aspects of cloud	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	-	-	-	-	-	-	-	-	-	2
CO 3	3	2	-	-	-	-	-	-	-	-	-	2
CO 4	3	2	-	-	-	-	-	-	-	-	-	2
CO 5	3	2	-	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	20	20	20
Level 2: Understand	30	30	80
Level 3: Apply			
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. Explain different clouddelivery models.
2. Compare public clouds and private clouds.
3. List the essential characteristics of cloud computing.

Course Outcome 2 (CO 2):

1. Explainload balancing in google cloud.
2. Describe different types of virtualization technologies.
3. Illustrate the working of Google Bigtable.
4. Discuss on system imaging for creating virtual machine instances.

Course Outcome 3 (CO 3):

1. Compare virtual machines and containers.
2. Explain serverless computing.
3. Give the advantages of using docker.
4. Outline the concept of microservices paradigm.

Course Outcome 4 (CO 4):

1. Find out the features that makes Eucalyptus cloud different from other private clouds.
2. Discuss the deployment plans for Eucalyptus cloud.
3. Interpret different types of SLA.
4. Illustrate Aneka cloud platform with necessary diagrams.

Course Outcome 5 (CO 5):

1. Explain the seven complementary principles that support software assurance.
2. Summarize various access control issues in cloud.
3. Outline any two acts for preserving privacy principles of cloud.
4. Discuss briefly the fundamental characteristics of cloud security design principles.

Model Question Paper

Course Code: ITT434

Course Name: CLOUD COMPUTING

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Describe the essential characteristics of cloud computing.
2. Write various benefits provided by SaaS model.
3. Explain how machine imaging helps for system portability and application instantiations in cloud.
4. Differentiate emulation, paravirtualization and full virtualization
5. Explain docker container technology.
6. Discuss microservice solution with suitable example.
7. Describe the different types of SLA.
8. Explain VM provisioning in Eucalyptus cloud.
9. List and explain the factors affecting cloud security services.
10. Give any five NIST 33 security principles.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 a. Examine the architectural influences behind cloud computing. 8
b. Discuss the evolution of SPI framework and compare it with traditional 6

OR

12 Write short notes on cloud service delivery models and cloud deployment models. 14

- 13 a. With neat diagram explain VMware's vSphere cloud infrastructure. 6
b. Discuss the working and design principles of Amazon Simple Storage Service. 8

OR

- 14 a. Explain various cloud computing services offered by Amazon. 8
b. Write the features and benefits of NRVANIX storage delivery network. 6
- 15 a. Illustrate Google's Kubernetes in detail. 7
b. Summarize the installation of Docker with Docker Hub. 7

OR

- 16 a. Outline the setting up of Amazon EC2 container service to manage microservices based on Docker containers. 8
b. Examine the pros and cons of virtual machine and container approaches. 6
- 17 a. Explain SLA management in cloud. 8
b. Describe the deployment planning process documented for Eucalyptus. 6

OR

- 18 a. Explain the life cycle of SLA. 8
b. Illustrate Aneka architecture. 6
- 19 a. Summarize the relevant cloud security design principles. 7
b. Discuss briefly the important areas addressed by a software system's cloud security policy. 7

OR

- 20 a. Summarize the additions to be incorporated to software requirements engineering process to promote secure software. 6
- b. Outline the privacy related acts for preserving information privacy in cloud. 8

Syllabus**Module 1: Introduction to Cloud Computing (6 Hours)**

Cloud Computing Fundamentals: What is Cloud Computing, Essential Characteristics, Architectural Influences

Cloud delivery models The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud deployment models, Public Clouds, Community Clouds, Private clouds, Hybrid clouds.

(T1: Chapter 1,2)

Module 2: Cloud Computing Technologies (7 hours)

Using virtualization technologies, Load balancing and virtualization, Understanding hypervisors, Understanding machine imaging, Porting Applications
Cloud storage- Overview, Cloud storage providers, Cloud Computing with the Titans- Google, Microsoft, Amazon, IBM.
(T2: Chapter 5, T3: Chapter 3,7)

Module 3: Computing in the Cloud (8Hours)

Virtual Machines and Containers, Serverless Computing, Using and Managing Containers:- Container Basics, Docker and the Hub.
Agents and Microservices: Microservices and Container Resource Managers, Managing Identity in a swarm, A simple Microservices Example, Amazon EC2 Container Service, Google's Kubernetes.
(T4: Chapter 4,6,7)

Module 4: Cloud Management (6 Hours)

Building Your Own Cloud with Eucalyptus-Implementing Cloud Infrastructure Abstractions, Deployment Planning.
Aneka, SLA Management in Cloud Computing-Types of SLA, Life cycle of SLA, SLA management in cloud.
(T4: Chapter 12, T5: Chapter 5,16)

Module 5: Security in cloud (8 Hours)

Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements.
Privacy and Compliance Risks, Threats to Infrastructure Data and Access Control, Cloud Service Provider Risks.
(T1: Chapter 3,4)

Text Books

1. Cloud Security -A Comprehensive Guide to Secure Cloud Computing, Ronald L Krutz and Russell Dean Vines
2. Cloud Computing Bible, Barrie Sosinsky, Published by Wiley Publishing, 2011.
3. Cloud Computing: A Practical Approach, Anthony T. Velte Toby J. Velte, Robert Elsenpeter, 2010, The McGraw-Hill.
4. Cloud Computing for Science and Engineering, Ian Foster and Dennis B. Gannon.
<https://cloud4scieng.org/chapters/>
5. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.

Reference Books

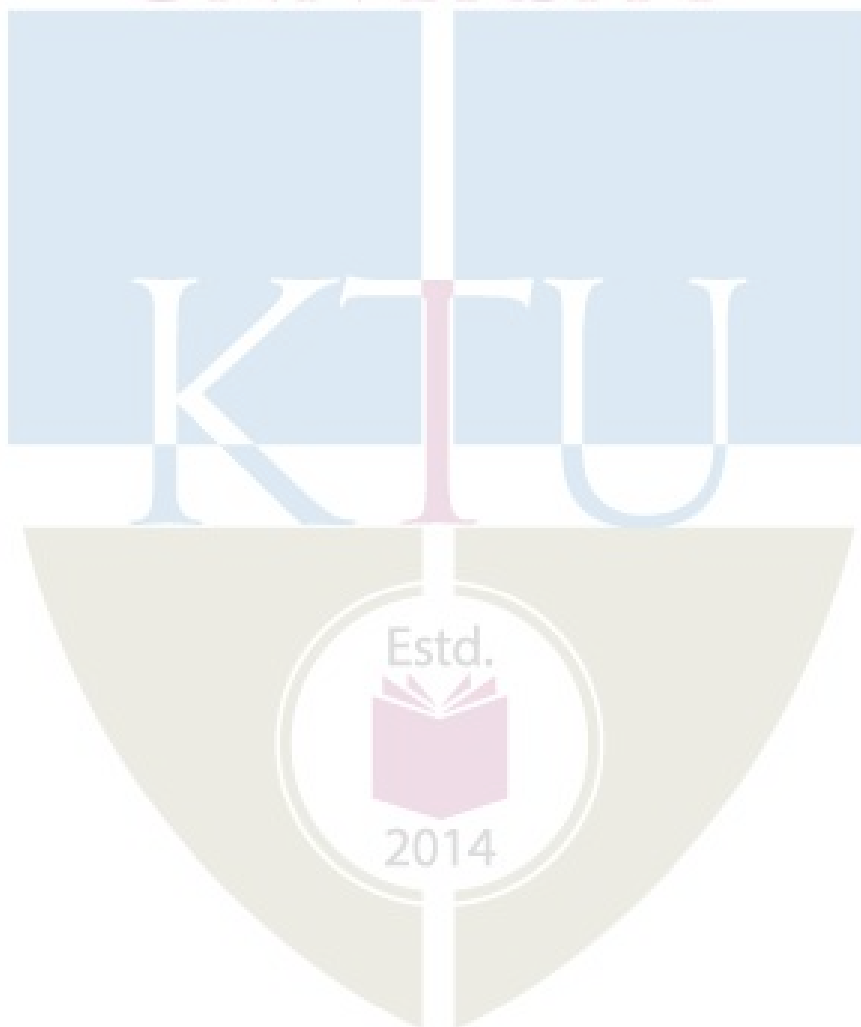
1. Kai Hwang, Geoffrey C. Fox, Jack K. Dongarra, Distributed and Cloud Computing: From parallel processing to Internet of Things, Morgan Kaufmann 2013.
2. Jonathan Baier, Getting Started with Kubernetes: 2nd Edition, Packt publishers, 2015.

Course Contents and Lecture Schedule

INFORMATION TECHNOLOGY

Sl. No.	Topic	No. of Lectures
1	Introduction to Cloud Computing	6 Hours
1.1	What is Cloud Computing, Essential Characteristics,	1
1.2	Architectural Influences	1
1.3	Cloud delivery models: The SPI Framework SPI Evolution, The SPI Framework vs. the Traditional IT Model	1
1.4	Cloud Software as a Service (SaaS), Benefits of the SaaS Model	1
1.5	Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS)	1
1.6	Cloud deployment models, Community Clouds, Public clouds, Private clouds, Hybrid clouds	1
2	Cloud Computing Technologies	7 Hours
2.1	Using virtualization technologies	1
2.2	Load balancing and virtualization	1
2.3	Understanding hypervisors	1
2.4	Understanding machine imaging, Porting Applications	1
2.5	Cloud storage- Overview, Cloud storage providers	1
2.6	Cloud Computing with the Titans- Google, Microsoft	1
2.7	Cloud Computing with the Titans- Amazon, IBM	1
3	Computing in the Cloud	8 Hours
3.1	Virtual Machines and Containers, Serverless Computing	1
3.2	Using and Managing Containers: - Container Basics	1
3.3	Docker and the Hub	1
3.4	Agents and Microservices: Microservices and Container Resource Managers	1
3.5	Managing Identity in a swarm, A simple Microservices Example	1
3.6	Amazon EC2 Container Service	2
3.7	Google's Kubernetes	1
4	Cloud Management	6 Hours
4.1	Building Your Own Cloud with Eucalyptus-Implementing Cloud Infrastructure Abstractions	1
4.2	Deployment Planning	1

4.3	Aneka	1
4.4	SLA Management in Cloud Computing:- Types of SLA	1
4.5	Life cycle of SLA	1
4.6	SLA management in cloud	1
5	Security in the cloud	8 Hours
5.1	Cloud Information Security Objectives, Cloud Security Services	1
5.2	Relevant Cloud Security Design Principles	1
5.3	Secure Cloud Software Requirements	2
5.4	Privacy and Compliance Risks	1
5.5	Threats to Infrastructure Data and Access Control	2
5.6	Cloud Service Provider Risks	1



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT444	DATA MINING AND WAREHOUSING	PEC	2	1	0	3

Preamble: This course introduces students to understand the data mining concepts and various data pre-processing techniques, analyze various data mining algorithms for finding hidden and interesting patterns in data, also to learn about the fundamental concepts of data warehouse architectures.

Prerequisite: ITT306 Data Science

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Understand the basic concepts in data mining and the data warehouse architectures.	Level 2: Understand
CO 2	Identify suitable preprocessing techniques to improve the quality of data and the ease of the mining process.	Level 3: Understand
CO 3	Use frequent pattern and association rule mining techniques to identify associations among objects.	Level 3: Apply
CO 4	Implement appropriate classification and clustering techniques to solve real life complex problems.	Level 3: Apply
CO 5	Demonstrate advanced data mining techniques and applications.	Level 2: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	-
CO 2	2	2	1	1	-	-	-	-	-	-	-	1
CO 3	2	2	2	1	-	-	-	-	-	-	-	1
CO 4	2	2	2	1	-	-	-	-	-	-	-	1
CO 5	2	2	2	-	2	-	-	-	-	-	-	1

3/2/1: High/Medium/Low

Assessment Pattern

INFORMATION TECHNOLOGY

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	30	20	50
Level 3: Apply	10	20	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Describe the various steps in knowledge discovery process with necessary diagram
2. Distinguish OLTP and OLAP. Clearly bring out the advantages of OLAP.
3. Write a note on various components of Data Warehouse.

Course Outcome 2 (CO 2):

1. List out and explain the major tasks involved in data preprocessing.
2. With Suitable example explain the purpose binning.
3. Describe in detail the various normalization techniques used in data transformation.

Course Outcome 3 (CO 3):

1. With example explain Apriori frequent pattern mining algorithm.

2. Identify and describe issues regarding preprocessing the data for classification and prediction.
3. Draw a multi-layer feed forward neural network and clearly state the role of each element in classification.

Course Outcome 4 (CO 4):

1. What is cluster analysis? Identify the typical requirements for clustering as a data mining tool.
2. Explain in detail about Density based clustering technique using DBSCAN algorithm.
3. Demonstrate the distance based outlier detection approaches.

Course Outcome 5 (CO 5):

1. Present the various approaches in similarity based retrieval in image databases.
2. Write a note on data mining tool RapidMiner.
3. Analyze the three popular text mining approaches based on the kinds of data they take as input.

Model Question Paper

Course Code: ITT444

Course Name: DATA MINING AND WAREHOUSING

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Define Data Mining. Explain the architecture of a typical data mining system.
2. Compare and contrast data mart and data warehouse.
3. Identify the necessity of dimensionality reduction in data mining.
4. Identify the methods that can handle missing data in databases. Illustrate with suitable example.
5. Describe the commonly used four techniques for assessing the performance of a classifier.
6. Discuss the different ways to combine multiple base-learners.
7. Describe any one of the grid based clustering approaches.
8. What is an Outlier? How outlier analysis improves the performance of clustering?
9. Identify the challenges for efficient and effective knowledge discovery and uses of resources on internet
10. Briefly explain the various web usage mining approaches.

Part B

INFORMATION TECHNOLOGY

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 Draw the three-tier data warehousing architecture and explain the functionalities of each layer. 14

OR

- 12 Show the different OLAP schema with suitable example and explain each model. 14
- 13 Describe in detail with suitable examples the various numerosity reduction techniques that can be applied to obtain a reduced representation of the data set in data mining. 14

OR

- 14 Categorize the various data discretization techniques and explain each category techniques in detail. 14
- 15 Generate association rules using the Apriori algorithm on the grocery store example given below with support threshold $s=33.34\%$ and confidence threshold $c=60\%$. Show the candidate and frequent itemsets for each database scan. Enumerate all the final frequent itemsets. Also indicate the association rules that are generated and highlight the strong ones, sort them by confidence.

Transaction ID	Items
T1	HotDogs, Buns, Ketchup
T2	HotDogs, Buns
T3	HotDogs, Coke, Chips
T4	Chips, Coke
T5	Chips, Ketchup
T6	HotDogs, Coke, Chips

14

OR

- 16 a. Suppose a computer program for recognizing dogs in photographs identifies eight dogs in a picture containing 12 dogs and some cats. Of the eight dogs identified, five actually are dogs while the rest are cats. Compute the precision and recall of the computer program. 5
- b. Describe neural network training process using back propagation algorithm. 9
- 17 Using k-means algorithm, cluster the following 7 samples into 3 clusters: $A1=(2,10)$, $A2=(2,5)$, $A3=(8,4)$, $A4=(5,8)$, $A5=(7,5)$, $A6=(6,4)$, $A7=(1,2)$. Suppose that the initial seeds (centers of each cluster) are $A1$, $A4$ and $A7$. Run the k-means algorithm for 1 epoch. At the end of this epoch shows:
- a. The new clusters;
- b. The centers of the new clusters; 14
- c. Draw a 10 by 10 space with all the 7 points and show the clusters after the first epoch and the new centroids.
- d. How many more iterations are needed to converge?

OR

- 18 a) Give one clustering application example for each of the following cases:
- ii. An application that uses clustering as a major data mining function.
- iii. An application that uses clustering as a pre-processing tool for data preparation for other data mining tasks. 4
- 10

- b) With necessary diagram describe the various approaches for effective clustering of high-dimensional data. INFORMATION TECHNOLOGY
- 19 Describe the steps involved in building classifier models in Weka. 14
- OR**
- 20 a What is text data mining? Give the differences between text mining and information retrieval. 10
- b. Describe briefly CRM Applications in data mining. 4

Syllabus

Module 1: Overview of data mining and data warehouse architectures (7 Hours)
Data mining Introduction –Types of data to be mined - Data mining functionalities - Classification of Data mining system- Data mining task primitives - Major issues in Data mining
Data Warehouse and OLAP Technology -Multidimensional data model -Data Warehouse Architecture.
Module 2: Data Pre-processing Techniques (6Hours)
Data pre-processing:– Need of data pre-processing - Descriptive Data summarization - Data cleaning - Data integration and transformation -Data reduction -Data discretization and Concept Hierarchy Generation.
Module 3: Association Rule Mining and Classification & Prediction (8 Hours)
Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods — Mining Various Kinds of Association Rules — Association Mining to Correlation Analysis.Sequential Rule Mining.
Classification and Prediction: - Issues Regarding Classification and Prediction - Rule Based Classification — Classification by Back propagation -k-Nearest Neighbor Classifier - Ensemble methods - Classifier Accuracy: confusion matrix, ROC curve - Associative Classification.
Module 4:Cluster and Outlier Analysis (7 Hours)
Cluster Analysis: - Types of Data in Cluster Analysis — Categorization of Major Clustering Methods, Partition Based Clustering methods - Density-Based Methods — Grid-Based Methods — Model-Based Clustering Methods — Clustering High-Dimensional Data — Constraint-Based Cluster Analysis — Outlier Analysis.
Module 5: Advanced Data Mining Techniques and Tools (7 Hours)
Advanced Data Mining Techniques: Multimedia Data Mining —Text Mining - Text Data Analysis and Information Retrieval, Text mining approaches - Web Mining- Web Content Mining, Web Structure Mining, Web Usage Mining. CRM Applications and Data mining - Practical Data Mining Tools: Weka, RapidMiner.

Text Books

1. Jaiwei Han, MichelineKamber, Data Mining Concepts and Techniques, Elsevier, 2nd Edition, 2006.
2. AlexBerson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP,TataMcGraw Hill Edition, Tenth Reprint 2007.

Reference Books

1. Pualraj Ponnaiah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2nd edition, 2001.
2. Dunham M H, Data Mining: Introductory and Advanced Topics, Pearson Education, New Delhi, 2003.
3. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, 3rd edition, Morgan Kaufmann, 2011.
4. Pang-Ning Tan and Michael Steinbach, Introduction to Data Mining, Addison Wesley,2nd edition, 2006.
5. M Sudeep Elayidom, Data Mining and Warehousing, Cengage Learning India Pvt. Ltd,1stEdition, 2015.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Overview of data mining anddata warehouse architectures	7 Hours
1.1	Data mining Introduction, Types of data to be mined	1
1.2	Data mining functionalities	1
1.3	Classification of Data mining system	1
1.4	Data mining task primitives, Major issues in Data mining	1
1.5	Data Warehouse and OLAP Technology	1
1.6	Multidimensional data model	1
1.7	Data Warehouse Architecture	1
2	Data Pre-processing Techniques	6 Hours
2.1	Data pre-processing-: Need of data pre-processing	1
2.2	Descriptive data summarization	1
2.3	Data cleaning	1
2.4	Data integration and transformation	1
2.5	Data reduction	1
2.6	Data discretization and Concept Hierarchy Generation.	1
3	Association Rule Mining and Classification & Prediction	8 Hours
3.1	Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods	1

3.2	Mining Various Kinds of Association Rules, Association Mining to Correlation Analysis	1
3.3	Sequential Rule Mining	1
3.4	Classification and Prediction: - Issues Regarding Classification and Prediction, Rule Based Classification	1
3.5	Classification by Back propagation	1
3.6	k-Nearest Neighbor Classifier	1
3.7	Ensemble methods, Classifier Accuracy: confusion matrix, ROC curve	1
3.8	Associative Classification	1
4	Cluster and Outlier Analysis	7 Hours
4.1	Cluster Analysis: - Types of Data in Cluster Analysis — A Categorization of Major Clustering Methods	1
4.2	Partition Based Clustering methods	1
4.3	Density-Based Methods	1
4.4	Grid-Based Methods, Model-Based Clustering Methods	1
4.5	Clustering High-Dimensional Data	1
4.6	Constraint-Based Cluster Analysis	1
4.7	Outlier Analysis	1
5	Advanced Data Mining Techniques and Tools	7 Hours
5.1	Multimedia Data Mining	1
5.2	Text Mining - Text Data Analysis and Information Retrieval	1
5.3	Text mining approaches	1
5.4	Web Content Mining, Web Structure Mining, Web Usage Mining	1
5.5	CRM Applications and Data mining	1
5.6	Practical Data Mining Tools: Weka	1
5.7	RapidMiner	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT454	SEARCH ENGINE OPTIMISATION	PEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in search engine optimization and various search engine optimization algorithms.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basics of search engine optimization	Level 2: Understand
CO 2	Identify SEO planning strategies.	Level 2: Understand
CO 3	Make use of SEO algorithm.	Level 3: Apply
CO 4	Describe keyword research	Level 2: Understand
CO 5	Explain the concept of content marketing.	Level 2: Understand
CO 6	Identify evaluation metrics for SEO techniques.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	-	-	-	-	-	-	-	-	-	1
CO 2	2	2	-	-	-	-	-	-	-	-	-	1
CO 3	3	2	-	-	-	-	-	-	-	-	-	1
CO 4	2	-	-	-	-	-	-	-	-	-	-	1
CO 5	2	-	-	-	-	-	-	-	-	-	-	1
CO 6	3	1										1

3/2/1: High/Medium/Low

Assessment Pattern

INFORMATION TECHNOLOGY

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	10
Level 2: Understand	40	30	70
Level 3: Apply		10	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Explain search engine optimization in detail
2. Describe algorithm based ranking system
3. Illustrate the use of knowledge graphs in SEO
4. Discuss ranking factors used for optimization

Course Outcome 2 (CO 2):

1. Illustrate SEO strategy plan.
2. List anythree types of Search Intents in SEO.
3. Explain the Strategic Goals of SEO Practitioners.

Course Outcome 3 (CO 3):

1. Discuss log file tracking in detail
2. Explain in detail the process of auditing an existing site.
3. Outline SEO problems that can be identified by auditing an existing site
4. List the technology and structural decisions in developing SEO techniques.

Course Outcome 4 (CO 4):

1. Describe how keyword research can be done.
2. Explain the process of identifying terms from relevant web pages.
3. Why do some keywords work better than other keywords in SEO?

Course Outcome 5 (CO 5):

1. What is content marketing? Explain with examples.
2. Explain different ways of doing content marketing.
3. Write and Explain Page Rank algorithm.
4. Describe SEO improvement by optimizing user experience.

Model Question Paper

Course Code: ITT454

Course Name: SEARCH ENGINE OPTIMISATION

Max.Marks :100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

1. Explain search engine.
2. Explain the need for Search Engine Optimization.
3. Illustrate the use of search intents.
4. List and explain the different types of search engine queries.
5. Give the reasons for search engine keyword demand with diagram.
6. Explain cross link relevant content. Give examples
7. Explain the significance of keyword review.
8. What do you mean by Keyword Cannibalization?
9. Briefly explain how links are earned in content marketing.
10. Outline the influence of links in page ranking.

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11 a.	Explain with example layout of google search results	9
b.	Discuss how crawling, indexing and ranking enables efficient SEO.	5

OR

12 a.	Explain document analysis and semantic connectivity in detail	10

b.	Discuss the type of contents that cannot be captured by search engines.	4
13 a.	Give the business factors that impact SEO query. Explain	10
b.	Explain SWOT analysis	4
OR		
14	Select any specific application in real life and illustrate how we can define SEO technique for that application	14
15 a.	Describe the importance of planning in SEO implementation	10
b.	Which are the technology decisions to be taken in SEO implementation?	4
OR		
16	Select any specific application in real life and illustrate how we can implement SEO technique for that application.	14
17 a.	Describe in detail tools used for keyword research.	12
b.	How Bing research keyword is useful?	2
OR		
18	Explain Experian Hitwise in detail	14
19	Give the roles of memes in marketing campaigns?	14
OR		
20 a.	Explain in detail the process of content marketing	7
b.	Describe competitive and diagnostics search metrics.	7

Syllabus

Module 1: Search Engine Basics (6 Hours)
Understanding search engine results, Algorithm-based ranking system- Crawling, Indexing and ranking. Knowledge graph, Analysing ranking factors, Determining searcher intent and delivering relevant, Fresh content
Module 2: SEO Planning (8 Hours)
Strategic goals, Understanding search engine traffic and visitor intent, Developing an SEO plan prior to site development, Understanding your audience and finding your niche, SEO for raw traffic, Advanced methods for planning and evaluation
Module 3: SEO Implementation (8 Hours)
First stages: The importance of planning, Identifying the site development process and players, Development platform and information architecture, Auditing an existing site to identify SEO problems, Identifying current server statistics software and gaining access, Advanced methods for planning and evaluation-Case study-Real life application.
Module 4: Keyword Research (6 Hours)
The theory behind keyword research, Traditional approaches: domain expertise and site content analysis, Keyword research options, Leveraging the long tail of keyword demand
Module 5: Content Marketing (7 Hours)
Content Marketing: Introduction, Choosing the right content marketing strategy, Types of content marketing campaigns, Building an audience, Relationships and outreach. Tracking Results and Measuring Success-importance, measuring search traffic, Competitive and Diagnostic Search Metrics.

Text Books

1. Eric Enge, Stephan Spencer, and Jessie C. Stricchiola, The Art of SEO Mastering Search Engine Optimization, O'Reilly, Third edition, 2015.

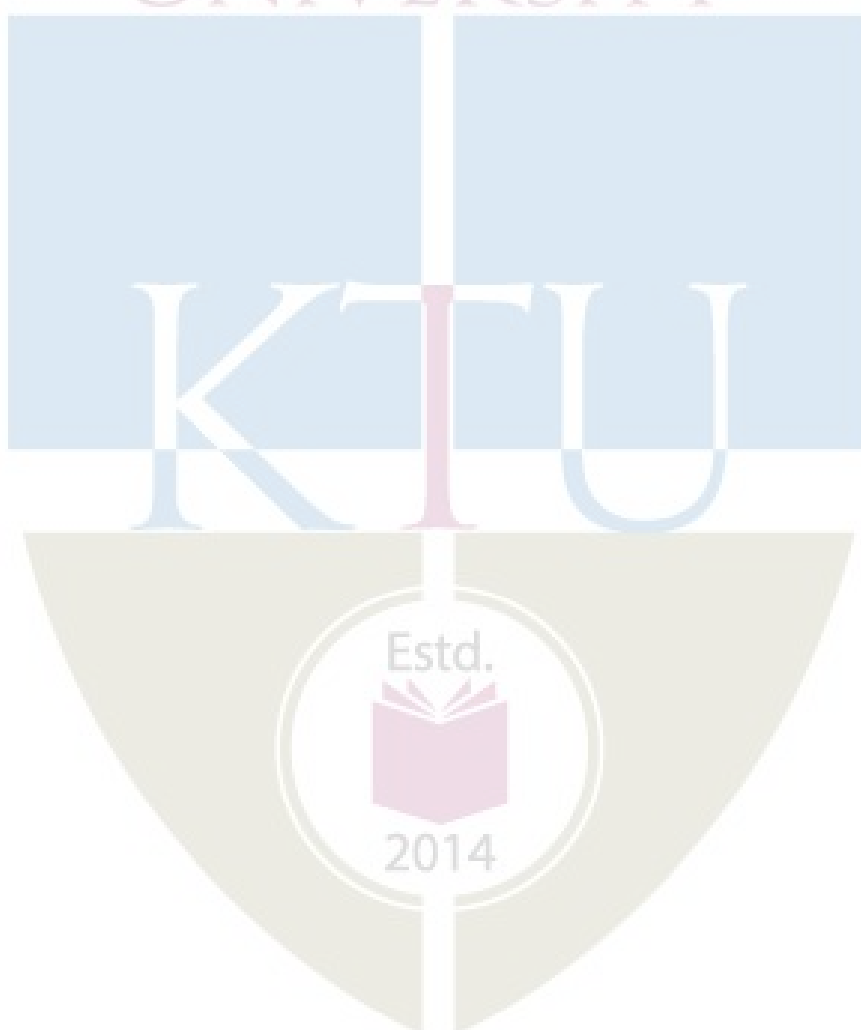
Reference Books

1. Jerri L. Ledford, SEO: Search Engine Optimization Bible, Wiley India, 2nd Edition, 2009
2. John I Jerkovic, SEO Warrior: Essential Techniques for Increasing Web Visibility, O'Reilly Media, 2009

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Search Engine Basics	6 Hours
1.1	Understanding Search Engine Results	1
1.2	Algorithm-based Ranking System	1
1.3	Crawling, Indexing, Ranking.	2
1.4	Knowledge Graph	1
1.5	Analysing Ranking factors, Determining Searcher Intent and Delivering Relevant, Fresh Content	1
2	SEO Planning	8 Hours
2.1	Understanding Search Engine Traffic, Visitor Intent	1
2.2	Developing an SEO Plan Prior to Site Development	2
2.3	Understanding Your Audience, Finding Your Niche	2
2.4	SEO for Raw Traffic	2
2.5	Advanced Methods for Planning and Evaluation	1
3	SEO Implementation	8 Hours
3.1	First Stages: The Importance of Planning	1
3.2	Identifying the Site Development Process and Players	2
3.3	Development Platform and Information Architecture	1
3.4	Auditing an Existing Site to Identify SEO Problems	1
3.5	Identifying Current Server Statistics Software and Gaining Access, Advanced Methods for Planning and Evaluation	1
3.6	Case Study	2
4	Keyword Research	6 Hours
4.1	The Theory Behind Keyword Research	1
4.2	Traditional Approaches: Domain Expertise and Site Content Analysis	1

4.3	Keyword Research Options	2
4.4	Leveraging the Long Tail of Keyword Demand	2
5	Content Marketing	7Hours
5.1	Introduction	1
5.2	Choosing the right content marketing strategy	1
5.3	Types of Content Marketing Campaigns	1
5.4	Building an audience, Relationships and outreach	1
5.5	Tracking Results and Measuring Success-importance, measuring search traffic	1
5.6	Competitive and Diagnostic Search Metrics	2



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT464	COMPUTER GRAPHICS	PEC	2	1	0	3

Preamble: Computer Graphics is a graduate – level preliminary course to introduce the necessary background, the basic algorithms, and the applications of computer graphics. The course is intended to deliver the fundamental concepts of Graphics Systems, Display Technologies, 2D Geometric Transformations, 2D Clipping, Visible Surface Detection Methods and Colour Models.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Illustrate line drawing and circle generation algorithms.	Level 3:Apply
CO 2	Explain the techniques used for various display technologies.	Level 2: Understand
CO 3	Illustrate the matrix corresponding to various 2D transformations.	Level 3: Apply
CO 4	Explain 2D line clipping and polygon clipping algorithms and 3D transformations.	Level 2: Understand
CO 5	Describe various visible surface detection methods and colour models.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	2	1	-	-	-	-	-	-	-	-
CO 4	2	2	2	-	-	-	-	-	-	-	-	-
CO 5	3	2	2	-	-	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	20	20	30
Level 2: Understand	20	20	50
Level 3: Apply	10	10	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. Derive the decision parameter in Bresenham's line drawing algorithm.
2. Write midpoint circle drawing algorithm. Illustrate it with radius=10 which is centred at the point (5,5).
3. Differentiate between raster scan and random scan systems with neat diagrams.

Course Outcome 2 (CO 2):

1. Differentiate between LCD and PLASMA displays.
2. Explain OLED displays. How it differs from LED.

3. Explain the working principle behind AMOLED.

Course Outcome 3 (CO 3):

1. Translate the square ABCD whose co-ordinates are A (0,0), B (3,0), C (3,3) and D (0,3) by 2 units in both directions and then scale it by 1.5 units in x- direction and 0.5 units in y-direction.
2. Draw a triangle A (5,5), B (10,5), C (5,15) and do the following transformation on the triangle: Translate the triangle by 3 in x – direction and 4 in y-direction, increase the size of the triangle to double of it and rotate the triangle by 90 degrees.
3. Explain homogeneous matrix representation of 2D transformation.

Course Outcome 4 (CO 4):

1. Describe Sutherland – Hodgeman Polygon Clipping algorithm with an example.
2. What is clipping? Describe Cohen Sutherland line clipping algorithm.
3. How rotation is working in three- dimensional transformation?

Course Outcome 5 (CO 5):

1. Explain Z-buffer algorithm with necessary equations.
2. Describe the different methods to detect Back Faces with the help of equations.
3. Discuss HSV colour model?

Model Question Paper

Course Code: ITT464

Course Name: COMPUTER GRAPHICS

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Differentiate between raster scan and random scan systems.
2. Compare DDA line drawing algorithm with Bresenham's algorithm.
3. Write short notes on E-Paper displays.
4. What are the advantages and disadvantages of LCD?
5. Show that transformation matrix for reflection about $y=x$ followed by reflection about y- axis is equivalent to rotation about origin by 90 degrees.
6. Define homogeneous coordinates.
7. Write the basic 3D transformation matrices.
8. Define clipping. What are the different types of clipping?
9. What is RGB colour model?
10. Which are the two different fields in A – Buffer method?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 a. Illustrate Bresenham's line drawing algorithm with endpoints (20,10) and (30,18). 7
 b. Derive the decision parameter in midpoint circle drawing algorithm and write the algorithm. 7
- OR**
- 12 a. Using DDA algorithm rasterize the line from (0,0) to (4,6) and plot the line. 9
 b. Write a boundary fill procedure to fill an 8 connected region in filled area primitives. 5
- 13 a. With neat diagram explain working principle of cathode ray tube in display devices. 9
 b. What is the working principle behind the plasma panel? 5
- OR**
- 14 a. Differentiate LED and OLED. 7
 b. Describe the working principle of AMOLED along with their advantages and disadvantages. 7
- 15 a. Consider the square A (1,0), B (0,0), C (0,1), D (1,1). Rotate the square ABCD by 45 degree clockwise about fixed-point A (1,0). Write composite transformation matrix and draw resulting figure. 8
 b. What is a shearing transformation? Give the transformation matrices for x-direction and y-direction shear. 6
- OR**
- 16 a. A triangle is defined by matrix $\begin{bmatrix} 2 & 4 & 4 \\ 2 & 2 & 4 \end{bmatrix}$
 Find the transformed coordinates after the following transformation
 (1) 90° rotation about origin (2) Shearing along x axis by 1 unit 8
- b. Translate the square ABCD whose co-ordinates are A (0,0), B (3,0), C (3,3) and D (0,3) by 2 units in both directions and then scale it by 1.5 units in x-direction and 0.5 units in y-direction. 6
- 17 a. How rotation is working in the x-axis, y-axis and z-axis in the three dimensional transformation? 7
 b. Explain Sutherland – Hodgeman polygon clipping algorithm with suitable example. 7
- OR**
- 18 a. Describe Cohen Sutherland line clipping algorithm with an example. 7
 b. Explain 3D geometric transformation in detail. 7
- 19 a. Explain Scan line algorithm with a neat diagram. 7
 b. What is visible surface detection? Explain Back face removal algorithm. 7
- OR**
- 20 a. Discuss about Painter's algorithm. 7
 b. Explain any twocolour models. 7

Syllabus

Module 1: Graphics Systems (8 Hours)
Raster Scan & Random Scan systems. Output Primitives – Line Drawing Algorithms (DDA, Bresenham), Bresenham's circle generation algorithm. Filled Area Primitives – Scan Fill, Flood Fill, Boundary Fill. Inside outside tests.
Module 2: Display Technologies(6 Hours)
Working principle behind CRT, LCD, Plasma, LED, OLED, AMOLED, E-Paper displays.
Module 3: 2-Dimensional Geometric Transformations (8 Hours)
Basic Transformations, Reflection & Shear, Homogenous Matrix representation of transformations, Composite Transformations.
Module 4: 2-D Clipping & 3-Dimensional Geometric Transformations (6 Hours)
2-D Clipping: Point Clipping, Cohen-Sutherland Line Clipping Algorithm, Sutherland-Hodgeman Polygon Clipping Algorithm. 3-Dimensional Geometric Transformations: Basic transformations, Composite 3D transformations (Basics only)
Module 5: Visible Surface Detection Methods & Colour Models (7 Hours)
Visible Surface Detection Methods: Back Face Detection, Depth Buffer, A-Buffer, Scan line, Depth sorting methods. Colour Models: RGB Model, CMY Model, HSV Model

Text Books

1. Donald Hearn, Pauline Baker, Computer Graphics – C Version, Pearson Education, 2nd Edition, 2002
2. Amarendra N' Sinha and Arun D Udai, "Computer Graphics", The McGraw-Hill Companies.

Reference Books

1. David F. Rogers, Procedural Elements for Computer Graphics, Tata McGraw-Hill.
2. Foley, van Dam, Feiner & Hughes, Computer Graphics Principles & Practice, Pearson Education.
3. William M. Newman, Robert F. Sproull, Principles of Interactive Computer Graphics, Tata McGraw-Hill.
4. David F. Rogers, J. Alan Adams, Mathematical Elements for Computer Graphics, Tata McGraw-Hill.
5. https://poli.cs.vsb.cz/edu/apps/down/disp_overview.pdf
6. <https://en.wikipedia.org/wiki/AMOLED>

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Graphics Systems	8 Hours
1.1	Raster Scan & Random Scan systems	1
1.2	Output Primitives – Line Drawing Algorithms	1
1.3	DDA	1
1.4	Bresenham's line drawing algorithm	2
1.5	Bresenham's circle generation algorithm	2
1.6	Filled area primitives (Scan Fill, Flood Fill, Inside outside tests)	1
2	Display Technologies	6 Hours
2.1	Working principle behind CRT	1
2.2	LCD	1
2.3	Plasma	1
2.4	LED, OLED	1
2.5	AMOLED	1
2.6	E-Paper displays.	1
3	2-Dimensional Geometric Transformations	8 Hours
3.1	Basic Transformations	2
3.2	Reflection & Shear	2
3.3	Homogenous Matrix representation of transformations	2
3.4	Composite Transformations	2
4	2-D Clipping&3-Dimensional Geometric Transformations	6 Hours
4.1	Point Clipping	1
4.2	Cohen-Sutherland Line Clipping Algorithm	1
4.3	Sutherland-Hodgeman Polygon Clipping Algorithm	1
4.4	3-Dimensional Geometric Transformations: Basic transformations	2
4.5	Composite 3D transformations (Basics only)	1
5	Visible Surface Detection Methods&Colour Models	7 Hours
5.1	Back Face Detection	1
5.2	Depth Buffer, A-Buffer	1
5.3	A-Buffer	1
5.4	Scan line	1
5.5	Depth sorting methods.	1
5.6	Colour Models	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT474	BLOCK CHAIN TECHNOLOGY	PEC	2	1	0	3

Preamble: The purpose of this course is to introduce the foundation of blockchain technology. The course introduces the cryptographic principles behind blockchain and helps the students understand concepts like consensus, crypto-currency, smart contracts, use cases etc. The course enables students to develop simple decentralized applications using blockchain networks such as Ethereum.

Prerequisite: ITT201 Data Structures, ITT303 Operating System Concepts

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the cryptographic building blocks of blockchain technology	Level 2: Understand
CO 2	Explain the fundamental concepts of blockchain technology	Level 2: Understand
CO 3	Summarize the classification of consensus algorithms	Level 2: Understand
CO 4	Explain the concepts of first decentralized cryptocurrency bitcoin	Level 2: Understand
CO 5	Explain the use of smart contracts and its use cases.	Level 2: Understand
CO 6	Develop simple applications using Solidity language on Ethereum platform.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	1
CO 2	2	2	-	-	-	-	-	-	-	-	-	1
CO 3	2	2	-	-	-	-	-	-	-	-	-	1
CO 4	2	2	-	-	-	-	-	-	-	-	-	1
CO 5	2	2	-	-	-	-	-	-	-	-	-	1
CO6	3	2	2	2	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	40	25	70
Level 3: Apply		15	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Distinguish between Symmetric cryptography and asymmetric cryptography.
2. Explain Cryptographic hash functions and its applications

Course Outcome 2 (CO 2):

1. Categorize consensus mechanism used in blockchain.
2. Define Blockchain. Explain how decentralization of computing or processing power is achieved by a blockchain.

Course Outcome 3 (CO 3):

1. Explain how Proof of Stake can achieve consensus among peers.

2. Explain the working of Raft protocol.

Course Outcome 4 (CO 4):

INFORMATION TECHNOLOGY

1. Describe the use of genesis block.
2. Explain the mining algorithm used in bitcoin.

Course Outcome 5 (CO 5):

1. Illustrate how blockchain technology can be used in supply chain management.
2. What are oracles in a blockchain ecosystem? Explain the generic data flow from a smart contract to an oracle.

Course Outcome 6 (CO 6):

1. Develop a smart contract for voting process. In this application, delegated voting is allowed and the counting is automatic and completely transparent at the same time.
2. Develop a smart contract for auction process. The contract should be a blind auction where it is not possible to see the actual bid until the bidding period ends.

Model Question Paper

Course Code: ITT474

Course Name: BLOCK CHAIN TECHNOLOGY

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Discuss the role of hash tables in blockchain.
2. Illustrate asymmetric cryptography.
3. Illustrate the blockchain based decentralized system
4. Explain how Proof of Stake can achieve consensus among peers.
5. If your blockchain network has 5 Byzantine nodes, what is the minimum number of nodes that are required to ensure Byzantine fault tolerance using PBFT protocol
6. How are transactions verified in a Bitcoin network?
7. Explain how smart contracts can be used for enforcing agreements between parties in the form of business logic.
8. Explain the concept of blockchain-based digital identity cards.
9. Explain error handling in Solidity language.
10. With the help of a figure show the relationship between the transaction, transaction trie, and block header in Ethereum

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11.a. Explain the importance of Cryptography in Blockchain. 9
- b. Explain how hash functions are used to build Merkle trees in blockchain. 5

OR

- 12.a. Explain public and private keys. Perform encryption and decryption using RSA for $p=3$, $q=11$, $e=7$ and $M=5$ 7
- b. Explain Cryptographic hash functions and its importance in Blockchain. 7
- 13.a. Illustrate and explain how blockchain works using a neat diagram. 7
- b. Explain the benefits, features and limitations of blockchain. 7

OR

- 14.a. Explain consensus mechanisms used in blockchain. List out any six consensus algorithms used in the context of blockchain. 7
- b. Define blockchain. Explain how decentralization of computing or processing power is achieved by a blockchain 7
- 15.a. Explain and illustrate how Paxos protocol can be used to achieve consensus 7
- b. Show how Practical Byzantine Fault Tolerance can achieve consensus in the presence of Byzantine faults. 7

OR

- 16.a. Describe the various fields that make up a transaction in Bitcoin. 7
- b. What is the role of a Bitcoin miner? Explain the mining algorithm used in Bitcoin with the help of a flowchart. 7
- 17.a. Illustrate how blockchain technology can be implemented in finance sector. 7
- b. Discuss oracles in a blockchain ecosystem. Explain the generic data flow from a smart contract to an oracle. 7

OR

- 18.a. Explain the design process of decentralized applications with diagrams. 7
- b. Explain the use of blockchain technology in supply chain management. 7
- 19.a. Using Solidity language, create a simple bank contract that allows a user to deposit, withdraw and view balance. 7
- b. Define block difficulty. Explain how block difficulty is adjusted in Ethereum blockchain network. 7

OR

- 20.a. Using Solidity language, create a simple voting smart contract where a chairperson will give the right to vote to each address individually. 7
- b. Explain the concept of Gas in Ethereum. Explain how transaction cost can be 7

calculated in an Ethereum blockchain network.

Syllabus

Module 1: Fundamentals of Cryptography (7 Hours)
Introduction to Cryptography, Symmetric cryptography – AES. Asymmetric cryptography – RSA. Cryptographic hash functions-Applications of cryptographic hash functions – Merkle trees, Distributed hash tables.
Module 2: Fundamentals of Blockchain Technology (6 Hours)
Blockchain – Definition, architecture, elements of blockchain, benefits and limitations, types of blockchain. Consensus – definition, types, consensus in blockchain. Decentralization – Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Blockchain and full ecosystem decentralization.
Module 3: Consensus Algorithms and Bitcoin (8 Hours)
Consensus Algorithms, Crash fault-tolerance (CFT) algorithms – Paxos, Raft. Byzantine fault-tolerance (BFT) algorithms – Practical Byzantine Fault Tolerance (PBFT), Proof of work (PoW), Proof of stake (PoS), Types of PoS. Bitcoin – Definition, Cryptographic keys – Private keys, public keys, addresses. Transactions – Lifecycle, coinbase transactions, transaction validation. Blockchain – The genesis block. Mining – Tasks of miners, mining algorithm, hash rate. Wallets – Types of wallets.
Module 4: Smart Contracts and Use cases (7 Hours)
Smart Contracts – Definition, Smart contract templates, Oracles, Types of oracles, Deploying smart contracts. Decentralization terminology – Decentralized applications, Decentralized Autonomous Organizations. Use cases of Blockchain technology – Government, Health care, Finance, Supply chain management. Blockchain and allied technologies – Blockchain and Cloud Computing, Blockchain and Artificial Intelligence.
Module 5: Ethereum and Solidity (7 Hours)
Ethereum – The Ethereum network. Components of the Ethereum ecosystem – Keys and addresses, Accounts, Transactions and messages. The Ethereum Virtual Machine, Blocks and blockchain. The Solidity language – The layout of a Solidity source code, Structure of a smart contract, variables, data types, control structures, events, inheritance, libraries, functions, error handling. Smart contracts Case study: Voting, Auction

Text Books

1. Imran Bashir, Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, Packt Publishing, Third edition, 2020.

Reference Books

1. Ritesh Modi, Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and blockchain, Packt Publishing, First edition, 2018.
2. Kumar Saurabh, Ashutosh Saxena, Blockchain Technology: Concepts and Applications, First Edition, Wiley Publications, First edition, 2020.
3. Chandramouli Subramanian, Asha A George, et al, Blockchain Technology, Universities Press (India) Pvt. Ltd, First edition, August 2020.
4. Lorne Lantz, Daniel Cawrey, Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, O'Reilly Media, First edition, 2020.
5. Andreas M. Antonopoulos, Gavin Wood, Mastering Ethereum: Building Smart Contracts and DApps, O'Reilly Media, First edition, 2018.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Fundamentals of Cryptography and Hash functions	7 Hours
1.1	Introduction to cryptography	1
1.2	Symmetric cryptography, AES	1
1.3	Asymmetric cryptography, RSA	1
1.4	Cryptographic hash functions	1
1.5	Applications of cryptographic hash functions	1
1.6	Merkle trees	1
1.7	Distributed hash tables	1
2	Fundamentals of Blockchain Technology	6 Hours
2.1	Blockchain – definition and architecture	1
2.2	Elements of blockchain.	1
2.3	Blockchain – benefits and limitations, types.	1
2.4	Consensus – definition, types, consensus in blockchain	1
2.5	Decentralization using blockchain, Methods of decentralization	1
2.6	Routes to decentralization, Blockchain and full ecosystem decentralization	1
3	Consensus Algorithms and Bitcoin	7 Hours
3.1	Consensus Algorithms – Crash fault-tolerance (CFT) algorithms – Paxos, Raft (working is expected).	1

3.2	Byzantine fault-tolerance (BFT) algorithms – Practical Byzantine Fault Tolerance (PBFT) (working is expected).	1
3.3	Proof of work (PoW), Proof of stake (PoS), Types of PoS	1
3.4	Bitcoin – Definition, Cryptographic keys – Private keys, public keys, addresses.	1
3.5	Transactions – Lifecycle, coinbase transactions, transaction validation	1
3.6	Blockchain – The genesis block. Mining – Tasks of miners	1
3.7	Mining – mining algorithm, hash rate. Wallets – Types of wallets.	1
4	Smart Contracts and Use cases	6 Hours
4.1	Smart Contracts – Definition, Smart contract templates	1
4.2	Oracles, Types of oracles, Deploying smart contracts.	1
4.3	Decentralization terminology –Decentralized applications, Decentralized Autonomous Organizations.	1
4.4	Use cases of Blockchain technology – Government, Health care.	1
4.5	Use cases of Blockchain technology – Finance, Supply chain management.	1
4.6	Blockchain and Allied Technologies – Blockchain and Cloud Computing, Blockchain and Artificial Intelligence.	1
5	Ethereum and Solidity	9 Hours
5.1	Ethereum - The Ethereum network, Components of the Ethereum ecosystem – Keys and addresses, Accounts	1
5.2	Components of the Ethereum ecosystem – Transactions and messages	1
5.3	The Ethereum Virtual Machine	1
5.4	Ethereum Blocks and blockchain	1
5.5	The Solidity language – The layout of a Solidity source code, Structure of a smart contract, variables, data types	1
5.6	The Solidity language – control structures, events, inheritance, libraries	1
5.7	The Solidity language – functions, error handling.	1
5.8	Smart contracts Case study: Voting.	1
5.9	Smart contracts Case study: Auction.	1

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VIII
PROGRAM ELECTIVE IV



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT416	SOCIAL NETWORKS ANALYSIS	PEC	2	1	0	3

Preamble: This course gives a basic understanding of what social network analysis is and how it can be applied. Topics covered include network structure and methods for social network analysis, link analysis and network community detection, information propagation on the web and some applications.

Prerequisite: NIL

Course Outcomes: After the completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO 1	Discuss the basic notation and terminology used in social network analysis	Level 2: Understand
CO 2	Compare and interpret social network structure, size and its connectivity pattern.	Level 2: Understand
CO 3	Discover community structure in complex network using statistical techniques	Level 3: Apply
CO 4	Apply link prediction techniques to discover new links in the social network	Level 3: Apply
CO 5	Describe influence in social media, perform recommendations and analyze behavior	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2										
CO 2	2	1	1	1								
CO 3	2	1	1	1								1
CO 4	2	1	1	1								1
CO 5	2	1	1	1								1

3/2/1: High/Medium/Low

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	35	25	60
Apply	10	20	30
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14marks.

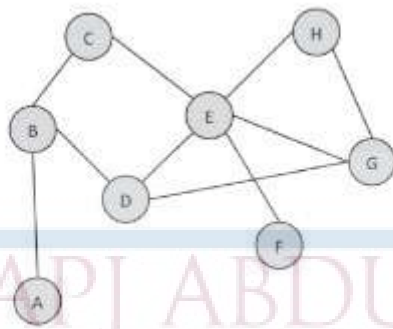
Course Level Assessment Questions**Course Outcome 1 (CO1):**

List the 15 people you are closest to. Turn this list into a network by listing all the connections between these people

1. Is your network directed or undirected?
2. What do the edges represent (friendship, family relationship, close relationships, acquaintances, etc.)?

Course Outcome 2 (CO2):

Consider the following graph



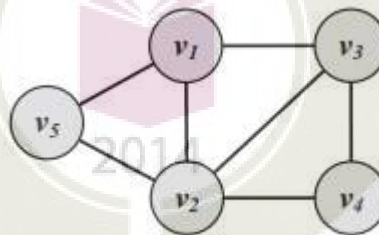
1. What is the degree distribution for this graph?
2. What is the density of the graph?
3. Which node has the highest closeness centrality?
4. Which nodes have the highest degree centrality?
5. What is the cohesion of the graph

Course Outcome 3 (CO3):

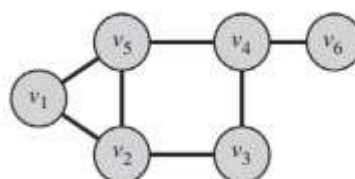
1. Explain the Usage of Girvan and Newman's divisive algorithm as part of agglomerative/Division Algorithms.
2. Depict the community discovery in directed networks.

Course Outcome 4 (CO4):

1. Using a neighborhood-based link prediction method compute the top two most likely edges for the following figure.



2. Compute the most likely edge for the following figure for each path based link prediction technique.



Course Outcome 5 (CO5):

1. Discuss different influence based concepts and measures act at local and global levels.
2. What is meant by Existential Test for Social Influence?
3. Explain the Diffusion Influence Model.
4. Explain the different privacy breaches in social networks.
5. Explanation of different privacy preserving mechanisms.

Model Question paper

Course Code: ITT416

Course Name: SOCIAL NETWORK ANALYSIS

Max.Marks:100

Duration: 3 Hours

PART A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

1. What are the challenges in social media mining?
2. Explain content based analysis.
3. What is Eigenvector Centrality?
4. Explain Heavy tailed Distributions.
5. Why Text analysis is a part of social network analytics?
6. Discuss the measures for community evaluation.
7. Describe Kernighan-Lin Algorithm.
8. Explain the Simrank Algorithm.
9. Explain influence and homophily.
10. What are privacy definitions for publishing the data?

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. a. Describe various research issues present Online Social Networks? 4
b. Explain the different laws of Dynamic unweighted graphs with suitable diagrams. 10

OR

12. a. Discuss uses of related patterns in static unweighted graphs. 10
b. For a real-world social network, is BFS or DFS more desirable? Provided details. 4
13. a. Why are random graphs incapable of modeling real-world graphs? 6
b. Discuss the relationship between harmonic functions, escape probabilities and commute times. 8

OR

14. a. Compare and contrast the global and local graph clustering using random walks. 8
b. How do you explain Collaborative Filtering and Combating Webspam in 6

- connection with random walk?
- 15 a. Explain Girvan-Newman Algorithm. 6
b. What is multi-level Graph partitioning? Explain the main components of MLGP. 8

OR

- 16 a. Explain why Markov Clustering is popular in bioinformatics and its major shortcomings. 6
b. What is meant by community discovery by shingling and how it is different from flow based post processing? 8

OR

- 17 a. How node neighborhood based features are used in feature set construction? 6
b. Discuss the link prediction method using The Katz Score 8

OR

- 18 a. Explain the purpose of page rank algorithm in detail. 8
b. Describe the network evolution based probabilistic model. 6
19 a. What is homophily? Explain social similarity and Influence in short words. 6
b. Explain the roles of different classes; influence and friendship drift and autocorrelation with respect to social influence analysis? 8

OR

- 20 1. Explain identity and attribute disclosure as part of privacy breaches. 8
2. Differentiate between the terms l-diversity and t-closeness. 6

Syllabus

Module 1 : Introduction to Social Network Data Analytics(6 hours)	
Introduction to Social Network Analysis , Online social networks Research Issues and Topics, Statistical properties of social networks: Preliminaries, Static properties, Dynamic properties, Challenges of Social Network Streams,	
Module 2 :Random Walks in Social Networks(7 hours)	
Random walks on Graphics, Walks based on proximity measures, Other graph based proximity measures, Graph theoretic measures for semi supervised learning, Clustering with random walk based measures, Applications in computer vision, Text Analysis, Evaluation and datasets, Link prediction and data sources	
Module 3 : Community Discovery in Social Networks(8 hours)	
Communities in Context, Core Methods – KL Algorithm, Special algorithms, Markov Clustering, other approaches. Emerging Fields and problems: Community Discovery in dynamic networks, Heterogeneous networks, Directed networks, Coupling content and relationship information for community discovery.	
Module 4 : Link Prediction in Social Networks(8 hours)	
Background, Feature based Link Prediction, Bayesian Probabilistic Models, Probabilistic Relational Models, Linear Algebraic Methods, Link Predictions: The Katz Score, Hitting & Commute Time, Rooted PageRank, SimRank	
Module 5 : Social Influence Analysis(6 hours)	
Influence Related Statistics, Social Similarity and Influence, Influence Maximization in Viral Marketing, Privacy breaches in social networks, Privacy definitions for publishing data, Privacy preserving mechanisms.	

Text Books

1. Charu.C. Aggarwal, Social Network Data Analytics, Springer Science+Business Media, LLC 2011.

Reference Books

1. R. Zafarani, M. A. Abbasi, and H. Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
2. Krishna Raj P M, Ankith Mohan, K G Srinivasa ,Practical Social Network Analysis with Python , Springer Liu, Bing. Web data mining. Springer-Verlag Berlin Heidelberg, 2007.
3. Chakrabarti, Soumen. Mining the Web: Discovering knowledge from hypertext data. Morgan Kaufmann, 2003.
4. Scime, Anthony, ed. Web mining: applications and techniques. IGI Global, 2005.

Course Contents and Lecture Schedule

SlNo.	Topic	No. of Lectures
1	Introduction to Social Network Data Analytics	6 Hour
1.1	Introduction to Social Network Analysis	1
1.2	Online social networks Research Issues and Topics	1
1.3	Statistical properties of social networks: Preliminaries	1
1.4	Static properties, Dynamic properties	1
1.5	Challenges of Social Network Streams	2
2	Random Walks in Social Networks	7 Hours
2.1	Random walks on Graphics	1
2.2	Walks based on proximity measures	1
2.3	Other graphs based proximity measures	1
2.4	Graph theoretic measures for semi supervised learning	1
2.5	Clustering with random walk based measures,	1
2.6	Applications in computer vision, Text Analysis,	1
2.7	Evaluation and datasets, Link prediction and Data sources	1
3	Community Discovery in Social Networks	8 Hours
3.1	Communities in Context	1
3.2	Core Methods – KL Algorithm	1
3.3	Special algorithms, Markov Clustering, other approaches	2
3.4	Emerging Fields and problems: Community Discovery in dynamic networks,	2

3.5	Heterogeneous networks and directed networks	1
3.6	Coupling content and relationship information for community discovery.	1
4	Link Prediction in Social Networks	8 Hours
4.1	Background, Feature based Link Prediction	1
4.2	Bayesian Probabilistic Models	1
4.3	Probabilistic Relational Models	1
4.4	Linear Algebraic Methods	1
4.5	Link Predictions: The Katz Score	1
4.6	Link Predictions: Hitting & Commute Time,	1
4.7	Link Predictions: Rooted PageRank,	1
4.8	Link Predictions: SimRank	1
5	Social Influence Analysis	6 Hours
5.1	Influence Related Statistics, Social Similarity and Influence,	2
5.2	Influence Maximization in Viral Marketing	1
5.3	Privacy breaches in social networks	1
5.4	Privacy definitions for publishing data, Privacy preserving mechanisms.	2



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT426	INTERNET OF THINGS	PEC	2	1	0	3

Preamble: This course covers the fundamentals of IoT and provides skills for IoT based product development including the selection of sensors, protocols, hardware boards, interfacing, and implementation for product building. Real life case studies are introduced in this course.

Prerequisite: ITT305 Data Communication and Networking

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the key techniques and theory behind Internet of Things	Level 2: Understand
CO 2	Distinguish between different IoT Protocols and their applications	Level 2: Understand
CO 3	Apply effectively the various enabling technologies (both hardware and software) for IoT.	Level 3: Apply
CO 4	Describe the integration of Cloud and IoT with data acquisition and analytics	Level 2: Understand
CO 5	Design and build IoT system for any one interesting Use case	Level 3: Apply

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	-	-	-	-	-	-	-	-	-	1
CO 2	1	1	2	2	-	-	-	-	-	-	-	1
CO 3	2	1	3	-	3	-	-	-	-	-	-	1
CO 4	1	1	2	2	-	-	-	-	-	-	-	1
CO 5	1	1	2	-	3	-	-	-	2	-	-	1

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	20
Understand	30	25	65
Apply	5	10	15

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Define IoT and explain its characteristics.
2. Which are the functional components of IoT
3. Compare IoT with M2M, CPS, WoT.

Course Outcome 2 (CO2)

1. Explain about the different types of IoT Protocols.
2. Differentiate between Connectivity protocols and Transport protocols with suitable examples

3. Explain about MQTT Protocol and its features

Course Outcome 3(CO3):

1. Differentiate between sensors and actuators
2. Design an IoT application to log the temperature values to a file using Raspberry Pi. Illustrate with sample code
3. Differentiate between Scalar and Vector Sensors

Course Outcome 4 (CO4):

1. With a neat diagram illustrate the NIST model for cloud computing
2. Differentiate between SaaS, PaaS, IaaS
3. Explain any two open source cloud platforms with their features

Course Outcome 5 (CO5):

1. Differentiate between a Smart Environment Vs Smart Device
2. Explain how a doorbell can be converted into an IoT smart device with its smart features and implementation details
3. Describe a connected Vehicle ? Explain its features.

Optional Exercises

1. Integrate a temperature sensor like DHT11 with Raspberry Pi and print the values
2. Integrate Raspberry Pi with an IoT-Cloud Platform like ThingsSpeak and log the temperature values from the sensor to the platform
(Similar Exercises can be done for other sensors like:- Gas(MQ2), Motion(PIR) etc)

Model Question paper

Course Code: ITT426

Course Name: INTERNET OF THINGS

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Define IoT and explain its characteristics
2. Discuss about IoT device Interoperability
3. Explain the different types of IoT Transport Protocols

4. Differentiate between Connectivity protocols and Transport protocols with suitable examples
5. Explain about Scalar and Vector Sensors
6. Differentiate between sensors and actuators
7. With a neat diagram illustrate the NIST model for cloud computing
8. Differentiate between SaaS and PaaS
9. Differentiate between a Smart Environment Vs Smart Device
10. Explain how healthcare can be made smarter by making use of IoT

Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. Write short note about the following
- a) IoT Device interoperability
 - b) IoT user interoperability
 - c) IoT Challenges
- 14
- OR**
12. Explain the architectural stack in IoT and IoT enabling technologies
- 14
13. Explain any three IoT Data Protocols and their applications
- 14
- OR**
14. What do you mean by connectivity technologies? Explain any three connectivity technologies.
- 14
15. Design an IoT application to log the temperature values to a file using Raspberry Pi. Illustrate with sample code
- 14
- OR**
16. Differentiate between Arduino and Raspberry Pi board, their hardware specifications and features
- 14
17. Discuss about different cloud platforms and their features(Any 3)
- 14
- OR**
18. Explain about the various cloud computing service models and their applications
- 14
19. Explain a case study where a normal device is converted into an IoT smart device with its smart features and its implementation details
- 14
- OR**
20. Differentiate between Smart Environment and Smart Device with suitable examples
- 14

Module 1 : IoT Introduction (6 Hours)
Introduction to IoT - IoT definition - Characteristics - Things in IoT - IoT complete architectural stack – IoT, Functional components-IoT enabling technologies - IoT challenges -Industrial IoT Vs Consumer IoT, IoT levels, Machine-to-Machine (M2M) communications, Cyber-Physical-Systems (CPS), Web-of-Things (WoT), Interoperability in IoT-User Vs device interoperability
Module 2: Protocols for IoT (8 Hours)
Protocols for IoT -Types of protocols based on functionality, infrastructure protocol IPV4/V6, Identification (URLs), Connectivity protocols-(6LowPAN, RPL), Transport/Communication protocols- WIFI, LiFi, BLE, NFC, Data protocols-(MQTT, CoAP, XMP), A cases study with MQTT/CoAP usage
Module 3: IoT Hardware/Software interfacing (8 Hours)
Sensors and Hardware for IoT- Sensors Vs Transducers, Sensor Classes:- Analog/Digital, Scalar/Vector, Sensor types; Actuation-introduction, actuators, types; Python basics, Arduino and Raspberry Pi Boards and their features, IoT Implementation case study with any one of the boards and data acquisition from sensors. Open Source Cloud-IoT Platforms and their Applications: ThingsSpeak, DeviceHive, ThingsBoard
Module 4 : Cloud and Data Analytics in IoT (7 Hours)
Cloud and Data analytics- Cloud computing fundamentals-NIST model, essential characteristics, Service models-(SaaS, PaaS, IaaS), Deployment models-(Public, Private, Hybrid), Cloud-Service management and security, Open Source Cloud IoT platforms and their features-(Microsoft Azure, Amazon EC2), Basics of data handling and analytics-Data Handling, Big data and its characteristics, Data flow Model(Generation, Acquisition, Storage, Analysis),
Module 5: IoT Application case studies (6 Hours)
Case studies with architectural analysis: IoT applications -Smart environments Vs Smart devices, Smart Cities and Smart Homes - Smart Water - Smart Agriculture - Smart Energy - Smart Healthcare – Connected Vehicles

Text Books

1. Bahga A, Madisetti V , Internet of Things: A hands-on approach; Vijay Madisetti, First Edition ,2014.
2. Shriram K Vasudevan, Abhishek SN and Sundaram RMD. Internet of Things, Wiley India First Edition,;2019
3. Raj P, Raman AC. The Internet of things: Enabling Technologies, Platforms, and Use-cases. Auerbach Publications; 2017.

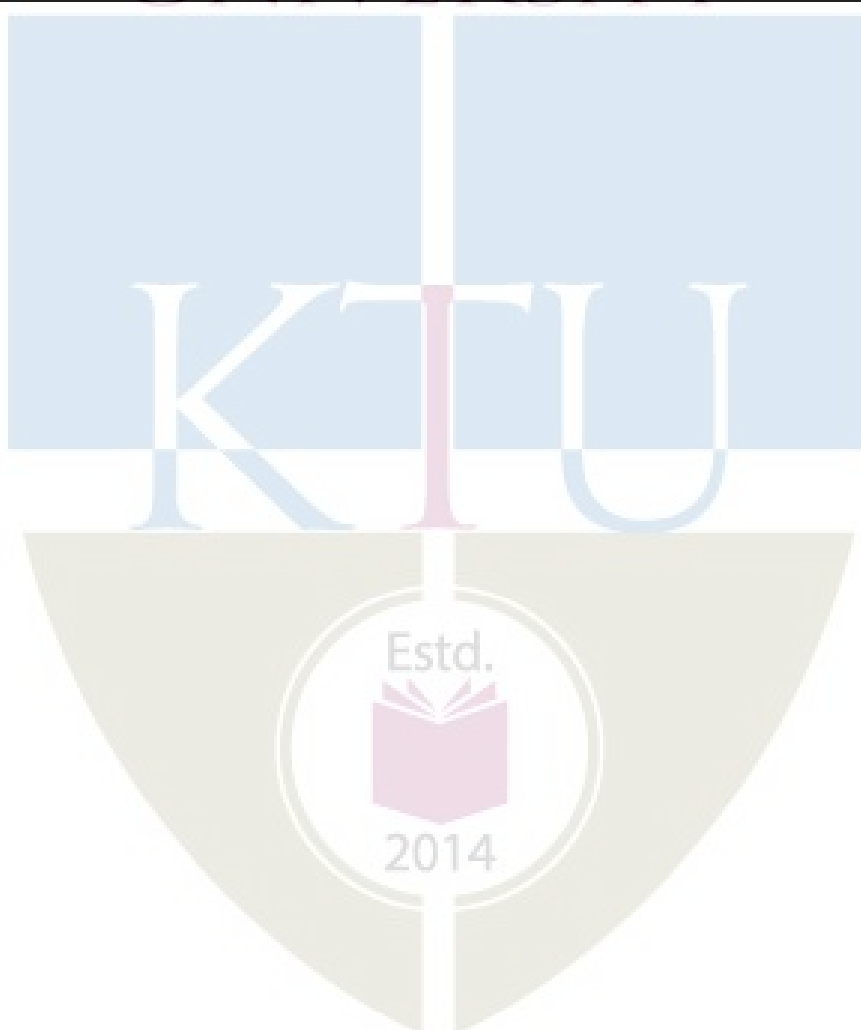
References

1. NPTEL Course on Introduction to Internet of Things by IIT Kharagpur
<https://nptel.ac.in/courses/106/105/106105166/>
2. Article about Open Source Cloud-IoT Platforms
<https://www.opensourceforu.com/2018/10/the-top-open-source-iot-platforms-for-developers/>
3. Links to Some useful Cloud-IoT Platform
<https://thingspeak.com/>
<https://devicehive.com/>
<https://thingsboard.io>

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	IoT Introduction	6 Hours
1.1	Introduction to IoT - IoT definition - Characteristics - Things in IoT - IoT Complete Architectural Stack – IoT	2
1.2	Functional Components-IoT enabling Technologies - IoT Challenges -Industrial IoT Vs Consumer IoT, IoT Levels	2
1.3	Machine-to-Machine (M2M) communications, Cyber-Physical-Systems (CPS), Web-of-Things (WoT), Interoperability in IoT-User Vs Device interoperability	2
2	IoT Protocols	8 Hours
2.1	Protocols for IoT -Types of protocols based on functionality, infrastructure protocol IPV4/V6, Identification (URLs),	3
2.2	Connectivity Protocols-(6LowPAN, RPL),	1
2.3	Transport/Communication Protocols- (WIFI, LiFi, BLE, NFC), ,	1
2.4	Data Protocols-(MQTT, CoAP, XMP)	2
2.5	A Case Study with MQTT/CoAP usage	1
3	IoT Hardware/Software interfacing	8 Hours
3.1	Sensors and Hardware for IoT- Sensors Vs Transducers, Sensor Classes:- Analog/Digital, Scalar/Vector, Sensor types	2
3.2	Actuation-introduction, actuators, types; Python Basics	1
3.3	Arduino and Raspberry Pi Boards and their features	2
3.4	IoT Implementation Case study with any one of the boards and data acquisition from sensors.	2
4	Cloud and Data Analytics in IoT	7 Hours
4.1	Cloud and Data analytics- Cloud computing fundamentals-NIST model, essential characteristics,	1

4.2	Service models-(SaaS, PaaS, IaaS), Deployment models-(Public, Private, Hybrid), Cloud-Service management and security,	2
4.3	Open Source Cloud platforms and their features-(OpenStack, Microsoft Azure, Amazon EC2)	2
4.4	Basics of Data Handling and Analytics-Data Handling, Big data and its characteristics, Data flow Model(Generation, Acquisition, Storage, Analysis),	2
5	IoT Application case studies	6 Hours
5.1	Case studies with architectural analysis: IoT applications -Smart environments Vs Smart devices	2
5.2	Smart Cities and Smart Homes	1
5.3	Smart Water - Smart Agriculture	1
5.4	Smart Energy - Smart Healthcare, Connected Vehicles	2



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT436	HIGH SPEED NETWORKS	PEC	2	1	0	3

Preamble: This course introduces the basic concept of frame relay and ATM networks, describes the end-to-end performance parameters and techniques used by TCP, updates knowledge about the development in high speed networks and discuss about various protocols for quality support

Prerequisite: ITT305 Data Communication and Networking

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome(CO)	Bloom's Category
CO 1	Explain the Asynchronous Transfer Mode Protocol architecture and High Speed Local Area Network Applications.	Level 2: Understand
CO 2	Discuss the Queuing Models, frame relay to manage the traffic and congestion control in High Speed Network.	Level 2: Understand
CO 3	Compare congestion control and traffic management in TCP with Asynchronous Transfer Mode protocol in High Speed Networks	Level 2: Understand
CO 4	Describe the Architecture of Integrated and Differentiated services	Level 2: Understand
CO 5	Outline the protocols for Quality of Service Support	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	1	-	-	-	-	-	-	-	-	-
CO 2	3	2	2	-	-	-	-	-	-	-	-	-
CO 3	2	1	1	-	-	-	-	-	-	-	-	-
CO 4	2	2	2	-	-	-	-	-	-	-	-	-
CO 5	2	1	1	-	-	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	40	40	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain the various ATM service categories in detail.
What are the requirements for WLAN? Explain the IEEE802.11 architecture in detail.
2. Write short notes on
 - a) Wireless LANs.

- b) Wi-fi networks.
- c) Wi-Max networks.
- 3. What is Ethernet? Discuss in detail about Fast Ethernet & Gigabit Ethernet.

Course Outcome 2 (CO2)

- 1. Explain the effects of congestion in packet switching networks.
- 2. Explain how congestion avoidance is done in frame relay networks.
- 3. Explain about traffic management in packet switching networks.
- 4. Describe the single server queuing model with its structures and parameters.

Course Outcome 3(CO3):

- 1. Describe TCP congestion control
- 2. Discuss timer management in transmission control protocol
- 3. Explain with an example guaranteed frame rate(GFR) traffic management in ATM networks
- 4. Describe the mechanisms used in ATM traffic control to avoid congestion condition

Course Outcome 4 (CO4):

- 1. Give the requirements for inelastic traffic
- 2. Explain RED algorithm in detail
- 3. Discuss about various queuing discipline

Course Outcome 5 (CO5):

- 1. Discuss about various protocols for quality support

Model Question paper

Course Code: ITT436

Course Name: HIGH SPEED NETWORKS

Max.Marks: 100

Duration: 3 Hrs

PART A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

- 1. Explain the role of frame relay?
- 2. Write short notes on Fast Ethernet and Gigabit Ethernet?
- 3. Outline the reasons for congestion in communication network?
- 4. Explain about single server Queue and its applications

5. Write down various window management techniques
6. State Kendall's notation
7. Write the five DS traffic conditioner elements
8. Describe the design goals for RED
9. Explain the design goals of resource reservation protocol
10. Define MPLS?

PART B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. a. Explain about frame relay networks in detail with suitable diagram 8
- b. Describe the various requirements specific to wireless LAN 6

OR

12. a. Explain about Fibre Channel networks 8
- b. Explain with diagrammatic illustration ATM protocol architecture. 6
13. a. Explain the effects of congestion and the different congestion control methodologies in packet switching networks 7
- b. Explain in detail about the concept of traffic management 7

OR

14. What are queuing systems? Classify queuing models and discuss the same 14
15. a. Write about KARN's algorithm and window management 8
- b. Compare the performance of TCP over ATM 6

OR

16. a. Explain in detail about GFR traffic management 10
- b. Explain in detail about the Jackson's Algorithm 4
17. a. Discuss in detail about ISA architecture 7
- b. With neat diagram write about differentiated services 7

OR

18. Write in detail about queuing discipline: 14
 - a. BRFQ,
 - b. GPS,
 - c. WFQ

d. FQ

19.	a. Describe about RSVP characteristics in detail	7
	b. Discuss in detail about RSVP protocol mechanism	7

OR

20.	a. Write about Real time Transport Protocol (RTP) protocol architecture	8
	b. Describe in detail about RTCP	7

Syllabus

Module 1(7 hours)
Frame Relay Networks , Asynchronous transfer mode , ATM protocol architecture, ATM logical connection , ATM cell , ATM service categories , AAL. High speed LAN's: Fast Ethernet ,Gigabit Ethernet, Fibre channel , Wireless LAN's, WiFi and WiMax networks applications, requirements , Architecture of 802.11.
Module 2(7 hours)
Queuing analysis, Queuing models, Single server queues, Effects of congestion, Congestion control, Traffic management, Congestion control in packet switching networks, Framelay congestion control.
Module 3(9 hours)
TCP flow control ,TCP congestion control ,Retransmission ,Timer management , Exponential RTO backoff , KARN's algorithm , Window management , Performance of TCP over ATM. Traffic and congestion control in ATM ,Requirements , Attributes , Traffic management frame work, Traffic control , ABR traffic management , ABR rate control, RM cell formats , ABR capacity allocations ,GFR traffic management.
Module 4(7 hours)
Integrated Services Architecture ,Approach, Components, Services- Queuing discipline , FQ , PS , BRFQ , GPS , WFQ , Random early detection , Differentiated services.
Module 5(5 hours)
RSVP, Goals & characteristics, Data flow, RSVP operations, Protocol mechanisms, Multiprotocol label switching, Operations, Label stacking, Protocol details, RTP, Protocol architecture, Data transfer protocol, RTCP.

Text Books

1. William Stallings, High speed networks and internet, Pearson Education, Second Edition, 2002.

Reference Books

1. Warland, PravinVaraiya, High performance communication networks, Jean Harcourt Asia Pvt. Ltd., Second Edition , 2001.

2. IrvanPepelnjk, Jim Guichard, Jeff Apar, MPLS and VPN architecture”, Cisco Press, Volume 1 and 2, 2003.
3. Abhijit S. Pandya, Ercan Sea, “ATM Technology for Broad Band Telecommunication Networks”, CRC Press, New York, 2004
4. <https://www.sics.se/~peter/HSN-visions.htm>

Course Contents and Lecture Schedule

Module 1: HIGH SPEED NETWORKS		7 hours
1.1	Frame Relay Networks , Asynchronous transfer mode	1
1.2	ATM Protocol Architecture,	1
1.3	ATM logical Connection, ATM Cell, ATM Service Categories, AAL.	1
1.4	High Speed LAN's:Fast Ethernet ,Gigabit Ethernet, Fibre Channel	2
1.5	Wireless LAN's, WiFi and WiMax Networks applications, requirements, Architecture of 802.11.	2
Module 2: CONGESTION AND TRAFFIC MANAGEMENT		7 hours
2.1	Queuing Analysis , Queuing Models – Single Server Queues	2
2.2	Effects of Congestion , Congestion Control	1
2.3	Traffic Management ,Congestion Control in Packet Switching Networks	2
2.4	Frame Relay Congestion Control.	2
Module 3:TCPAND ATM CONGESTION CONTROL		9 hours
3.1	TCP Flow control , TCP Congestion Control	1
3.2	Retransmission , Timer Management	1
3.3	Exponential RTO backoff, KARN's Algorithm	1
3.4	Window management , Performance of TCP over ATM	2
3.5	Traffic and Congestion control in ATM ,Requirements , Attributes ,Traffic Management Frame work	2
3.6	Traffic Control , ABR traffic Management , ABR rate control, RM cell formats , ABR Capacity allocations , GFR traffic management	2
Module 4: INTEGRATED AND DIFFERENTIATED SERVICES		7 hours
4.1	Integrated Services Architecture , Approach, Components, Services	2
4.2	Queuing Discipline , FQ , PS	2
4.3	BRFQ , GPS , WFQ , Random Early Detection	2
4.4	Differentiated Services	1
Module 5: PROTOCOLS FOR QOS SUPPORT		5 hours
5.1	RSVP – Goals & Characteristics	1
5.2	Data Flow, RSVP operations – Protocol Mechanisms	1
5.3	Multiprotocol Label Switching – Operations, Label Stacking – Protocol details	2
5.4	RTP – Protocol Architecture – Data Transfer Protocol– RTCP.	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT446	ADHOC AND WIRELESS SENSOR NETWORKS	PEC	2	1	0	3

Preamble: Students will be able to learn ad hoc network and Sensor network fundamentals, understand the different routing protocols, develop in-depth knowledge on sensor network architecture and design issues, and understand the transport layer and security issues in ad hoc and sensor networks

Prerequisite: ITT305 Data Communication and Networking

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcomes(CO)	Bloom's Category Level
CO 1	Explain the basics of MAC protocols and routing protocols used in mobile ad hoc networks	Level 2: Understand
CO 2	Discuss the transport layer protocols and achieving QoS in mobile ad hoc networks	Level 2: Understand
CO 3	Describe the basics of MAC protocols and routing protocols used in wireless sensor networks	Level 2: Understand
CO 4	Discuss the transport layer and operating systems used in wireless sensor networks	Level 2: Understand
CO 5	Describe the security issues in wireless sensor networks	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	-	-	-	-	-	-	-	-	2
CO 2	3	2	1	-	-	-	-	-	-	-	-	2
CO 3	3	2	1	-	-	-	-	-	-	-	-	2
CO 4	3	2	1	-	-	-	-	-	-	-	-	2
CO 5	3	2	1	-	-	-	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination Marks
	Test 1	Test 2	
Remember	20	20	20
Understand	30	30	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Discuss the features of contention based routing protocols
2. Compare proactive and reactive routing protocols
3. What are the features of ad hoc networks?

Course Outcome 2 (CO2)

1. Explain about the issues and challenges in providing QoS in mobile ad hoc networks
2. What are the advantages of snooping TCP over I-TCP?
3. Explain in detail about the transport protocols for ad hoc networks

Course Outcome 3(CO3):

1. List the features of ZigBee
2. Why do we need MAC protocols for wireless sensor networks
3. Explain about the hybrid MAC protocols for wireless sensor networks

Course Outcome 4 (CO4):

1. Describe the taxonomy of routing and data dissemination protocols used in wireless sensor networks
2. Discuss the features of sensor protocols for information via negotiation
3. Explain the features of Contiki OS

Course Outcome 5 (CO5):

1. What are the security vulnerabilities in wireless sensor networks?
2. Discuss about the key management protocols used in wireless sensor networks
3. Explain in detail about TESLA

Model Question Paper

Course Code: ITT446

Course Name: ADHOC AND WIRELESS SENSOR NETWORKS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. Discuss the issues in designing routing protocols for ad hoc networks?
2. What are the advantages of hybrid routing?
3. List the QoS parameters used in networking
4. Can we use the traditional TCP for ad hoc networks? Justify
5. Describe the challenges in designing MAC protocols for wireless sensor networks
6. Differentiate between WSNs and MANETs
7. Explain the major objectives of TinyOS
8. What is the need for data dissemination in wireless sensor networks?
9. Discuss the major constraints of wireless sensor networks?
10. What is denial of service attack?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 Discuss the classification of MAC protocols for ad hoc networks and explain about the contention based MAC protocols

14

OR

- 12 Explain in detail about the reactive routing protocols for ad hoc networks
- 13 Compare the various TCP solutions for adhoc wireless networks

14

14

OR

- 14 Explain in detail about the MAC layer and Network layer QoS solutions 14
- 15 Explain in detail about IEEE 802.15.4 protocol stack 14

OR

- 16 Explain the network architecture of wireless sensor network 14
- 17 Explain the LEACH routing with the help of neat diagram.
Give its advantages and disadvantages. 14

OR

- 18 Explain in detail about the transport layer protocol for wireless sensor networks 14
- 19 Write the layer wise attacks in wireless Sensor networks and
explain its impact on networks. 14

OR

- 20 List the possible solutions to mitigate the denial-of-service
attacks in sensor networks and explain how it improves the
performance of the system. 14

Syllabus

Module 1: MAC & Routing in Ad hoc Networks (7Hours)
Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols
Module 2: Transport & QoS in Ad hoc Networks(6 Hours)
TCP challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model
Module 3: Wireless Sensor Networks(7Hours)
Introduction to wireless sensor networks (WSN), Network architecture and protocol stack, MAC access control – fundamental MAC protocols, MAC design for WSNs, MAC protocols for WSN (Contention based, Contention free, and Hybrid protocols), IEEE 802.15.4, Zigbee
Module 4: Routing and Transport Layer (8Hours)
Routing and data dissemination – Fundamentals and challenges, taxonomy of routing and data dissemination protocols, Overview of routing and data dissemination protocols – geographic adaptive fidelity, LEACH, Sensor protocols for information via negotiation, joint mobility and routing protocol. Transport Protocols and Quality of Service – Transport protocol design for WSNs, Transport protocols for WSNs, Operating systems for sensor networks – TinyOs, Contiki
Module 5: Security in WSNs (7Hours)
Security requirements in WSNs, Security vulnerabilities in WSNs – DoS attacks, physical layer attacks, link layer, network layer, transport layer attacks, Attacks on secrecy and authentication, Security mechanisms for WSNs – cryptography in WSNs, Key management

protocols, Defence against DoS attacks, Defence against routing attacks - TESLA, SPINS , Intrusion detection in WSNs.

INFORMATION TECHNOLOGY

Text Books

1. Jun Zheng, Abbas Jamalipour, Wireless Sensor Networks: A Networking Perspective, John Wiley, 2009
2. C.Siva Ram Murthy and B.S.Manoj, Ad Hoc Wireless Networks – Architectures and 2 Protocols, Pearson Education, 1/e, 2006.

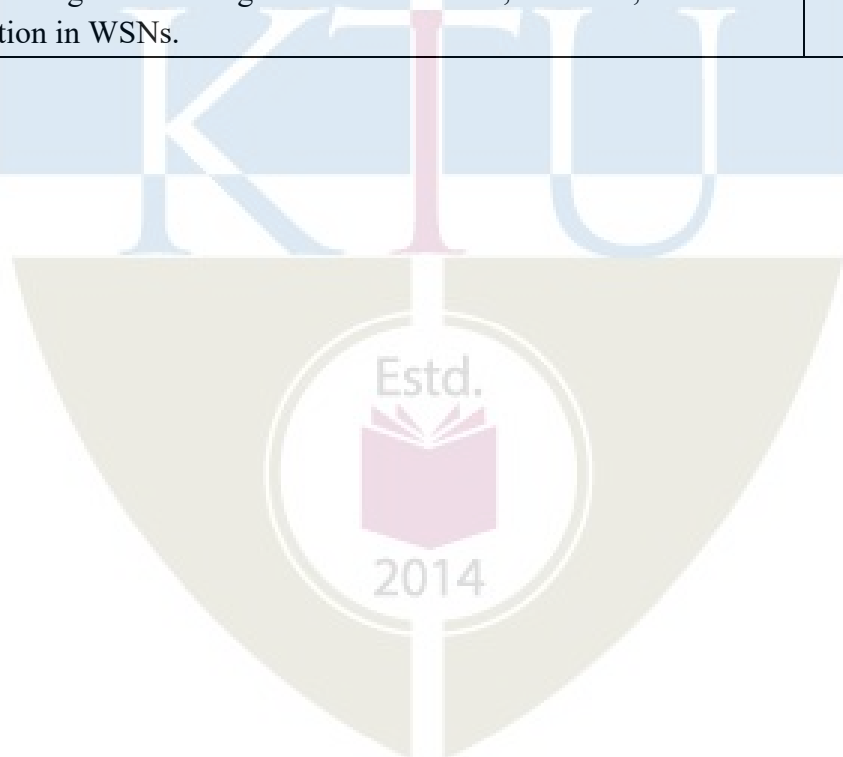
References

1. <https://arxiv.org/ftp/arxiv/papers/1301/1301.5065.pdf>
2. Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, Wiley, 2005

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	MAC & Routing in Ad hoc Networks	7 Hours
1.1	Introduction – Issues and challenges in ad hoc networks	1
1.2	MAC Layer Protocols for wireless ad hoc networks	1
1.3	Contention-Based MAC protocols	1
1.4	MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols	1
1.5	Routing in Ad hoc Networks – Design Issues	1
1.6	Proactive and Reactive Routing Protocols	1
1.7	Hybrid Routing Protocols	1
2	Transport & QoS in Ad hoc Networks	6 Hours
2.1	TCP challenges and Design Issues in Ad Hoc Networks	1
2.2	Transport protocols for ad hoc networks	2
2.3	Issues and Challenges in providing QoS	1
2.4	MAC Layer QoS solutions	1
2.5	Network Layer QoS solutions – QoS Model	1
3	Wireless Sensor Networks	7 Hours
3.1	Introduction to wireless sensor networks (WSN)	1
3.2	Network architecture and protocol stack	1
3.3	MAC access control – fundamental MAC protocols, MAC design for WSNs	1
3.4	MAC protocols for WSN (Contention based, Contention free, and Hybrid protocols)	1
3.5	MAC protocols for WSN (Hybrid protocols)	1
3.6	IEEE 802.15.4	1
3.7	Zigbee	1
4	Routing and Transport Layer	8 Hours

4.1	Routing and data dissemination – Fundamentals and challenges, taxonomy of routing and data dissemination protocols	1
4.2	Overview of routing and data dissemination protocols	1
4.3	Geographic adaptive fidelity, LEACH	1
4.4	Sensor protocols for information via negotiation, joint mobility and routing protocol, GPSR.	1
4.5	Transport Protocols and Quality of Service	1
4.6	Transport protocol design for WSNs	1
4.7	Transport protocols for WSNs	1
4.8	Operating systems for sensor networks – TinyOs, Contiki	1
5	Security in WSNs	7 Hours
5.1	Security requirements in WSNs	1
5.2	Security vulnerabilities in WSNs – DoS attacks, physical layer attacks, link layer	1
5.3	Network layer, transport layer attacks, Attacks on secrecy and authentication	1
5.4	Security mechanisms for WSNs,	1
5.5	Cryptography in WSNs	1
5.6	Key management protocols, Defence against DoS attacks	1
5.7	Defence against routing attacks - TESLA, SPINS , Intrusion detection in WSNs.	1



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT456	HUMAN COMPUTER INTERFACING	PEC	2	1	0	3

Preamble: The goal of this course is for the students, working in teams, to propose a new human computer interface, or an improvement to an existing interface, to solve a particular problem. The course is split into five modules: Human Computer Interface Foundation, Designing Interaction, Interaction Design Models, Guidelines in HCI and Collaboration, Human Factors, Security and Validation Concepts.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO 1	Describe the basic concepts of human, computer interactions	Level 1: Understand
CO 2	Depict the processes of human computer interaction life cycle	Level 2: Understand
CO 3	Discuss the various interaction design models	Level 2: Understand
CO 4	Learn design standards/guidelines for evaluating the developed interactions	Level 2: Understand
CO 5	Describe the principles of human computer interactions through the prototype mode and validations	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	1	-	-	1	-	-	-	-	-	1
CO 2	2	2	1	-	-	1	-	-	-	-	-	1
CO 3	2	2	2	1	-	-	-	-	-	-	-	2
CO 4	2	2	2	1	-	1	-	-	-	-	-	1
CO 5	2	2	1	1	-	1	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	40	40	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Describe the relation between psychology and the design of interactive systems.
2. Differentiate between text entry devices and display devices.
3. Explain about virtual reality and 3D interaction devices.

Course Outcome 2 (CO2):

1. Illustrate the known interactive design models.

2. Explain about the framework used for discovery.
3. Explain what is meant by Iteration and prototyping?

Course Outcome 3 (CO3):

1. Explain Task hierarchy of cognitive models.
2. What are Linguistic models?
3. What are applications of physical models?
4. Explain GOMS Analysis.
5. Explain the working of communication and collaborative models.
6. What is meant face to face communication?
7. Describe group working.
8. What are the outcomes of task decompositions?

Course Outcome 4 (CO4):

1. List the Shneiderman's eight golden rules.
2. What are Norman's Seven Principles for transforming difficult tasks into simple ones?
3. Why are there few effective HCI standards?
4. What is Nielsen's heuristics and heuristic evaluation technique?

Course Outcome 5 (CO5):

1. What decision support systems?
2. Identify the frameworks for groupware.
3. What is cognitive walk-through?
4. Explain the applications of augmented and Virtual reality.
5. How do you implement synchronous groupware?

Model Question paper**Course Code: ITT456****Course Name: HUMAN COMPUTER INTERFACING****Max.Marks:100****Duration: 3 Hours****PART A****Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)**

1. What are the underlying principles of HCI?
2. Explain about human memory, reasoning and problem solving.
3. Explain positioning and pointing devices.
4. Differentiate between elicitation and interpretation.
5. Explain the challenges involved in display-based systems.
6. Explain the operation of key stroke level model.
7. Explain the GOMS Analysis in detail.
8. State and explain the Norman's principles.
9. Summarize the principles affecting learnability.
10. Compare and contrast usability testing and interface testing.

Part B**Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)**

11. a. Explain the various devices used for virtual reality and 3D interaction in detail. 10
b. What is meant by emotion and individual differences? 4
- OR
12. a. Explain in detail about psychology and design of interactive systems. 10
b. What are sensors and special devices? Write short answer. 4
13. a. Explain the discovery framework? 6

- b. Explain the Screen design and Layout in detail. 8
- OR
14. a. What are the phases of task analysis? 6
- b. Explain the task decomposition procedure in detail. 8
15. a. Compare and contrast three state model and keystroke model. 10
- b. Explain how encoding is done in keyboard level model. 4
- OR
16. a. Write short notes on principles to support usability. 6
- b. Explain the Keyboard level model and the heuristic for operator placement. 8
17. a. Explain Norman's model of interaction in detail. 6
- b. Explain Nielsen's ten heuristics. 8
- OR
18. a. Explain Shneiderman's eight golden rules in detail 10
- b. What is Contextual evaluation? 4
19. a. What are shared artifacts? Explain. 6
- b. Explain the meeting and decision support systems. 8
- OR
20. a. What do you mean by perceptual interfaces? 4
- b. Illustrate the Augmented and virtual reality validations. 10

Syllabus

Module 1: HCI Foundations (7 hours)
Input–output channels, Human memory- Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems, Text entry devices – Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction - Physical controls, sensors and special devices.
Module 2 : Designing Interaction (6 hours)
Models of Interaction, Frameworks and HCI, Interaction Styles, Contexts of Interaction, The Process of Design, Navigation Design, Screen Design and Layout, Iteration and Prototyping.
Module 3: Cognitive Models (9 hours)
Goal and Task hierarchy, GOMS, Linguistic Models, Physical and device Models, Cognitive architectures, Communication and collaboration models, Face to face communication, Text Based communication, Group working, Task Analysis, Task decomposition.
Module 4: Design Rules, Guidelines in HCI and Evaluation (6 hours)
Principles to support usability, standards and guidelines, Shneiderman's eight golden rules, Nielsen's ten heuristics, Heuristic evaluation, contextual evaluation, Evaluation through expert analysis, evaluation through user participation
Module 5: Human Factors And Security and Validation Concepts (7 hours)
Groupware systems, computer mediated communication, Meeting and decision support systems, Shared applications and artifacts, Frameworks for groupware Implementing synchronous groupware, Augmented and Virtual Reality, Validations - Usability testing, Interface Testing, User Acceptance Testing

Textbooks

1. A Dix, Janet Finlay, G D Abowd, R Beale., Human-Computer Interaction, 3rd Edition, Pearson Publishers, 2008
2. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2010.

Reference Books

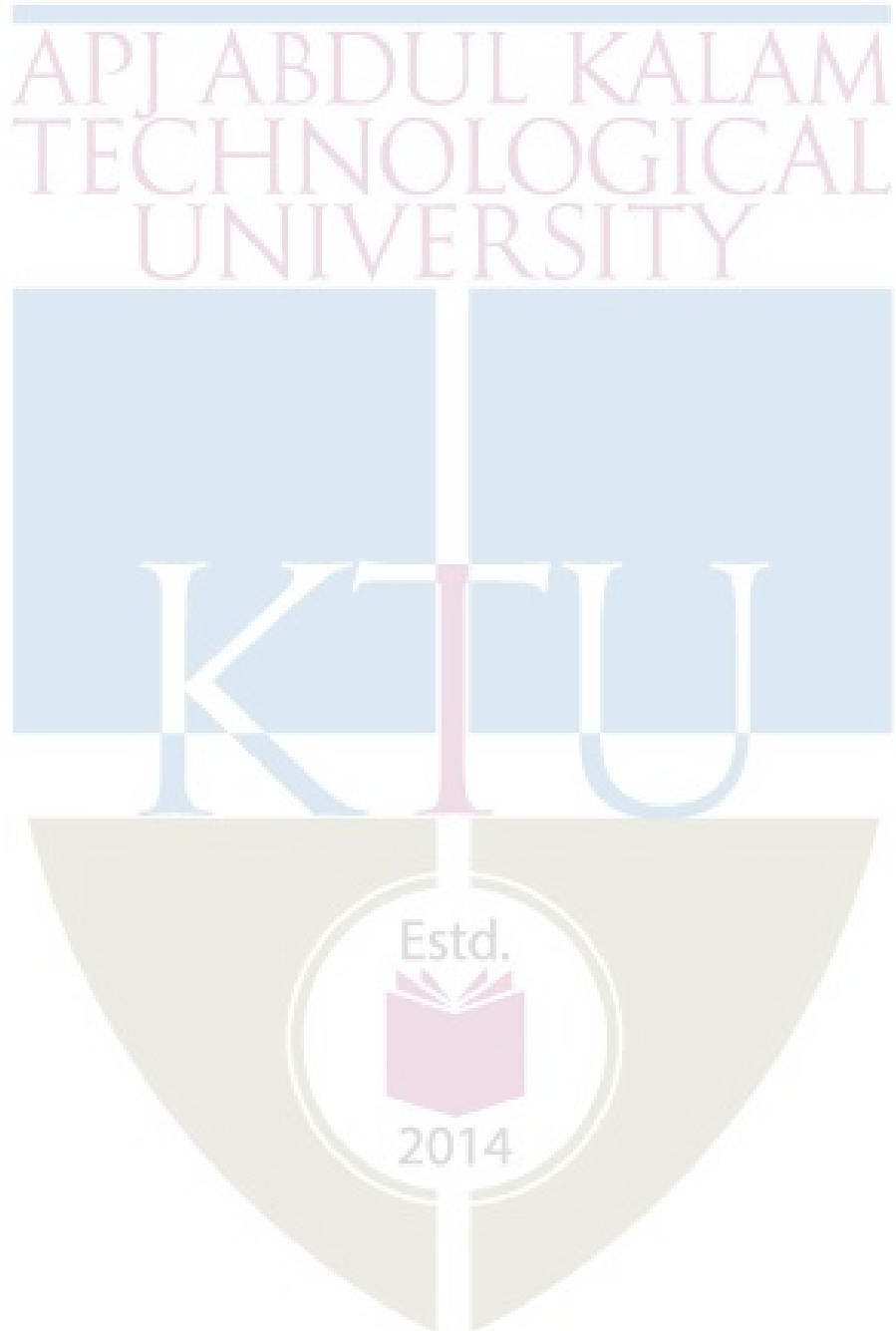
1. Rogers, Sharp & Preece, Interaction Design, Beyond Human-Computer Interaction, Third Edition, Wiley, 2014.
2. Pamayiotis Zaphiris & Sri Kurniawan, Human Computer Interaction research in Web Design and Evaluation, First Edition, Idea Group Publishing, 2007.

3. Dan, R. Olsen, Jy, Human Computer Interaction, First Edition, Cengage Learning, 2010.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	HCI Foundations	7 hours
1.1	Input–Output channels	1
1.2	Human memory	2
1.3	Individual differences	1
1.4	Text entry devices	1
1.5	Display devices	1
1.6	Devices for virtual reality and 3D interaction	1
2	Designing Interaction	6 hours
2.1	Models of Interaction, Frameworks and HCI	1
2.2	Interaction Styles	1
2.3	Contexts of Interaction	1
2.4	The Process of Design, Navigation Design	1
2.5	Screen Design and Layout	1
2.6	Iteration and Prototyping	1
3	Cognitive Models	9 hours
3.1	Goal and Task hierarchy	1
3.2	GOMS, Linguistic Models	1
3.3	Physical and device Models	1
3.4	Cognitive architectures	1
3.5	Communication and collaboration models	1
3.6	Face to face communication, Text Based communication	1
3.7	Group working	1
3.8	Task Analysis, Task decomposition.	2
4	Design Rules, Guide Lines in HCI and Evaluation	6 hours
4.1	Principles to support usability, standards, and guidelines	1
4.2	Shneiderman's eight golden rules	1
4.3	Nielsen's ten heuristics, Heuristic evaluation	1
4.4	contextual evaluation,	1
4.5	Evaluation through expert analysis,	1
4.6	Evaluation through user participation	1
5	Human Factors, Security and Validation Concepts	7 hours
5.1	Groupware systems, computer mediated communication,	2
5.2	Meeting and decision support systems, Shared applications and artifacts	1
5.3	Frameworks for groupware, Implementing synchronous groupware	2

5.4	Augmented and Virtual Reality	1
5.5	Usability testing, Interface Testing, User Acceptance Testing perceptual interfaces	1



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT466	PARALLEL PROCESSING	PEC	2	1	0	3

Preamble: The main goal of this course is to equip students with knowledge and skills on how parallel architecture and how parallel algorithms could run on modern computing devices

Prerequisite: ITT204 Computer Organization

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain the basic concepts of parallel processing and parallel processors.	Level 2: Understand
CO 2	Outline the management of parallel systems shared memory and interconnection networks	Level 2: Understand
CO 3	Discuss the significance of Core Level Parallel Processing, Grid and Cloud Computing	Level 2: Understand
CO 4	Describe the significance of Parallel Algorithms	Level 2: Understand
CO 5	Write and demonstrate simple Parallel Programs	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	-	-	-	-	-	-	-	2
CO 2	3	2	2	1	-	-	-	-	-	-	-	2
CO 3	3	2	2	1	-	-	-	-	-	-	-	2
CO 4	3	2	3	1	-	-	-	-	-	-	-	2
CO 5	3	2	3	2	2	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	20	10	20
Level 2: Understand	30	30	70
Level 3: Apply		10	10
Level 4: Analyze			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have a maximum 2 subdivisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. Discuss Pipelining.
2. Explain the features of superscalar processors.
3. List the advantages of Multithreaded Processors?

Course Outcome 2 (CO 2):

1. What are SIMD Computers?
2. How Message Passing takes place in Parallel Computers?
3. List the applications of an Array Processor?

Course Outcome 3 (CO 3):

1. Discuss the generalized structure of Chip Multiprocessors (CMPs)
2. List the issues which arise while designing the interconnection system between cores in a multicore processor.
3. Explain the features of General Purpose Graphics Processing Unit (GPGPU)

Course Outcome 4 (CO 4):

1. Explain the structure of RAM
2. List the four categories of PRAM Model
3. Discuss the procedure for mesh search.

Course Outcome 5 (CO 5):

1. Write an OpenMP program to compute π
2. What are CUDA Threads, Thread Blocks, Grid and Kernel
3. Write a CUDA program to multiply two matrices.

Model Question Paper

Course Code: ITT466
Course Name: PARALLEL PROCESSING

Max.Marks :100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

1. What is the difference between Branch Prediction Buffer and Branch Target Buffer used to reduce the delay in control dependency?
2. What are VLIW processors?
3. List the advantages of shared memory parallel computers using a bus for sharing memory and an interconnection network for sharing memory.
4. What is the difference between a blocking switch and a non-blocking switch?
5. The number of transistors which are packed in a microprocessor chip has been doubling every two years. Will this trend stop? Explain the reasoning for your answer.
6. What are the differences between a chip multiprocessor and a many core processor?
7. Differentiate between RAM and PRAM
8. How do we perform searching on tree interconnection networks?
9. What are the advantages and disadvantages of explicit and implicit parallel programming approaches?
10. Write short notes on the real world applications of Hadoop.

Part B

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*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11	a.	Compare Data and Temporal parallel processing	5
	b.	Explain in detail about Multithreaded Processors	9

OR

12	a.	Discuss the delays in pipelining	9
	b.	Explain Instruction level Parallelism	5
13	a.	What are the similarities and differences between (i) Vector processing, (ii) Array processing, and (iii) Systolic processing? Give an application of each of these modes of computation in which their unique characteristics are essential.	9
	b.	Write short notes on Distributed Shared Memory Parallel Computers	5

OR

14	a.	Discuss Flynn's Classification of Computers	7
	b.	Explain Routing techniques for Directly Connected Multicomputer Systems	7
15	a.	Explain the structure of Chip Multiprocessor with neat diagram	10
	b.	Enumerate the differences between multithreaded parallelism and multicore parallelism.	4

OR

16	a.	Write short notes on cache coherence protocols used in CMPs	4
	b.	What are the types of interconnection networks used to interconnect cores in many-core processors? List the advantages and disadvantages of each of these.	10
17	a.	Discuss Concurrent Read Concurrent Write (CRCW) PRAM	4
	b.	Explain the various parallel algorithms to perform matrix multiplication	10

OR

18	a.	Write short notes on the analysis of parallel algorithms	4
	b.	Discuss how searching is done in a sorted sequence and a random sequence in PRAM Models	10
19	a.	What are the OpenMP synchronization constructs ?	4
	b.	Write CUDA and OpenCL programs to transpose a square matrix.	10

OR

20	a.	Discuss message passing with MPI	4
	b.	Write a pseudocode that illustrates the basic structure of a MapReduce program that counts the number of occurrences of each word in a collection of documents.	10

Syllabus

Module 1: Introduction (7 Hours)
Introduction, Solving Problems in Parallel, Instruction Level Parallel Processing, Pipelining of Processing Elements, Delays in Pipeline Execution ,Difficulties In Pipelining , Superscalar Processors , Very Long Instruction Word (VLIW) Processor, Some commercial processors Multithreaded Processors.
Module 2: Parallel Computers, Shared Memory Concepts & Interconnection Networks (7 Hours)
Structure of Parallel Computers, A Generalized Structure of a Parallel Computer; Classification of Parallel Computers , Vector Computers , A Typical Vector Supercomputer, Array Processors, Systolic Array Processors, Shared Memory Parallel Computers, Interconnection Networks, Distributed Shared Memory Parallel Computers, Message Passing Parallel Computers
Module 3: Core Level Parallel Processing (7 Hours)
Core Level Parallel Processing: Consequences of Moore's law and the advent of chip multiprocessors , A generalized structure of Chip Multiprocessors ,MultiCore Processors or Chip MultiProcessors (CMPs), Chip Multiprocessors using Interconnection Networks , General Purpose Graphics Processing Unit (GPGPU)
Module 4: Parallel Algorithms (7 Hours)
Parallel Algorithms , Models of Computation - RAM - PRAM ,Analysis of Parallel Algorithms Searching,Matrix Operations -Matrix Multiplication
Module 5: Parallel Programming(7 Hours)
Parallel Programming , Message Passing Programming with MPI , Shared Memory Programming with OpenMP , Heterogeneous Programming with CUDA and OpenCL , Programming in Big Data Era -Mapreduce -Hadoop

Text Books

1. V Rajaraman, C Siva Ram Murthy, Parallel Computers- Architecture and Programming, PHI learning, Second edition, 2016.

Reference Books

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Introduction to Parallel Computing, Addison-Wesley an imprint of Pearson Education, Second Edition, 2003. (<http://wwwusers.cs.umn.edu/~karypis/parbook/>).
2. Vipin Kumar, Ananth Grama, Anshul Gupta, and George Karypis, Introduction to Parallel Computing Design and Analysis of Algorithms, The Benjamin/Cummings Publishing Company, Inc. 1994.
3. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP, Mc Graw Hill, 2003.
4. Harry F. Jordan and Gita Alaghband, Fundamentals of Parallel Processing, Prentice Hall and Pearson Education, 2003.

Course Contents and Lecture Schedule

INFORMATION TECHNOLOGY

Sl. No.	Topic	No. of Lectures
1	Introduction	7 Hours
1.1	Why Do We Need High Speed Computing? - How Do We Increase The Speed Of Computers? Some Interesting Features Of Parallel Computers	1
1.2	Utilizing Data Parallelism -Comparison of Temporal And Data Parallel Processing	1
1.3	Data Parallel Processing With Specialized Processors-Inter-Task Dependency Instruction Level Parallel Processing	1
1.4	Instruction Level Parallel Processing; Pipelining of Processing Elements ; Delays In Pipeline Execution	1
1.5	Difficulties in Pipelining; Superscalar Processors; Very Long Instruction Word (VLIW) Processor	1
1.6	Some Commercial Processors : ARM Cortex A9 Architecture, Intel Core I7 Processor , IA-64 Processor Architecture	1
1.7	Multithreaded Processors - Coarse Grained Multithreading, Fine Grained Multithreading , Simultaneous Multithreading	1
2	Parallel Computers, Shared Memory Concepts & Interconnection Networks	7 Hours
2.1	A Generalized Structure of a Parallel Computer -Classification of Parallel Computers - Flynn's Classification	1
2.2	Coupling Between Processing Elements, Classification Based On Mode of Accessing Memory , Classification Based On Grain Size	1
2.3	Vector Computers- A Typical Vector Supercomputer- Array Processors - Systolic Array Processors	1
2.4	Shared Memory Parallel Computers Synchronization of Processes in Shared Memory Computers	1
2.5	Shared Bus Architecture - Shared Memory Parallel Computer using an Interconnection Network.	1
2.6	Interconnection Networks - Networks to Interconnect Processors to Memory or Computers to Computers	1
2.7	Direct Interconnection of Computers - Routing Techniques For Directly Connected Multicomputer Systems, Distributed Shared Memory Parallel Computers	1
3	Core Level Parallel Processing,	7 Hours
3.1	Core Level Parallel Processing: Consequences of Moore's law and the advent of chip multiprocessors	1
3.2	A generalized structure of Chip Multiprocessors	1
3.3	MultiCore Processors or Chip MultiProcessors (CMPs)- -Cache Coherence in Chip Multiprocessors	1
3.4	Chip Multiprocessors using Interconnection Networks - Ring	1

	Interconnection of Processors	
3.5	Ring Bus Connected Chip Multiprocessors - Intel Xeon Phi Coprocessor Architecture [2012]	1
3.6	Mesh Connected Many Core Processors - Intel Teraflop Chip [Peh, Keckler and Vangal, 2009] -	1
3.7	General Purpose Graphics Processing Unit (GPGPU)	1
4	Parallel Algorithms	7 Hours
4.1	Parallel Algorithms- Models of Computation	1
4.2	The Random Access Machine (RAM)	1
4.3	The Parallel Random Access Machine (PRAM) - Interconnection Networks	1
4.4	Analysis of Parallel Algorithms - Running Time - Number of Processors - Cost	1
4.5	Searching- Searching on PRAM Models	1
4.6	Searching on Interconnection Networks	1
4.7	Matrix Operations- Matrix multiplication only	1
5	Parallel Programming	7 Hours
5.1	Message Passing Programming - Introduction	1
5.2	Message Passing Programming with MPI	1
5.3	Shared Memory Programming with OpenMP	1
5.4	Shared Memory Programming with OpenCL	1
5.5	Heterogeneous Programming With CUDA	1
5.6	Programming In Big Data Era ,Mapreduce	1
5.7	Programming In Big Data Era , Hadoop	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT476	NETWORK SCIENCE	PEC	2	1	0	3

Preamble: The course seeks to introduce fundamental elements of the emerging science of complex networks and their applications. Network science is an emerging discipline that investigates the topology, structural properties, evolution dynamics, and vulnerabilities of complex networks. The applications of network science span a wide variety of areas: Internet, physical, biological, ecology, and social systems. Network Science course will focus on the algorithmic, computational, and statistical methods of network science. This course will also discuss the robustness of networks, community structures and modelling of the spreading of disease using complex networks.

Prerequisite: MAT 101 Linear Algebra and Calculus, MAT 208 Probability, Statistics and Advanced Graph Theory.

Course Outcomes: After the completion of the course the student will be able to

CONo.	Course Outcomes (CO)	Bloom's Category Level
CO 1	Discuss the main concepts and characteristics of network science.	Level2: Understand
CO 2	Explain the evolution of random network based on graph theoretical concepts.	Level 2: Understand
CO 3	Interpret the nature of scale free networks based on Barabasi-Albert model.	Level2: Understand
CO 4	Build robust network by assessing the structural vulnerabilities.	Level3: Apply
CO 5	Model disease spreading pattern in communities.	Level 3: Apply

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	1	-	-	-	-	-	-	2
CO 2	3	2	-	-	-	-	-	-	-	-	-	2
CO 3	3	2	-	-	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	3	2	-	-	-	-	-	2
CO 5	3	3	3	3	3	3	-	-	-	-	-	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	20	5	25
Understand	30	20	50
Apply		25	25
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Discuss the possibilities of understanding the complexity from the perspective of Complex Network.
2. Explain the nature of complex system with an example.
3. Comment on the structural similarity of real-world networks by citing examples.

Course Outcome 2 (CO2)

1. Compare and contrast random networks and real-world networks.

2. Explain the evolution of random network and the emergence of giant component.
3. Explain the use of degree distribution in explaining the structural similarity in networks.

Course Outcome 3(CO3):

1. Explain the Scale Free phenomenon and its significance.
2. Compare real network and random network based on average path length, clustering coefficient and degree distribution.
3. Explain the presence of hubs in real networks based on Barabasi-Albert model.

Course Outcome 4 (CO4):

1. Consider a star network, where a single node is connected to $N - 1$ degree one nodes. Assume that $N \gg 1$. How can you explain the assortative or disassortative nature of this network.
2. Calculate the critical threshold f_c for networks with Power law with exponential cut off.
3. Explain the breakdown of a network as inverse percolation.

Course Outcome 5 (CO5):

1. Consider a one-dimensional lattice with N nodes that form a circle, where each node connects to its two neighbours. Partition the line into n_c consecutive clusters of size $N_c = N/n_c$. Calculate the modularity of the obtained partition.
2. Calculate the characteristic time τ and the epidemic threshold λ_c of the SI, SIS and SIR models for networks with Exponential degree distribution.
3. “Random immunization is unable to eradicate a disease, but selective immunization, that targets the hubs can help us eradicate the disease”, Do you agree with the statement? Justify your answer.

Model Question paper

Course Code: ITT476
Course Name: NETWORK SCIENCE

Max.Marks:100

Duration: 3 Hours

PART A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

1. Define complex network. How study of complex network is useful in understanding

the complex systems.

2. Explain the nature of complex system with an example.
3. Define Erdos-Renyi network.
4. Explain the small world phenomenon.
5. Comment on the difference observed in degree distribution of random graphs and scale free networks.
6. Explain clustering coefficient.
7. Define assortative and disassortative network with example.
8. Explain Molloy-Reed Criterion.
9. Define strong and weak communities.
10. Explain Susceptible-Infected-Recovered (SIR) Model.

PART B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. Explain the universality of network characteristics by analysing various real world networks. 14

OR

12. Explain the characteristics of network science with example. 14

- 13.a. Explain the evolution of random network and the emergence of giant component. 7

- b. Define Degree distribution? Explain its importance in analysing the structure of Internet. 7

OR

14. Compare real network and random network based on average path length, clustering coefficient and degree distribution. 8

- a. Compare the structure of random network and real network based on cluster size distribution. 6

- 15.a. Explain briefly the Scale Free phenomenon and its significance. 8

- b. Explain power law distribution. 6

OR

INFORMATION TECHNOLOGY

- 16.a. Analyse the relationship between the formation of hubs in network and power law degree distribution. 8
- b. Explain Barabasi-Albert model of growth of complex network. 6
- 17.a. How can you measure Degree Correlations? Explain how this measure helps to study assortative and disassortative Network. 7
- b. “Scale free network show robustness towards random node failure”, Do you agree with the statement, Justify your answer. 7

OR

- 18.a. Write a note on percolation theory. Explain How percolation theory is used for studying robustness of a network. 8
- b. Write a note on friendship paradox in the context of scale free networks. 6
- 19.a. Suggest and explain one method to find number of ways the nodes of a network can be grouped into communities. 6
- b. Compare and contrast the SI, SIS and SIR Models for Epidemic Modelling. 8

OR

20. Explain agglomerative and divisive procedures used for community detection. 9
- a. Compare them based on computational complexity.
- b. Explain how the speed with which a pathogen spreads depends on the degree distribution of the relevant contact network. 5

Syllabus

Module 1: Introduction to Network science (5 Hours)

Introduction to network science- The main premise of network science, History and relation to graph theory, physics, sociology, and other disciplines, Examples of networks from different application domains, The characteristics of Network Science, societal and scientific impact.

Familiarisation of Network analysis and visualization tools- NetworkX, Gephi, Cytoscape, Infomap, Igraph, Statnet, Network Workbench, Pajek network visualization, Jung network analysis, GraphViz, Matlab's Random Boolean Networks (RBN) toolbox.

Module 2:Random Networks(6 Hours)

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Relevant Concepts From Graph Theory-Undirected, directed, signed, weighted and spatial networks ,Paths, connected components ,Directed Acyclic Graphs, Bipartite graphs Max-flow/min-cut, Clustering coefficients.

The Random Network Model- Introduction, Number of Links, Degree Distribution in random network, The Evolution of a Random Network, Small Worlds, Clustering Coefficient in random network, Watts-Strogatz model.

Module 3: Scale Free Propertyand The Barabasi-Albert model (7 Hours)

Power Laws and Scale-Free Networks, Discrete Formalism, Continuum Formalism, Hubs, The Meaning of Scale-Free, Universality, Ultra-Small Property, The Role of the Degree Exponent.

The Barabasi-Albert model-Growth and Preferential Attachment, TheBarabási-Albert Model, Degree Dynamics, Degree Distribution in BA Model, Measuring Preferential Attachment, Non-linear Preferential Attachment,The Origins of Preferential Attachment,Diameter and Clustering Coefficient.

Module 4: Degree correlations and Network Robustness(8 Hours)

Degree correlations-Assortativity and Disassortativity, Measuring Degree Correlations, Structural Cutoffs, Correlations in Real Networks, Generating Correlated Networks, The Impact of Degree Correlations.

Network Robustness- Percolation Theory, Inverse Percolation Transition and Robustness, Robustness of Scale-free Networks, Molloy-Reed Criterion, Critical Threshold, Attack Tolerance,Cascading Failures, Modelling Cascading Failures, Failure Propagation Model, Branching Model, Building Robustness,Designing Robust Networks.

Module 5: Communities and Spreading Phenomena (9 Hours)

Communities- Basics of Communities,Hierarchical Clustering,Agglomerative Procedures: theRavasz Algorithm, Divisive Procedures: the Girvan-Newman Algorithm, Hierarchy in Real Networks, Modularity, OverlappingCommunities, Testing Communities, Characterizing Communities.

Spreading Phenomena- Epidemic Modelling, Susceptible-Infected (SI) Model, Susceptible-Infected-Susceptible (SIS) Model, Susceptible-Infected-Recovered (SIR) Model, Network Epidemics, Susceptible-Infected (SI) Model on a Network, SIS Model and the Vanishing Epidemic Threshold, Contact Networks, Digital Viruses,Beyond the Degree Distribution, Temporal Networks,Bursty Contact Patterns, Complex Contagion, Immunization, Random Immunization, Vaccination Strategies in Scale-Free Networks, Epidemic Prediction, ‘What if’ Analysis, Effective Distance.

Text Books

1. A-L. Barabási, Network Science, Cambridge University Press 2016, Available online: <http://barabasi.com/networksciencebook/>
2. M.E.J. Newman, Networks - An introduction, Oxford Univ Press, 2010.
3. D. Easley and J. Kleinberg, Networks, Crowds and Markets, Cambridge Univ Press.

Reference Books

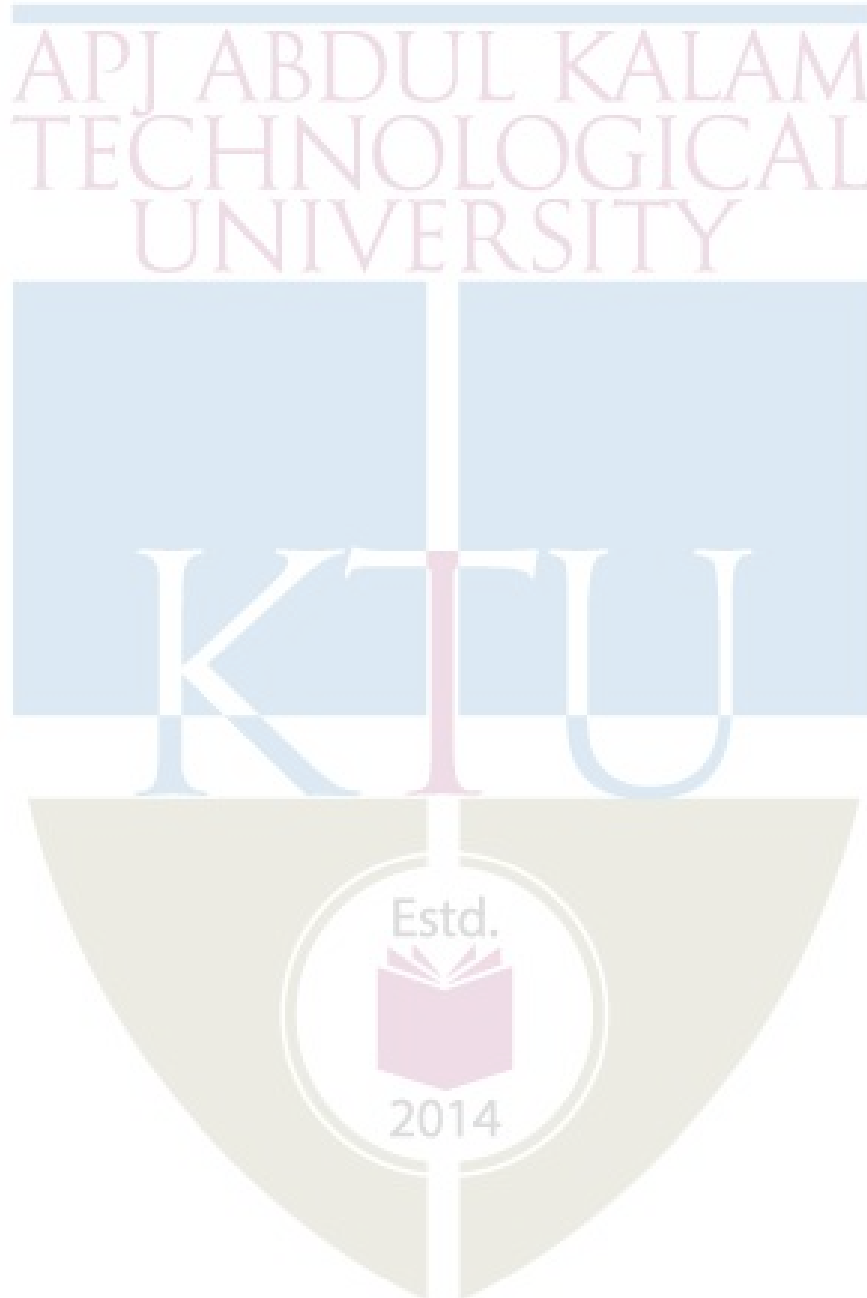
1. R. Cohen and S. Havlin, Complex Networks - Structure, Robustness and Function, Cambridge Univ Press, 2010.
2. M.O. Jackson, Social and Economic Networks, Princeton Univ Press, 2008.
3. Barrat, M. Barthélemy and A. Vespignani, Dynamical Processes on Complex Networks, Cambridge Univ Press, 2008.
4. E. Kolaczyk, Statistical analysis of network data, Springer, 2009.
5. S. Wasserman, K. Faust, Social Network Analysis: Methods and Applications, Cambridge Univ Press, 1994.
6. P. Van Mieghem, Graph Spectra for Complex Networks, Cambridge Univ Press, 2011.
7. R. Diestel, Graph Theory (4th edition), Springer, 2010.
8. R.K. Ahuja and T.L. Magnanti, Network Flows: Theory, Algorithms, and Application, Pearson, 1993.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction to network science	5 Hours
1.1	The main premise of network science, History and relation to graph theory, physics, sociology, and other disciplines, Examples of networks from different application domains.	2
1.2	The characteristics of Network Science, societal and scientific impact.	1
1.3	Familiarisation of Network analysis and visualization tools- NetworkX, Gephi, Cytoscape, Infomap, Igraph, Statnet, Network Workbench, Pajek network visualization, Jung network analysis, GraphViz, Matlab's Random Boolean Networks (RBN) toolbox.	2
2	Random Networks	6 Hours
2.1	Relevant Concepts From Graph Theory -Undirected, directed, signed, weighted and spatial networks, Paths, connected components.	1
2.2	Directed Acyclic Graphs, Bipartite graphs Max-flow/min-cut, Clustering coefficients.	1
2.3	The Random Network Model- Introduction, Number of Links, Degree Distribution in random network.	1

2.4	The Evolution of a Random Network.	1
2.5	Small Worlds, Clustering Coefficient in random network	1
2.6	Watts-Strogatz model.	1
3	Scale Free Property and The Barabasi-Albert model	7 Hours
3.1	Scale Free Property- Introduction, Power Laws and Scale-Free Networks, Discrete Formalism, Continuum Formalism, Hubs.	2
3.2	The Meaning of Scale-Free, Universality	1
3.3	Ultra-Small Property, The Role of the Degree Exponent.	1
3.4	Growth and Preferential Attachment, The Barabási-Albert Model, Degree Dynamics, Degree Distribution in BA Model, Measuring Preferential Attachment, Non-linear Preferential Attachment.	2
3.5	The Origins of Preferential Attachment, Diameter and Clustering Coefficient.	1
4	Degree correlations and Network Robustness	8 Hours
4.1	Degree correlations-Introduction, Assortativity and Disassortativity, Measuring Degree Correlations.	2
4.2	Structural Cut-offs, Correlations in Real Networks	1
4.3	Generating Correlated Networks, The Impact of Degree Correlations.	1
4.4	Network Robustness- Introduction, Percolation Theory, Inverse Percolation Transition and Robustness, Robustness of Scale-free Networks.	1
4.5	Molloy-Reed Criterion, Critical Threshold, Attack Tolerance.	1
4.6	Modelling Cascading Failures, Failure Propagation Model, Branching Model, Building Robustness, Designing Robust Networks.	2
5	Communities and Spreading Phenomena	9 Hours
5.1	Communities- Introduction, Basics of Communities, Hierarchical Clustering, Agglomerative Procedures: the Ravasz Algorithm, Divisive Procedures: the Girvan-Newman Algorithm.	2
5.2	Hierarchy in Real Networks, Modularity, Overlapping Communities.	1
5.3	Testing Communities, Characterizing Communities.	1
5.4	Spreading Phenomena- Introduction, Epidemic Modelling, Susceptible-Infected (SI) Model, Susceptible-Infected-Susceptible (SIS) Model, Susceptible-Infected-Recovered	2
5.5	Model, Network Epidemics, Susceptible-Infected (SI) Model on a Network, SIS Model and the Vanishing Epidemic Threshold, Contact Networks.	1

5.6	Digital Viruses, Beyond the Degree Distribution, Temporal Networks, Bursty Contact Patterns, Complex Contagion.	1
5.7	Immunization, Random Immunization, Vaccination Strategies in Scale-Free Networks, Epidemic Prediction, 'What if' Analysis, Effective Distance.	1



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VIII

PROGRAM ELECTIVE V



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT418	INFORMATION STORAGE MANAGEMENT	PEC	2	1	0	3

Preamble: Information Storage Management is a graduate – level preliminary course to understand data creation, the amount of data being created, the value of data to a business, challenges in data storage and data management. The course is divided into five modules: (1) Data, Information (2) DAS, SCSI, SAN (3) NAS (4) Information availability (5) Securing the storage infrastructure

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain data creation and the value of data to a business.	Level 2: Understand
CO 2	Describe the solutions available for data storage and core elements of a storage infrastructure	Level 2: Understand
CO 3	Summarise concepts of SAN storage technologies	Level 2: Understand
CO 4	Explain concepts of NAS storage technologies	Level 2: Understand
CO 5	Describe challenges in data storage security	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	1	-	-	-	-	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	-
CO 3	2	2	1	-	-	-	-	-	-	-	-	-
CO 4	2	2	1	-	-	-	-	-	-	-	-	-
CO 5	2	2	2	-	-	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Assessment Pattern

INFORMATION TECHNOLOGY

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	40	40	80
Level 3: Apply			
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Define Data and Information
2. Explain the evolution of storage architecture and data centre infrastructure
3. Explain Information lifecycle.
4. Describe RAID and Intelligent storage system

Course Outcome 2 (CO 2):

1. Differentiate DAS, SAN and SCSI.
2. Explain various connectivity options.
3. Explain SAN based virtualization.

Course Outcome 3 (CO 3):

1. Describe NAS, its benefits, components, implementations.
2. Explain object based storage.
3. Describe CAS

Course Outcome 4 (CO 4):

1. Explain information availability
2. Describe backup and restore and SCB - Topologies
3. Explain local replication, remote replication and advanced replication technologies.

Course Outcome 5 (CO 5):

1. Explain how to securing the storage infrastructure.
2. Describe how to manage the storage infrastructure
3. Explain Data Warehousing with Oracle BI

Model Question Paper

Course Code: ITT418

Course Name: INFORMATION STORAGE MANAGEMENT

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Differentiate between Data and Big Data.
2. Write a short note on Stripping & mirroring
3. Describe the various type of FC Connectivity.
4. Describe the Components of FC SAN?
5. Explain the benefits of NAS?
6. Describe the key features of CAS.
7. Define Information Availability.
8. Explain the purposes of Backup?
9. List information security framework goals.
10. Describe the Challenges in Storage Infrastructure Management.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11	a.	Which are the essential software parts of a host system in a Data centre environment?	7
	b.	Write notes: read and write Operation with Cache.	7
OR			
12	a.	Differentiate between Software RAID and Hardware RAID	5
	b.	What are the components of an Intelligent Storage System?	9

13	a. Explain Fibre Channel Architecture.	9
	b. Describe SAN based virtualization.	5
OR		
14	a. Explain FCoE and its Frame Structure.	7
	b. List the components of iSCSI.	7
15	a. Explain different type of NAS Implementations.	9
	b. List the various NAS File Sharing Protocols?	5
OR		
16	a. Describe about Object-Based Storage Devices.	9
	b. Explain the key components of Unified Storage	5
17	a. Describe BC terminology and Planning lifecycle.	7
	b. Explain backup topologies.	7
OR		
18	a. Explain various Local Replication Technologies.	7
	b. Explain various Remote Replication Technologies.	7
19	a. List the security implementations in SAN.	8
	b. Write the componentsmonitored in a Storage Infrastructure.	6
OR		
20	a. How to secure storage infrastructure in NAS.	9
	b. Describe the management activities in Storage Infrastructure.	5

Syllabus

Module 1 (7 Hours)
Data, Information, Evolution of storage architecture, Data center infrastructure, Information lifecycle. Data center environment: Application - Desktop - Memory virtualization RAID: Implementation - Methods - Levels, Intelligent storage system
Module 2(7 Hours)
Introduction to DAS and SCSI, SAN: Components - Connectivity options - Ports - FC architecture - Zoning - FC topologies, SAN based virtualization: Block level - VSAN, IP SAN: iSCSI - FCIP components - FCIP topology and frame structure, FCOE: Components – Benefits
Module 3:(7 Hours)
NAS: Benefits – Components - Implementations - File sharing protocols - I/O operations - Factors affecting NAS performance - File level virtualization, Object based storage: Operation Benefits - Fixed content and archives - Archive types, CAS: Architecture - Operations - Use cases, Unified storage.
Module 4 (7 Hours)
Introduction: Information availability - BC terminology - Planning lifecycle - Business impact analysis - Technology solutions, Backup and restore: Purposes - Methods - Architecture - Operations - SCB - Topologies - Targets - Deduplication, Local Replication: Terminology - Data consistency - Technologies - Restore and restart considerations,

Remote replication: Modes - Technologies - Advanced replication technologies.

Module 5: (7 Hours)

Securing the storage infrastructure: Security terminology - Security framework – Risk triad - Security domains -Implementations - Managing the storage infrastructure: Monitoring - Activities - Challenges - Solutions Data Warehousing with Oracle BI

Text Books

1. Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, New Delhi, 2006.
2. Somasundaram G, Alok Shrivastava, ISM – Storing, Managing and Protecting Digital Information, EMC Education Services, Wiley India, New Delhi, 2012.

Reference Books

1. Gerald J Kowalski, Mark T Maybury, Information Storage and Retrieval Systems: Theory and Implementation, BS Publications, New Delhi, 2009.
2. Marc Farley Osborne, “Building Storage Networks”, Tata McGraw Hill, New Delhi, 2001.
3. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education, New Delhi, 2002.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Module 1	7 Hours
1.1	Data, Information, Evolution of storage architecture, Data centre infrastructure, Information lifecycle.	1
1.2	Data centre environment, Application, Desktop, Memory virtualization	2
1.3	RAID: Implementation, Methods, Levels.	2
1.4	Intelligent storage system	2
2	Module 2	7 Hours
2.1	Introduction to DAS and SCSI	1
2.2	SAN: Components	1
2.3	Connectivity options - Ports	1
2.4	FC architecture - Zoning, FC topologies	1
2.5	SAN based virtualization: Block level - VSAN, IP SAN iSCSI	1
2.6	FCIP components - FCIP topology and frame structure	1
2.7	FCOE: Components – Benefits.	1
3	Module 3	7 Hours
3.1	NAS: Benefits – Components - Implementations	1

3.2	File sharing protocols	1
3.3	I/O operations - Factors affecting NAS performance	1
3.4	File level virtualization,	1
3.5	Object based storage: Operation Benefits	1
3.6	Fixed content and archives - Archive types,	1
3.7	CAS: Architecture - Operations - Use cases, Unified storage.	1
4	Module 4	7 Hours
4.1	Information availability - BC terminology	1
4.2	Planning lifecycle	1
4.3	Business impact analysis - Technology solutions,	1
4.4	Backup and restore: Purposes - Methods - Architecture - Operations	1
4.5	SCB - Topologies - Targets - Deduplication, Local Replication: Terminology	1
4.6	Data consistency - Technologies - Restore and restart considerations,	1
4.7	Remote replication: Modes - Technologies - Advanced replication technologies.	1
5	Module 5	7 Hours
5.1	Securing the storage infrastructure:	1
5.2	Security terminology - Security framework	1
5.3	Risk triad - Security domains -Implementations	2
5.4	Managing the storage infrastructure: Monitoring	1
5.5	storage infrastructure Activities - Challenges, Solutions	1
5.6	Data Warehousing with Oracle BI	1



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT428	SOFTWARE QUALITY ASSURANCE	PEC	2	1	0	3

Preamble: This course aims at facilitating the student to understand basic tenets of software quality and quality factors, be exposed to the Software Quality Assurance (SQA) architecture and the details of SQA components and SQA plan.

Prerequisite: ITT 309 Management for software Engineers

Course Outcomes: After the completion of the course the student will be able to

CO NO.	Course Outcome (CO)	Bloom's Category
CO 1	Elaborate about software quality, software quality actors and SQA	Level 2: Understand
CO 2	Explain the pre project and SQA components and interpret the concepts of software testing and CASE tools	Level 2: Understand
CO 3	Describe software quality infrastructure and risk management	Level 2: Understand
CO 4	Identify the software quality metrics and SQA plan	Level 2: Understand
CO 5	Discuss about the quality standards, certification, assessment and organizing for quality assessment	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	-	-	-	-	-	-	-	-	-	1
CO 2	2	1	-	-	-	-	-	-	-	1	-	1
CO 3	2	1	-	-	-	-	-	-	-	-	-	1
CO 4	2	1	-	-	-	1	-	1	-	-	2	2
CO 5	2	1	-	-	-	-	-	1	1	1	-	1

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	80	80	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination(ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. What are software errors and faults?
2. What are the software quality factors?
3. Explain SQA system.

Course Outcome 2 (CO2)

1. Explain contract review.
2. Explain about software testing.

3. What are CASE tools?

Course Outcome 3(CO3):

1. Explain about templates and checklists.
2. Explain Configuration management and Documentation control.
3. Explain risk management.

Course Outcome 4 (CO4):

1. Explain process metrics and product metrics.
2. Explain cost of software quality.
3. Describe SQA planning.

Course Outcome 5 (CO5):

1. Explain different Quality management standards.
2. Explain the concept of organizing for Quality Assurance.

Model Question paper

Course Code: ITT428

Course Code: SOFTWARE QUALITY ASSURANCE

Max Marks:100

Duration: 3hr

PART A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Differentiate software errors, faults and failures.
2. Write note on human components in the SQA system.
3. Distinguish between verification and validation.
4. Explain the elements of quality plan.
5. What are templates?
6. Explain the human factors in risk management.
7. What are the limitations of software metrics?
8. What are the application of cost model?

9. Explain on CMMI.
10. What is the role of management in SQA?

PART B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11.	a. Explain about McCall's Quality model.	9
	b. What is the need for software quality requirements?	5
OR		
12.	a. Define SQA. What are its objectives?	4
	b. Illustrate and explain the SQA architecture.	10
13.	a. Explain the concepts of contract review.	7
	b. What are the different strategies of software testing? Explain.	7
OR		
14.	a. Explain the Quality assurance activities in the development process	7
	b. Briefly explain about CASE tools.	7
15.	a. Explain about the corrective and preventive actions for quality control.	10
	b. What are checklists?	4
OR		
16.	a. Describe in detail about documentation control.	8
	b. Explain the different risk management roles.	6
OR		
17.	a. What are the components of project process control? Explain.	7
	b. Explain the Classical quality cost model.	7
OR		
18.	a. Explain in detail about SQA plan.	14
19.	a. What is Bootstrap methodology? Explain.	7
20.	b. Discuss about the SQA units and other actors in SQA systems.	7

OR

21.	a. Write a note on SPICE project.	10
	b. Explain on IEEE software engineering standards.	4

Syllabus

Module 1 (7 Hours)
Introduction: Software quality -The software quality challenge – Software errors, faults and failures – Software quality assurance (SQA) – Definition and objectives. Software quality factors- Need and classification of software quality requirements- McCall's quality model – Software quality factors - Product operation, revision, transition – Alternate models - Software compliance with quality factors. SQA system- An SQA architecture – Pre-project components- Software Project life cycle Components– Infrastructure components for error prevention and improvement- Management components- Human components.
Module 2 (8 Hours)
Pre-project software quality components: Contract review - Development and quality plans SQA components in the project life cycle- Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews. Software Testing –Definitions-Strategies- classification- Software Testing implementations – Quality of software maintenance components – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality.
Module 3 (7 Hours)
Software quality infrastructure: Procedures and work instructions - Templates - Checklists- Staff training and certification. Corrective and preventive actions – Configuration management- Documentation. Risk Management: Risk Management According to Standards and Models- Risk Management Roles- Human Factors and Risk Management.
Module 4 (8 Hours)
Management components of software quality: Project process control – Components – Implementation- Computerized tools. Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics Cost of software quality – Classical quality cost model – Extended model – Application of

Cost model.

Software Quality Assurance Plan : SQA Planning- Executing SQAP

Module 5 (5 Hours)

Standards, certification and assessment: Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project- ISO/IEC 15504 software process assessment standard.

SQA project process standards –IEEE software engineering standards

Organizing for Quality Assurance: Management and its role in software quality assurance- SQA units and other actors in SQA systems.

Text Books

1. Daniel Galin, Software Quality Assurance, Pearson Publication, 2009.
2. Claude Y. Laporte, Alain April, Software Quality Assurance, Wiley, IEEE Computer Society, Inc. 2018

Reference Books

1. Roger S Pressman, Software Engineering: A Practitioner's Approach, Seventh edition, Tata McGraw Hill.

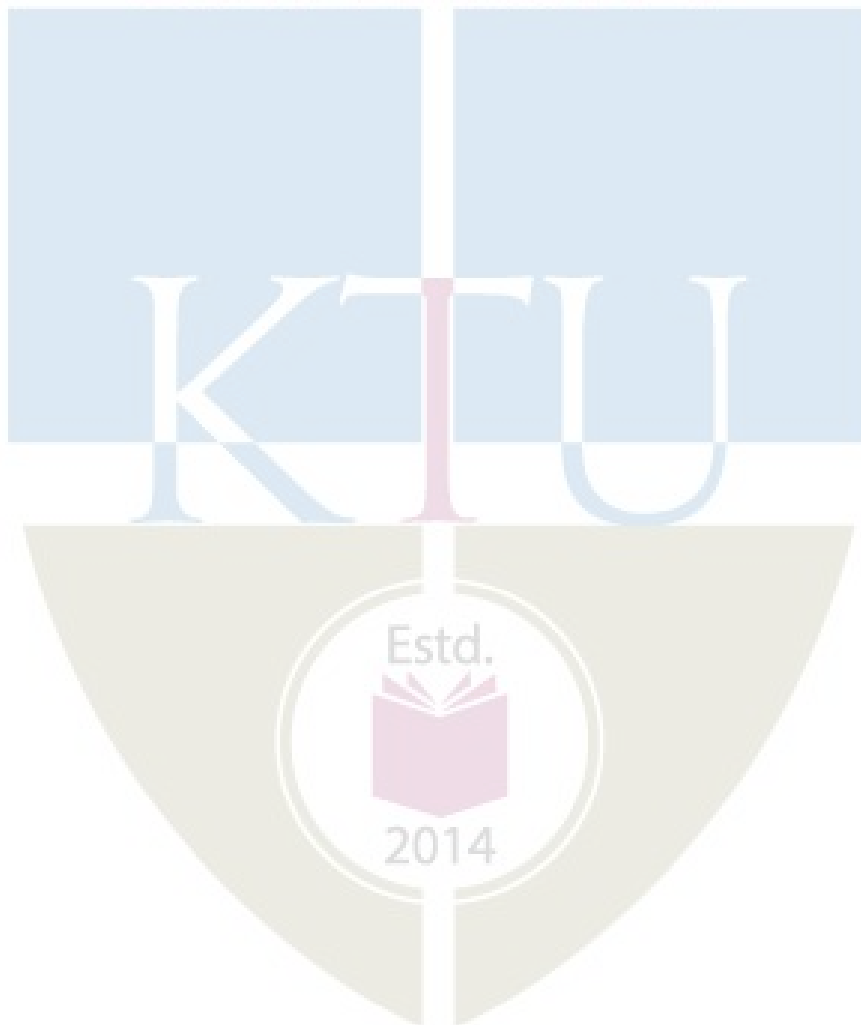
Course Contents and Lecture Schedule

Sl. No	Topic	No. of Lectures
1	Introduction	7 Hours
1.1	Introduction: Software quality – The software quality challenge- Software errors, faults and failures – Software quality assurance (SQA) – Definition and objectives.	1
1.2	Software quality factors- Need and classification of software quality requirements- McCall's quality model –	1
1.3	Software quality factors - Product operation, revision, transition – Alternate models - Software compliance with quality factors.	2
1.4	SQA system- An SQA architecture	1
1.5	Pre-project components- Software Project life cycle Components– Infrastructure components for error prevention and improvement- Management components- Human components.	2
2	Pre-project software quality components	8 Hours
2.1	Pre-project software quality components: Contract review -	2

	Development and quality plans	
2.2	SQA components in the project life cycle- Software Development methodologies	1
2.3	Quality assurance activities in the development process- Verification & Validation – Reviews.	2
2.4	Software Testing –Definitions-Strategies- classification- Software Testing implementations –	1
2.5	Quality of software maintenance components – Pre-Maintenance of software quality components	1
2.6	Quality assurance tools – CASE tools for software quality.	1
3	Software quality infrastructure & Risk Management	7 Hours
3.1	Software quality infrastructure: Procedures and work instructions	1
3.2	Templates - Checklists	1
3.3	Staff training and certification. Corrective and preventive actions	2
3.4	Configuration management-.	1
3.5	Risk Management: Risk Management According to Standards and Models	1
3.6	Risk Management Roles- Human Factors and Risk Management.	1
4	Management components of software quality & SQA	8 Hours
4.1	Management components of software quality: Project process control – Components – Implementation- Computerized tools.	2
4.2	Software quality metrics – Objectives of quality measurement – Process metrics	1
4.3	Product metrics – Implementation – Limitations of software metrics	1
4.4	Cost of software quality – Classical quality cost model	1
4.5	Extended model – Application of Cost model.	1
4.6	Software Quality Assurance Plan : SQA Planning	1
4.7	Executing SQA	1
5	Standards, certification and assessment & Organizing for Quality Assurance	5 Hours
5.1	Standards, certification and assessment: Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies -	1
5.2	Bootstrap methodology – SPICE Project- ISO/IEC 15504 software process assessment standard.	1
5.3	SQA project process standards –IEEE software engineering standards	1

5.4	Organizing for Quality Assurance: Management and its role in software quality assurance-	1
5.5	SQA units and other actors in SQA systems.	1

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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT438	SOFTWARE ARCHITECTURE	PEC	2	1	0	3

Preamble: This course will help the students to understand the software architecture with quality attributes in depth. Various architectural patterns and evaluation methods are discussed in detail. The syllabus also focuses on architecting applications in cloud environments.

Prerequisite: ITT309–Management for Software Engineers, ITT202–Principles of Object Oriented Techniques

Course Outcomes: After the completion of the course the student will be able to:

CO No:	Course Outcomes	BLOOM'S LEVEL
CO 1	Explain software architecture and recognize its importance, various contexts and the role of stakeholders	Level 2: Understand
CO 2	Describe the quality attributes of a software system	Level 2: Understand
CO 3	Summarize the knowledge of various architectural tactics and patterns.	Level 2: Understand
CO 4	Use architectural concepts in the design (ADD), implementation and testing phases of software project life cycle in agile projects	Level 3: Apply
CO 5	Interpret the evaluation, economic analysis and documentation of architectures	Level 2: Understand

Mapping of course outcomes with program outcomes:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1	1	1	1	1	-	-	-	-	-	-	-	-
CO 2	2	2	1	2	-	1	-	-	-	-	-	-
CO 3	1	1	2	2	-	-	-	-	-	-	-	-
CO 4	1	2	2	2	-	-	-	-	-	-	-	-
CO 5	2	2	1	2	-	-	-	-	-	1	2	-

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	15	35
Understand	30	25	55
Apply		10	10
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Define software architecture?
2. Why is software architecture important?
3. Describe architecture in a technical context
4. Describe architecture in a project life cycle context
5. Elaborate the role of different stakeholders in software architecture

Course Outcome 2 (CO2):

1. Describe the general scenario, tactics and the checklist for availability.
2. Why do software systems want to interoperate with each other?
3. Illustrate and explain the parameters for modifiability tactics.
4. How does resource management ensure performance?
5. How can we resist attacks on security.

Course Outcome 3(CO3):

1. Define architectural patterns
2. Explain the context, problem and solution of module patterns.

3. List a few popular architectures or platforms based on Broker pattern.
4. Illustrate the working of a Map-Reduce pattern with suitable diagram
5. Describe the relationship between tactics and patterns

Course Outcome 4 (CO4):

1. How would you employ the Agile practices of pair programming, frequent team interaction, and dedicated customer involvement in a distributed development environment?
2. Explain the Attribute Driven Design Method and its steps.
3. How can we make architecture and code consistent?
4. In embedded systems faults often occur “in the field” and it is difficult to capture and replicate the state of the system that led to its failure. What architectural mechanisms might you use to solve this problem?
5. Explain the different levels of testing and describe the role of architecture in each.

Course Outcome 5 (CO5):

1. Explain the evaluation of architecture using ATAM method
2. How can we document Software Architecture effectively?
3. Describe the CBAM method for economic analysis of architectures.
4. Discuss the architectural challenges in a cloud environment

Model Question paper

Course Code : ITT438

Course Name: SOFTWARE ARCHITECTURE

Max.Marks :100

Duration: 3 Hrs

PART A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Describe the role of software architecture in project risk reduction.
2. List any three stakeholders for a system and their interests in the software architecture.
3. How do you calculate availability of a system?
4. Define three characteristics of security.
5. List the weaknesses of pipe and filter pattern.
6. Define layer bridging in layered pattern
7. Explain Context description in ADD .
8. Describe the term framework ?
9. Why do we use Utility –response curve?
10. List out the different deployment models in cloud.

PART B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. a. List and explain the activities involved in creating a software architecture while developing a project 7
- b. Explain the process recommendations for a good software architecture 7
- OR
12. a. Discuss the technical context of software architecture. 7
- b. How does the architecture help in carrying out the early design decisions? 7
13. a. Explain how faults can be recovered? 10
- b. Define four tactics under detect attacks category. 4
- OR
14. a. Illustrate and describe the general scenario for modifiability 9
- b. Describe manage interfaces tactics for interoperability. 5
15. a. Describe the SOA pattern. 8
- b. List the weaknesses of broker pattern. How broker pattern can be improved with tactics? 6
- OR
16. a. Describe how the MVC pattern separates the application functionality from the user interface functionality? 10
- b. Give examples of systems that employ the publish-subscribe pattern. 4
17. a. Most user interface frameworks have some hooks and callbacks to the application specific functionality. How do these limitations affect the architectural implementation of the rest of the system? 9
- b. How can you ensure consistency of code and architecture? 5
- 2014 OR
18. a. Describe the principles of Incremental Commitment Model in agile projects. 7
- b. Consider an online learning management system and illustrate how agile architecting can be done on the system. 7
19. Explain the steps of ATAM evaluation method 14
- OR
20. a. Describe the essential characteristics of cloud and the different service models 7
- b. With block diagram, explain the architecture and allocation of cloud IaaS platform 7

Syllabus

Module 1 : Introduction (6 hours)
Introduction – Software architecture– importance of software architecture-Architecture in a technical context- Architecture in a project life cycle context, Role of stakeholders
Module 2 : Quality attributes (8 hours)
Quality attributes –Availability, Interoperability, Modifiability, Performance, Security.
Module 3 : Architecture Tactics and Patterns (8 hours)
Architecture Tactics and Patterns – Module patterns, Component and connector patterns, Allocation patterns, Relationship between tactics and patterns
Module 4 : Architecture in the agile project life cycle (6 hours)
Architecture in agile projects-The Attribute Driven Design Method-Architecture and implementation, Architecture and testing
Module 5: ATAM,CBAM, Cloud architecture, Architecture documentation (7 hours)
Architecture evaluation–Architecture Trade off Analysis Method-Documenting Software Architectures –Economic Analysis of Architectures- CBAM, Architecting in a cloud environment

Text Books

- 1.Len Bass, Paul Clements, and Rick Kazman., Software Architecture in Practice , Addison-Wesley Professional , 3rd Edition ,2012.

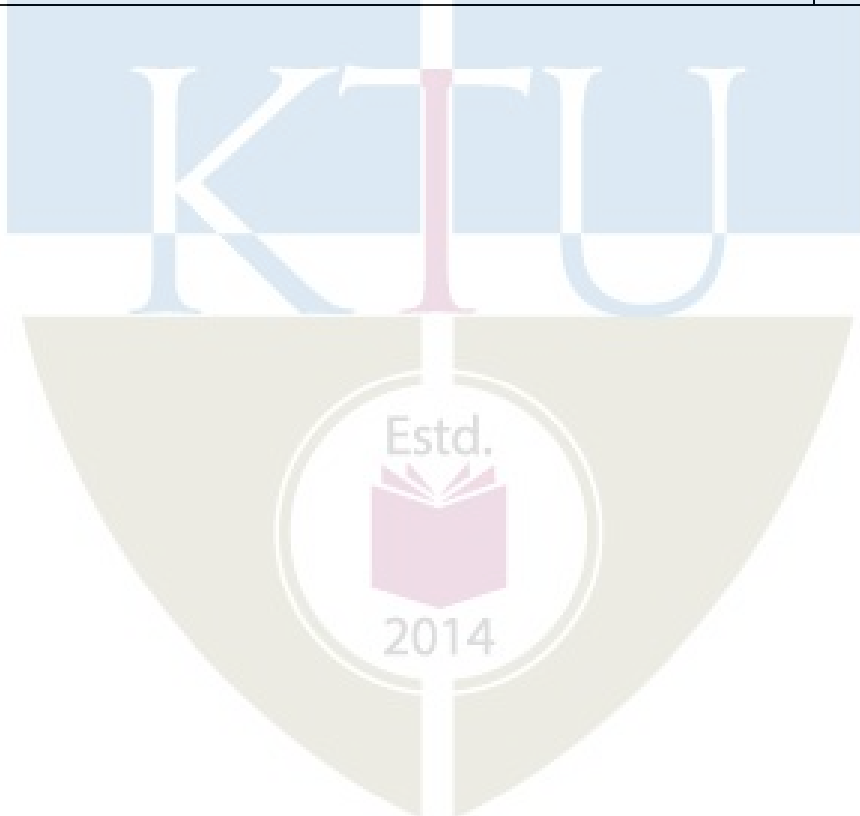
Reference Books

1. R.N. Taylor, N. Medvidovic, and E. M. Dashofy. Software Architecture: Foundations, Theory, and Practice, John Wiley & Sons, 2009.
2. Mary Shaw, David Garlan, Software architecture - perspectives on an emerging discipline, Prentice Hall, 1996

Course Contents and Lecture Schedule 2014

No	Topic	No. of Lectures
1	Introduction	6 Hours
1.1	Introduction - Software architecture– importance of software architecture	2
1.2	Architecture in a technical context	1
1.3	Architecture in a project life cycle context	2
1.4	Role of stakeholders	1
2	Quality attributes	8 Hours
2.1	Availability – general scenario, tactics and design solution	2
2.2	Interoperability – general scenario, tactics and design solution	2
2.3	Modifiability – general scenario, tactics and design solution	2

2.4	Performance - tactics	1
2.5	Security - tactics	1
3	Architecture Tactics and Patterns	8 Hours
3.1	Architecture Tactics and Patterns – Module Patterns	2
3.2	Component and Connector Patterns	2
3.3	Allocation Patterns	2
3.4	Relationship between tactics and patterns	2
4	Architecture in the project life cycle	6 Hours
4.1	Architecture in agile projects	2
4.2	The Attribute Driven Design Method	2
4.3	Architecture and implementation	1
4.4	Architecture and testing	1
5	ATAM,CBAM, Cloud architecture, Architecture documentation	7 Hours
5.1	Architecture evaluation–Architecture Trade off Analysis Method	2
5.2	Documenting Software Architectures	1
5.3	Economic Analysis of Architectures- CBAM	2
5.4	Architecting in a cloud environment	2



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT448	NETWORK ON CHIP	PEC	2	1	0	3

Preamble: The syllabus is prepared as an introductory course in the area of Networks-on-Chip (NoC) design which equip the engineering graduates to learn the communication infrastructure between the many cores of a Multi-Processor System-on-Chip (MPSoC). The course covers the basic concepts in the implementation of Networks-on-Chip (NoC) technology in VLSI integration. The course introduces students to the benefits of the NoC paradigm and separating IP design and functionality from chip communication. It will also enhance the students' ability to use modular platforms for NoC design and performance analysis.

Prerequisite: ITT204 Computer Organization

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basic concepts of NoC design.	Level 2: Understand
CO 2	Interpret the NoC topologies and MPSoC styles.	Level 2: Understand
CO 3	Categorize different routing algorithms and flow control on NoC with deadlock and livelock avoidance.	Level 3: Apply
CO 4	Interpret the microarchitecture of an NoC router.	Level 2: Understand
CO 5	Classify on-chip network workloads and familiarize the on-chip network simulators	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	-	-	-	-	-	-	2
CO 2	2	3	3	2	-	-	-	-	-	-	-	2
CO 3	2	2	2	2	-	-	-	-	-	-	-	2
CO 4	3	2	2	2	-	-	-	-	-	-	-	2
CO 5	3	2	3	2	3	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	10
Level 2: Understand	35	30	70
Level 3: Apply	5	10	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have a maximum 2 subdivisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. Discuss the building blocks of on-chip networks.
2. List the uses of interconnection networks.
3. Discuss the packet format used for processor-memory interconnect.

Course Outcome 2 (CO 2):

1. Differentiate ring and mesh on-chip network topology.
2. Explain with proper diagrams Multi-Processor System-on-Chip?
3. Can cache coherence protocol affect network performance? Illustrate.

Course Outcome 3 (CO 3):

1. Is XY routing minimal and deadlock free?
2. Discuss the taxonomy of routing protocols used in NoC.
3. Consider a 16-core TCMP machine in which cores are organized as regular square mesh topology. The system follows minimal west-first routing. How many unique minimal paths are there from 11 to 8? (Hint: core numbering starts from bottom left corner as 0 to top right corner).

Course Outcome 4 (CO 4):

1. Explain with a block diagram the architecture of an NoC router.
2. Describe the pipelined routing of a packet in a NoC based system.
3. Discuss the states associated with the input virtual channel of an NoC router.

Course Outcome 5 (CO 5):

1. Compare and contrast synthetic workloads and application-driven workloads.
2. Demonstrate the gem5 commands used to model a 4X4 mesh NoC with routing algorithm as XY routing running uniform-synthetic traffic with injection rate as 0.05.
3. When do we use SPEC CPU benchmarks while testing the NoC based system?

Model Question Paper

Course Code: ITT448
Course Name: NETWORK ON CHIP

Max.Marks :100

Duration: 3 Hrs

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. List the uses of interconnection networks.
2. Describe the organization of Multi-Processor System-on-Chip.
3. Can cache coherence protocol affect network performance? Illustrate.
4. Define flit. Discuss the different types of flits and its relevance.
5. In an NoC based system the use of input buffers can increase the total bandwidth in the network. Discuss
6. Describe buffer back pressure.
7. Describe the relevance of average packet latency in an NoC based system.
8. How do we separate flits from credits?
9. Write a short note on Flex NoC.
10. What are the configurable elements in the garnet module of gem5. List its use.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

- 11 a. Explain the advantages and disadvantages of Multi-Processor System-on-Chip. 8
b. Compare Network-on-Chip interconnect with traditional bus. 6

OR

- 12 a. Explain with a proper diagram the NoC paradigm. 9
b. Describe the challenges faced during the integration of different types of System-on-Chips. 5
- 13 a. With a proper example, explain protocol level network deadlock. 8
b. What are the design-time metrics that are agnostic to the traffic flowing through the network. 6

OR

- 14 a. Discuss in detail the impact of cache hierarchy on the performance of NoC based systems. 10
b. Write a short note on direct topologies used in NoC. 4
- 15 a. With a proper example, explain the working of X-Y routing in a 4X4 mesh NoC. 10
b. Demonstrate the working of store and forward packet based flow control technique in NoC. 4

OR

- 16 a. A packet is injected from router 4 with a destination address 14 in a 4x4 mesh interconnect network. It uses minimal west first routing. (Hint: core numbering starts from bottom left corner as 0 to top right corner as 15). How many outputport(s) are possible for this packet at the source router? 8
b. When do we go for wormhole switching? Illustrate with an example. 6
- 17 a. Explain the types of router pipeline stalls in an NoC router. 8
b. Explain in detail various buffer organizations used in an NoC router. 6

OR

- 18 a. Explain with a proper diagram round robin arbiter. 7
b. Demonstrate the phases of an NoC router with a proper diagram. 7
- 19 a. Discuss the key metrics that are used to analyze the performance of a NoC based system. 8
b. Compare and contrast synthetic workloads and application-driven workloads. 6

OR

- 20 a. Write the steps to implement an 4x4 NoC in GARNET standalone model in gem5 simulator with topology as mesh, routing as XY, and explain how to identify the saturation point while analyzing the injection rate and latency values for the given system. 10
b. When do we use SPEC CPU benchmarks while testing the NoC based system. 4

Syllabus

Module 1: Introduction to SoC and interconnection networks (5 Hours)

Interconnection networks:-System-on-Chip integration and its challenges, SoC to Network-on-Chip: a paradigm shift, Research issues in NoC development, Existing NoC examples, Uses of interconnection networks - Processor-memory interconnect - I/O interconnect - Packet switching fabric - Network basics, A simple interconnection network - Network specifications and constraints - Topology - Routing - Flow control - Router design - Performance analysis. (refer T1 and T3)

Module 2: Interface with system architecture and topology (8 Hours)

Interface with system architecture:- Shared memory networks in chip multiprocessors - Impact of coherence protocol on network - Coherence protocol requirements for the on chip network - Protocol level network deadlock. Impact of cache hierarchy implementation on network performance - Home node and memory controller design issues - Miss and transaction status holding registers, Message passing, NoC interface standards. Topology:- Metrics - Traffic - Independent metrics - Traffic-dependent metrics, Direct topologies: rings, meshes, and tori, Indirect topologies: crossbars, butterflies. (refer T2)

Module 3: Routing algorithms & flow control (7 Hours)

Routing algorithms:- Taxonomy of routing algorithms, Deterministic routing algorithms, Adaptive routing - Basics - Minimal adaptive routing - Fully adaptive routing, Partially adaptive algorithms - Turn model. Flow control - Messages, Packets, Flits, Phits, Message-based flow control - Packet-based flow control - Flit-based flow control - Virtual channels - Deadlock-free flow control - Buffer backpressure - Implementation. (refer T1, T2, T4)

Module 4: Router microarchitecture (7 Hours)

Router architecture:- Basic router architecture, Block diagram, The router pipeline, stalls, Closing the loop with credits, Reallocating a channel, Speculation and lookahead, Flit and credit encoding. Buffers and virtual channels - Switch design - Allocators and arbiters. (refer T1 and T2)

Module 5: Performance analysis & simulation (8 Hours)

Performance analysis:- Measures of interconnection network performance, Throughput, Latency, Fault tolerance, Common measurement pitfalls, Analysis, Queuing theory validation. Simulation:-Levels of detail, Network workloads, Application-driven workloads - SPEC CPU benchmarks, Synthetic workloads - Uniform random, Bit-rotation, Bit-reverse, Bit-complement, Introduction to NoC simulator - gem5. Case study - FlexNoC. (refer T1 and T5)

Text Books

- T1. William J. Dally, Brian P. Towles, Principles and Practices of Interconnection Networks, Elsevier, 2004.
- T2. Natalie Enright Jerger, Tushar Krishna, Li-Shiuan Peh, On-Chip Networks, Synthesis Lectures On Computer Architecture, Morgan & Claypool, Second Edition, 2017.
- T3. Santanu Kundu, Santanu Chattopadhyay, Network-on-Chip: The Next Generation of System-on-Chip Integration, CRC Press, 2014.
- T4. José Duato, Sudhakar Yalamanchili, Lionel Ni, Interconnection Networks: An Engineering Approach, Morgan Kaufmann, 2003.
- T5. www.gem5.org

Reference Books

- R1. A Jantsch and H. Tenhunen, Networks on Chip, Kluwer Academic Publishers, 2003.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Introduction to SoC and interconnection networks	5 Hours
1.1	System-on-Chip integration and its challenges, SoC to Network-on-Chip: A paradigm shift	1
1.2	Uses of interconnection networks - Processor-memory interconnect-I/O interconnect.	1
1.3	Packet switching fabric - Network basics.	1
1.4	A Simple interconnection network - Network specifications and constraints - Topology - Routing - Flow control - Router design - Performance analysis.	1
1.5	Introduction to Network-on-Chip (NoC).	1
2	Interface with system architecture and topology	8 Hours
2.1	Shared memory networks in chip multiprocessors - Impact of coherence protocol on network	1
2.2	Coherence protocol requirements for the on chip network - Protocol level network deadlock	1
2.3	Impact of cache hierarchy implementation on network performance - Home node and memory controller design issues	1
2.4	Miss and transaction status holding registers, Message passing, NoC interface standards	1
2.5	Topology - Metrics - Traffic-independent metrics -Traffic-dependent metrics	1
2.6	Direct topologies: Rings, Meshes	1
2.7	Direct topology - Tori	1

2.8	Indirect topologies: Crossbars, Butterflies.	1
3	Routing algorithms & flow control	7 Hours
3.1	Routing algorithms: Taxonomy of routing algorithms, Deterministic routing algorithms - XY routing	1
3.2	Adaptive routing - Basics - Minimal adaptive routing	1
3.3	Fully adaptive routing - Partially adaptive algorithms - Turn model - west-first	1
3.4	Flow control: Messages, Packets, Flits, Phits	1
3.5	Message-based flow control - Packet-based flow control	1
3.6	Flit-based flow control - Virtual channels	1
3.7	Implementation	1
4	Router microarchitecture	7 Hours
4.1	Router architecture: Basic router architecture, Block diagram	1
4.2	The router pipeline, Stalls	1
4.3	Closing the loop with credits, Reallocating a channel	1
4.4	Speculation and lookahead, Flit and credit encoding	1
4.5	Buffers and virtual channels	1
4.6	Switch design	1
4.7	Allocators and arbiters	1
5	Performance analysis & simulation	8 Hours
5.1	Performance analysis: Measures of interconnection network Performance, Throughput	1
5.2	Packet latency, Fault tolerance, Common measurement pitfall	1
5.3	Analysis, Queuing theory validation	1
5.4	Simulation: Levels of detail, Network workloads	1
5.5	Application-driven workloads - SPEC CPU benchmarks	1
5.6	Synthetic workloads - Uniform random, bit-rotation	1
5.7	Synthetic workloads - bit-reverse, bit-complement	1
5.8	Introduction to NoC simulator - gem5. Case study - FlexNoC.	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT458	NATURAL LANGUAGE PROCESSING	PEC	2	1	0	3

Preamble: This course presents an introduction to the computational modelling of natural language. Topics covered include: computational morphology, language modelling and sequence tagging, syntactic parsing and compositional semantics, deep learning architecture for natural language processing with selected applications.

Prerequisite: ITT306 Data Science

Course Outcomes: After the completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Levels
CO 1	Describe the fundamental concepts of Natural Language Processing	Level 2: Understand
CO 2	Discuss various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis and parts-of-speech tagging.	Level 2: Understand
CO 3	Explain different syntax and semantics approaches in NLP.	Level 2: Understand
CO 4	Describe deep learning architectures for sequence processing	Level 2: Understand
CO 5	Discuss the applications of natural language processing	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	-	-	-	-	-	-	-	-	-	-	1
CO 2	2	2	1	-	-	-	-	-	-	-	-	1
CO 3	2	2	-	-	-	-	-	-	-	-	-	1
CO 4	2	2	-	-	-	-	-	-	-	-	-	2
CO 5	2	2	2	-	-	-	-	-	-	-	-	2

3/2/1:High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	40	40	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	Continuous Internal Evaluation(CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Discuss various stages involved in NLP processes with suitable example.
2. Explain the need of preprocessing in NLP.
3. Describe Zipf's Law.

Course Outcome 2 (CO2):

1. Describe morphology? Why do we need to do morphological analysis?
2. Explain derivational and inflectional morphology in detail with suitable examples.
3. Describe the components of an HMM tagger.
4. Explain conditional random field taggers.

Course Outcome 3 (CO3):

1. Explain CFG with suitable example
2. Why semantic analysis is difficult?
3. What is parsing? Explain Top-down and Bottom-up approach of parsing with suitable examples.
4. Explain CYK algorithm
5. Discuss the disadvantages of probabilistic CFG

Course Outcome 4 (CO4):

1. Explain gradientdescent algorithm?
2. Demonstrate an RNN architecture for Language modelling
3. Describe the steps in training a neural network.
4. Explain the architecture of transformer model.

Course Outcome 5 (CO5):

1. Explain text summarization
2. Explain sentiment analysis
3. Discuss relation extraction and distant supervision in information extraction
- 4.

Model Question paper**Course Code: ITT458****Course Name: NATURAL LANGUAGE PROCESSING****Max.Marks:100****Duration: 3 Hours****PART A*****Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)***

1. Describe the challenges of natural language processing ?
2. Explain tokenization.
3. Explain N-gram language model.
4. Why CFG is used to represent natural language in parsing.
5. Describe distributional semantics.
6. Explain smoothing in language modelling?
7. Describe the different types of RNN?
8. Explain positional embedding?
9. Describe direct machine translation.
10. Explain sentiment analysis ?

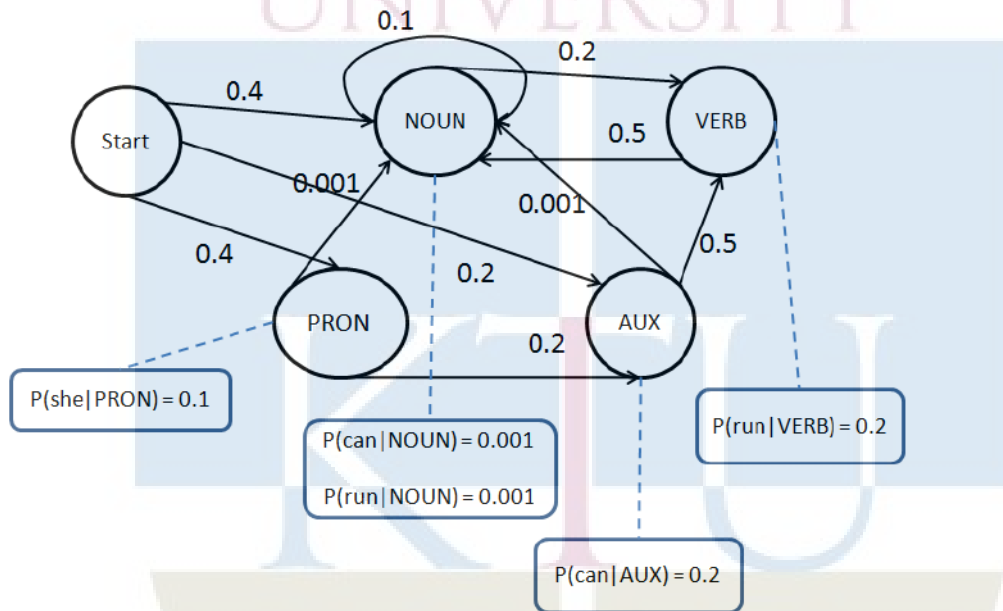
Part B

*Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)*

11. a. Explain Natural Language processing 4
 b. Discuss the various stages involved in NLP process with suitable examples 10

OR

12. a. Explain the minimum edit distance algorithm and compute the minimum edit distance between tumor and tutor 10
 b. Explain the difference between stemming and lemmatization. 4
 13. a. Explain part-of -speech tagging 4
 b. For the given HMM, show the transition and emission probability matrices. Also calculate the probability of $P(\text{she}|\text{PRONcan}|\text{NOUNrun}|\text{NOUN})$.



OR

14. a. Explain the role of FSA in morphological analysis? 6
 b. Describe derivational and inflectional morphology in detail with suitable examples 8
 15. a. Explain the significance of Word Sense Disambiguation in NLP. Describe any one WSD method 10
 b. Explain transition-based dependency parsing 4

OR

16. a. Explain distributional semantics and word embedding 6
 b. Derive a top-down, depth-first, left-to-right parse tree for the given sentence:
 The angry bear chased the frightened little squirrel
 Use the following grammar rules to create the parse tree: 8

S → NP VP	Det → the
NP → Det Nom	Adj → little angry frightened
VP → V NP	N → squirrel bear
Nom → Adj Nom N	V → chased

17. a. Explain the four types of sequence-to-sequence modeling with example. 8
b. Describe gradient descent algorithm 6
OR
18. a. Explain the architecture of LSTM. 8
b. Illustrate how transformer can be trained as a language model 6
19. a. Describe beam search 4
b. Explain how transformers can be used for text summarization 10
OR
20. a. Explain distance supervision for information extraction. 4
b. Describe the encoder decoder model for machine translation 10

Syllabus

Module 1 : Introduction to NLP and Text Processing Basics (5 Hours)
Introduction to NLP, Levels of NLP, Difficulties in NLP, Empirical Laws -Heap's Law, Zipf's Law, Type-Token Ratio, Basic Text Processing: Tokenization, Stemming & Lemmatization, Spelling Correction.
Module 2: Language Modelling and Sequence Tagging (7 Hours)
Language Modelling and Smoothing: N-Gram Language Model, Language Model Evaluation: Basic Smoothing, Advanced Smoothing Models, Morphology, Finite State Methods for Morphology, Part of Speech Tagging, Hidden Markov Model Models for POS Tagging, Maximum Entropy Models, Conditional Random Fields
Module 3: Syntax and Semantics (9 Hours)
Constituency Grammars- Context-Free Grammars, Treebanks, Constituency Parsing- PCFGs and CKY Parsing, Dependency Parsing- Dependency Relations, Dependency Formalisms, Dependency Treebanks, Transition-Based Dependency Parsing, Graph-Based Dependency Parsing Distributional Semantics, Distributional Models of Semantics, Word Embeddings, Lexical Semantics, WordNet, Word Sense Disambiguation
Module 4: Deep Learning Architectures for Sequence Processing (7 Hours)
Introduction to Neural Networks, Neural Language Models, Recurrent Neural Networks, RNN as Language Models, RNN for Sequence Labelling and Sequence Classification, Generation with RNN-based Language Models, Stacked and Bidirectional RNN architectures, Long short-term

memory, Gated Recurrent Units, Attention Mechanism, Transformers, Transformers as Language Models

Module 5 :Applications (7 Hours)

Encoder–Decoder Model for Neural Machine Translation, RNN based Machine Translation, Introduction to Attention Based Translation, Information Extraction, Text Summarization, Sentiment Analysis

Text Books

1. Jurafsky and Martin, Speech and Language Processing, Pearson Prentice Hall, Third Edition, 2018.
2. Daniel Jurafsky, James H. Martin, Speech and Language Processing", Prentice Hall, Second Edition, 2008
3. Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Reference Books

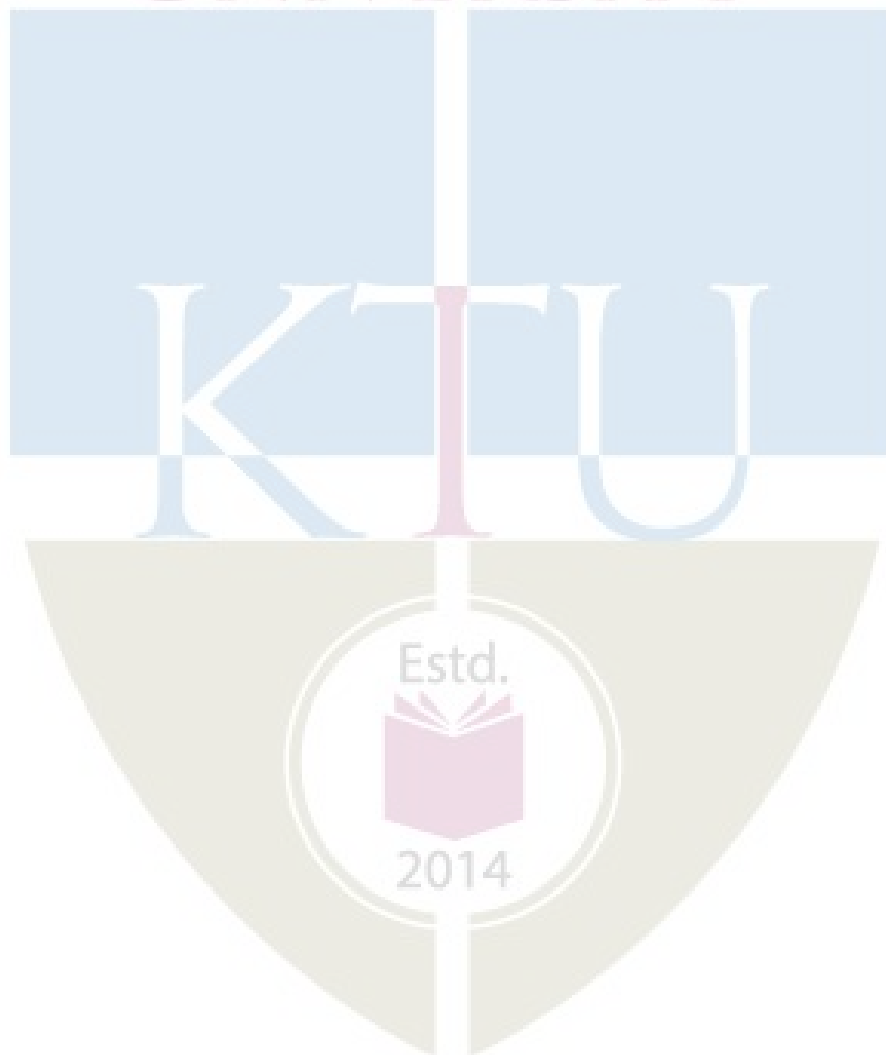
1. Stevan Bird, Natural Language Processing with Python, Shroff, 2009.
2. James Allen, Natural Language Understanding, Addison Wesley, Second Edition, 2007.
3. Nitin Indurkha, Fred J. Damerau, Handbook of Natural Language Processing, Chapman & Hall/CRC Machine Learning & Pattern Recognition, Second Edition, 2010.
4. Alexander Clark, Chris Fox, Shalom Lappin, The Handbook of Computational Linguistics and Natural Language Processing, Wiley-Blackwell, 2012.
5. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, First Edition 2017
6. <https://web.stanford.edu/~jurafsky/slp3/>
7. <https://nptel.ac.in/courses/106105158>
8. <https://nptel.ac.in/courses/106106211>
9. <https://www.coursera.org/specializations/natural-language-processing>

Course Contents and Lecture Schedule

SINo.	Topic	No. of Lectures
1	Introduction to NLP and Text Processing Basics	5 Hours
1.1	Introduction to NLP, Levels of NLP	1
1.2	Why NLP is hard –Lexical Ambiguity, Structural Ambiguity, Language impression and vagueness	1
1.3	Empirical Laws -Heap's Law, Zipf's Law, Type-Token Ratio,	1
1.4	Basic Text Processing: Tokenization, Stemming& Lemmatization	1

1.5	Spelling Correction –Edit Distance	1
2	Language Modelling and Sequence Tagging	7 Hours
2.1	N-Gram Language Model, Language Model Evaluation, Basic Smoothing	1
2.2	Advanced Smoothing Models	1
2.3	Computational Morphology, Finite State Methods for Morphology	1
2.4	Introduction to Part of Speech Tagging, Hidden Markov Model Models for POS Tagging	1
2.5	Viterbi Decoding for HMM, Baum Welch Algorithm	1
2.6	Maximum Entropy Models	1
2.7	Conditional Random Fields	1
3	Syntax and Semantics	9 hours
3.1	Constituency Grammars-Context-free grammars, Treebanks	1
3.2	Constituency Parsing- PCFGs and CKY Parsing	1
3.3	Dependency Parsing–Dependency Relations,Dependency Formalisms, Dependency Treebanks	1
3.4	Transition-Based Dependency Parsing	1
3.5	Graph-Based Dependency Parsing	1
3.6	Distributional Semantics , Distributional Models of Semantics - One hot encoding, Distributional Representation, Tf-Idf, Pointwise Mutual Information	1
3.7	Word Embeddings	1
3.8	Lexical Semantics , WordNet	1
3.9	Word Sense Disambiguation	1
4	Deep Learning Architectures for Sequence Processing	7 Hours
4.1	Introduction to Neural Networks, Backpropagation	1
4.2	Neural Language Models	1
4.2	Recurrent Neural Networks, RNN as Language Models	1
4.3	RNN for Sequence Labelling and Sequence Classification, Generation with RNN-based Language Models	1
4.4	Stacked and Bidirectional RNN architectures	1
4.5	Long short-term memory ,Gated Recurrent Units	1
4.6	Attention Mechanism, Transformers	1
4.7	Transformers as language models	1
5	Application	7 Hours

5.1	Encoder–Decoder Model for Neural Machine Translation	1
5.2	RNN based Machine Translation	1
5.3	Introduction to Attention Based Translation	1
5.4	Information Extraction : Relation Extraction	1
5.5	Information Extraction : Distant Supervision	1
5.6	Text Summarization using transformers	1
5.7	Sentiment Analysis using RNN	1



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT468	BIO-INFORMATICS	PEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in molecular biology, and to in still the confidence to develop algorithms for efficient analysis of biological data.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Define basic concepts in molecular biology and familiarize biological databases	Level 2: Understand
CO 2	Discuss various algorithms and tools for performing sequence alignment	Level 2: Understand
CO 3	Illustrate various algorithms for the construction of phylogenetic trees	Level 3: Apply
CO 4	Discuss various algorithms for predicting protein and RNA secondary structure	Level 2: Understand
CO 5	Explian gene expression profiling and epigenetic gene regulation	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	-	-	-	-	-	-	-	3
CO 2	3	2	2	1	-	-	-	-	2	-	-	3
CO 3	2	3	3	1	-	-	-	-	-	-	-	-
CO 4	2	2	2	1	-	-	-	-	-	-	-	-
CO 5	3	2	2	1	-	-	-	-	2	-	-	3

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
BL 1: Remember	10	10	10
BL 2: Understand	35	35	75
BL 3: Apply	5	5	15
BL 4: Analyze			
BL 5: Evaluate			
BL 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions**Course Outcome 1 (CO 1):**

1. What are codons? Give the triplet code for start and stop codons.
2. List any five applications of data mining in bioinformatics.

Course Outcome 2 (CO 2):

1. Given two DNA sequences ATCGGTA and ACTGTAT, compute the partial alignment score table between these two sequences using the Needleman-Wunsch algorithm. Use match score +5, mismatch score -1 and gap penalty -2.
2. Differentiate local and global sequence alignment methods.

Course Outcome 3 (CO 3):

1. What is Phylogenetic analysis? Explain in steps in constructing a phylogenetic tree using UPGMA method.
2. State the applications of HMM in bioinformatics. Apply the forward algorithm used in HMM to predict missing symbols in a given sequence.

Course Outcome 4 (CO 4):

1. Why is gene regulation required? Explain any two gene expression profiling techniques.
2. The sequence of the coding strand in a transcription unit is written as follows 5'GCATGCATGCATGCATGCAT3'. Write down the sequence of its mRNA.

Course Outcome 5 (CO 5):

1. What is epigenetic regulation? Explain any three kinds of epigenetic modifications in detail.
2. Explain the significance of pathway analysis.

Model Question Paper**Course Code: ITT468****Course Name: BIO-INFORMATICS****Max.Marks:100
Hours****Duration: 3****Part A***Answer all questions. Each question carries 4 marks. (10 * 3 = 30 Marks)*

1. Differentiate Bioinformatics and Computational Biology.
2. Explain how microarrays can be used for gene expression profiling.
3. If a double stranded DNA has 40% of cytosine, calculate the percentage of adenine in DNA.
4. Give the features of any three variants of BLAST tool.
5. What are the functions of mRNA, tRNA and rRNA?
6. Justify the statement: "Structure of a Protein determines its functionality".
7. What is sequence alignment? Mention any two tools for performing DNA sequence alignment.
8. List the applications of HMM in bioinformatics.
9. What are CpG islands?
10. Mention any two ways in which gene expression profiling can be applied to identify disease causing genes.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. a. With the help of a diagram explain the concept of central dogma of molecular biology. 8
 b. Explain the significance of BLOSUM matrix? 6

OR

12. a. Write short notes on (i) EMBL (ii) PDB (iii) Entrez 6
 b. Explain the various application areas of Bioinformatics. 8
13. a. Using the Needleman and Wunsch dynamic programming method, construct the partial alignment score matrix and scoring matrix for the given two sequences, using the following scoring policy: match score=+3, mismatch score=-1, gap penalty =-2.

ACAGTCGAACG

ACCGTCCG

- What is the optimal global alignment and score between sequences? 9
 b. How can we evaluate alignment of long multiple sequences? 5

OR

14. a. Compare PAM and BLOSUM matrices. 8
 b. BLAST and FASTA are two widely used tools for sequence alignment. Compare the similarities and differences in their approach. 6

OR

15. a. Explain character-based phylogenetic tree construction with an example. 6
 b. Use UPGMA to reconstruct a phylogenetic tree using the following distance matrix:

Species	A	B	C	D
B	3	-	-	-
C	6	5	-	-
D	9	9	10	-
E	12	11	13	9

8

OR

16. a. What is phylogenetic analysis? Explain the Neighbour-Joining method of phylogenetic analysis. 8

- b. Explain the Maximum Parsimony algorithm for phylogenetic trees. 6
17. a. Explain the Chou-Fasman method for predicting the secondary structure of proteins. 8
- b. Explain the features of regular protein secondary structures of alpha helix and beta pleated sheet. 6
- OR
18. a. Explain Nussinov algorithm for RNA secondary structure prediction with an example. 8
- b. Explain the lattice models for protein folding. 6
19. a. Explain with an example, the forward algorithm for HMMs. 6
- b. What is gene regulation? Explain any two gene expression profiling techniques in detail. 8
- OR
20. a. What do you mean by Gene prediction? Explain the different strategies for Gene Prediction. 8
- b. What is epigenetics? Explain any three different epigenetic modifications in detail. 6

Syllabus

Module 1: Introduction to Molecular Biology and Biological Databases (6 Hours)
Computational Biology and Bioinformatics – scope, Introduction to Molecular biology – Central Dogma, DNA and RNA structure, coding and non-coding RNAs, Genetic codes, Evolution
Biological Databases - Types of databases, Nucleic acid sequence databases – GenBank, DDBJ, EMBL, Protein sequence databases – SwissProt, UniProt, PDB
Module 2: Sequence Alignment (8 Hours)
Sequence Alignment – local/global, FASTA files, Algorithms for pairwise sequence alignment – Needleman and Wunsch, BLAST and its variants, Gaps and Scoring Matrices – basic concepts, construction, PAM and BLOSUM series, Multiple Sequence Alignment – CLUSTAL and its variants
Module 3: Molecular Phylogenetics(7 Hours)
Phylogenetic trees, Topologies, Distance based and Character based tree construction, Algorithms for Phylogenetic tree construction – UPGMA, Neighbor-Joining, Maximum Parsimony
Module 4: Protein and RNA Structure Prediction (8 Hours)
Introduction to Protein structure, Amino acids and Polypeptide Composition, Algorithms for Protein secondary structure prediction – Chou-Fasman, Protein Folding – Lattice models, Algorithms for predicting RNA secondary structure – Nussinov's algorithm

Module 5: Gene Expression and Pattern Matching (6 Hours)

Gene expression, Micro Arrays, NGS, Pathways, Algorithms for pattern matching – HMM, Forward algorithm, Gene Prediction, Epigenetics – basic concept, Types of epigenetic modifications, CpG islands

Text Books

1. D. E. Krane and M. L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 1/e, 2003
2. N Gautham, Bioinformatics Databases and Algorithms, Narosa Publications, 2006
3. Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT Press, 2004

Reference Books

1. T. K. Attwood and D. J. Parry-Smith, Introduction to Bioinformatics, Pearson Education, 2003.
2. Arthur M Lesk, Introduction to Bioinformatics, Oxford University Press, 2002
3. Jean Michel Claverie and Cedric Notredame, Bioinformatics – A Beginner's guide, Wiley-Dreamtech India Pvt. Ltd., 2003

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	Introduction to Molecular Biology and Biological Databases	6 Hours
1.1	Computational Biology and Bioinformatics – scope, Introduction to Molecular biology – Central Dogma	1
1.2	DNA and RNA structure, coding and non-coding RNAs	1
1.3	Genetic codes, Evolution	1
1.4	Biological Databases - Types of databases, Nucleic acid sequence databases – GenBank, DDBJ, EMBL	2
1.5	Protein sequence databases – SwissProt, UniProt, PDB	1
2	Sequence Alignment	8 Hours
2.1	Sequence Alignment – local/global, FASTA files	1
2.2	Algorithms for pairwise sequence alignment – Needleman and Wunsch	2
2.3	BLAST and its variants	1
2.4	Gaps and Scoring Matrices – basic concepts, construction,	1
2.5	PAM and BLOSUM series	1

2.6	Multiple Sequence Alignment – CLUSTAL and its variants	2
3	Molecular Phylogenetics	7 Hours
3.1	Phylogenetic trees, Topologies	1
3.2	Distance based and Character based tree construction	1
3.3	Algorithms for Phylogenetic tree construction – UPGMA	2
3.4	Neighbor-Joining algorithm	2
3.5	Maximum Parsimony algorithms	1
4	Protein and RNA Structure Prediction	8 Hours
4.1	Introduction to Protein structure	1
4.2	Amino acids and Polypeptide Composition	1
4.3	Algorithms for Protein secondary structure prediction – Chou-Fasman	2
4.4	Protein Folding – Lattice models	1
4.5	Algorithms for predicting RNA secondary structure	1
4.6	Nussinov's algorithm	2
5	Gene Expression and Pattern Matching	6 Hours
5.1	Gene expression, Micro Arrays	1
5.2	NGS, Pathways	1
5.3	Algorithms for pattern matching – HMM	1
5.4	Forward algorithm, Gene Prediction	1
5.5	Epigenetics – basic concept	1
5.6	Types of epigenetic modifications, CpG islands	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT478	DEEP LEARNING	PEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn fundamentals of deep learning and machine learning, and to design and build efficient deep learning models.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the fundamentals of linear algebra and probability required to understand machine/deep learning techniques.	Level 2: Understand
CO 2	Compare various supervised and unsupervised machine learning techniques for better decision making	Level 2: Understand
CO 3	Describe optimization techniques for building efficient machine/deep learning models	Level 2: Understand
CO 4	Demonstrate building of various deep learning models	Level 3: Apply
CO 5	Implement machine/deep learning models to solve typical problems	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	3	2	1	-	-	1	-	-	1
CO 3	2	2	2	1	-	-	-	-	-	-	-	1
CO 4	3	3	3	3	3	-	-	1	-	-	-	1
CO 5	3	3	3	3	3	-	-	1	-	-	-	1

3/2/1: High/Medium/Low

Assessment Pattern

INFORMATION TECHNOLOGY

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	10
Level 2: Understand	40	30	70
Level 3: Apply		10	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Define the inverse and transpose of a matrix.
2. What are identity matrix, upper triangular matrix and orthogonal matrix?
3. Define variance and covariance of a random variable
4. What is Eigen decomposition?

Course Outcome 2 (CO 2):

1. Compare Decision tree and Random Forest classifiers?
2. How k-means clustering method is different from hierarchical clustering?

3. Demonstrate with an example how ANN can solve a non-linear classification problem.
4. Demonstrate how Area Under ROC can be used for model selection.

Course Outcome 3 (CO 3):

1. Define the need for gradient based optimization
2. Explain the significance of learning rate in gradient descent optimization
3. Discuss the batch, and mini-batch gradient descent algorithms
4. Distinguish between batch and stochastic gradient descent algorithms

Course Outcome 4 (CO 4):

1. Draw the general architecture diagram of a deep learning model that can be used for machine translation
2. Demonstrate how a CNN network can be used to derive a one dimensional feature vector from a given image data.
3. Demonstrate max pooling and average pooling and explain how their results can influence the final model
4. Demonstrate the advantage of using bidirectional RNNs for text processing

Course Outcome 5 (CO 5):

1. Draw the architecture of a transfer learning model and discuss how it can be used for another solving another problem.
2. Assume you are given a set of sentences in a language and demonstrate how to build a deep learning model to predict these sentences expressing positive or negative sentiment.
3. Demonstrate how a CNN model can be used to solve the handwritten character recognition problem

Model Question Paper

Course Code: ITT478
Course Name: DEEP LEARNING

Max.Marks :100

Duration: 3 Hrs

Part A

*Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)*

1. Explain vector multiplication of dot product and cross product with suitable examples.
2. Describe linear least square optimization.
3. Write the stochastic gradient descent algorithm.

4. For a 3-2-1 multilayer neural network, demonstrate how output value is calculated in the feed forward step for a given input feature vector. Assume initial weight values and activation functions of your choice.
5. Explain any 3 activation functions with their graphical representations.
6. Describe the LeNet-5 CNN architecture.
7. Explain the vanishing/exploding gradient with respect to RNNs.
8. Describe the LSTM network.
9. Explain the working of Generative Adversarial Network.
10. Describe an application of transfer learning.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11	Describe gradient based optimization and constrained optimization with suitable examples.	14

OR

12	a Describe Principle Component Analysis and its significance in Machine learning	8
	b Define the following: (1) Marginal and conditional probabilities (2) Chain rule and (3) Bayes rule	6
13	a Demonstrate how linear regression technique can be used to predict the Systolic blood pressure of person if weight is given. You may create a sample dataset for 10 persons and predict it for a given person with weight 85kg.	10
	b Explain confusion matrix and its role in machine learning model building.	4

OR

14	a Explain how a Support Vector Machine model classifies a given input feature vector. Illustrate with an example also.	8
	b Describe the DBSCAN method of density based clustering.	6
15	a Explain the convolution and pooling operations with suitable examples	8
	b Describe the AlexNet CNN architecture.	6

OR

16	Describe the feed forward step in the learning of a CNN model for a binary classification. You may create a minimal CNN model with 3 stacked layers and a final fully connected layer, with activation functions and other parameters of your choice. Clearly show how the output is calculated for a	14

given input.

- 17 a Explain different types of RNNs with their architectures and one application for each of them. 8
- b Explain Gated Recurrent Unit and its usage. 6

OR

- 18 a Demonstrate the working of a Bidirectional RNN with an example. 10
- b Explain Deep Recurrent Networks 4
- 19 a Explain the working principle of Autoencoders 5
- b Explain how transfer learning can be used to solve a NLP problem with an example. 9

OR

- 20 a Explain how transfer learning can be used to solve an image processing problem with an example. 9
- b Explain the working principle of Generative Adversarial Networks 5

Syllabus

Module 1: Basics of Linear Algebra, Probability and Numerical Computation (6 Hours)

Linear Algebra:– Scalars, Vectors, Matrices and Tensors, Matrix and Vector operations, Types of matrices and vectors, Eigen Decomposition, Principal Component Analysis

Probability: - Random Variables, Probability Distributions, Marginal and Conditional Probabilities, Chain rule, Independence and Conditional independence, Expectation, Variance and Covariance, Bayes rule

Gradient based optimization, Constrained optimization, Linear Least Squares

Module 2: Machine Learning Basics (11 Hours)

Introduction to Learning algorithms:- - Types of learning algorithms - Supervised, Unsupervised, Reinforcement – Overfitting, Underfitting, Hyperparameters and Validation sets, Stochastic Gradient Descent.

Supervised learning algorithms: – Linear Regression, Logistic Regression, Naive Bayes, Decision Tree, Artificial Neural Networks, Support Vector Machines, Random Forest, Ensemble methods.

Performance metrics:- Mean Squared Error, Mean Absolute Error, Root Mean Squared Error, Accuracy, Confusion matrix, Precision, Recall, F1-score and Area Under Receiver Operating Characteristics Curve

Unsupervised learning algorithms:- K-means clustering, Hierarchical clustering, Density based clustering

Module 3: Deep Learning Networks – Convolutional Networks (6 Hours)

Challenges motivating Deep learning, Deep Forward Networks, Gradient based learning, Back propagation, Activation functions.
Convolution operation, Pooling, Variants of basic convolution function, Convolutional Neural Networks (CNN) – Convolution layer, Pooling layer, Fully connected layer – Types of CNNs – LeNet-5, AlexNet, ResNet
Module 4: Deep Learning Networks – Recurrent Networks (6 Hours)
Recurrent Neural Networks (RNN), Types of RNN – One-to-One, One-to-Many, Many-to-One, Many-to-Many – Vanishing/Exploding Gradient, Gated Recurrent Unit, Long-Short Term Memory Unit, LSTM Network, Bidirectional RNNs, Deep Recurrent Networks
Module 5: Deep Learning Networks – Advanced Topics and Applications (6 Hours)
Advanced Topics: - Basics of Autoencoders, Generative Adversarial Networks Applications: Building of deep learning models for Image Processing and Natural Language Processing using Deep Learning Networks, including Transfer Learning.

Text Books

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 1st Edition, 2016
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 1st Edition, 2006
3. Richard O. Duda, Peter E. Hart, David G. Stork, Pattern Classification, Wiley-Interscience, 2nd Edition, 2000

Reference Books

1. Charu C Aggarwal, Neural Networks and Deep Learning – A Textbook, Springer, 1st Edition, 2018
2. Charu C Aggarwal, Linear Algebra and Optimization for Machine Learning – A Textbook, Springer, 1st Edition, 2020
3. Francois Chollet, Deep Learning with Python, Manning, 1st Edition, 2017

Sl. No.	Topic	No. of Lectures
1	Basics of Linear Algebra, Probability and Numerical Computation	6 Hours
1.1	Linear Algebra:– Scalars, Vectors, Matrices and Tensors, Matrix and Vector operations	1
1.2	Types of matrices and vectors	1
1.3	Eigen Decomposition, Principal Component Analysis	1
1.4	Probability: - Random Variables, Probability Distributions, Marginal and Conditional Probabilities, Chain rule, Independence and Conditional independence	1
1.5	Expectation, Variance and Covariance, Bayes rule	1
1.6	Gradient based optimization, Constrained optimization, Linear Least Squares	1
2	Machine Learning Basics	11 Hours
2.1	Introduction to Learning algorithms:- - Types of learning algorithms - Supervised, Unsupervised, Reinforcement	1
2.2	Overfitting, Underfitting, Hyperparameters and Validation sets,	1
2.3	Stochastic Gradient Descent	1
2.4	Supervised learning algorithms: – Linear Regression	1
2.5	Logistic Regression, Naive Bayes	1
2.6	Decision Tree	1
2.7	Artificial Neural Networks	1
2.8	Support Vector Machines	1
2.9	Random Forest, Ensemble Methods	1
2.10	Performance metrics:- Mean Squared Error, Mean Absolute Error, Root Mean Squared Error, Accuracy, Confusion matrix	1
2.11	Precision, Recall, F1-score and Area Under Receiver Operating Characteristics Curve	1
3	Deep Learning Networks – Convolutional Networks	6 Hours
3.1	Challenges motivating Deep learning, Deep Forward Networks, Gradient based learning	1
3.2	Back propagation, Activation functions.	1
3.3	Convolution operation, Pooling, Variants of basic convolution function	1
3.4	Convolutional Neural Networks (CNN) – Convolution layer, Pooling	1

	layer, Fully connected layer	
3.5	Types of CNNs – LeNet-5	1
3.6	AlexNet, ResNet	1
4	Deep Learning Networks – Recurrent Networks	6 Hours
4.1	Recurrent Neural Networks (RNN), Types of RNN – One-to-One, One-to-Many,	1
4.2	Types of RNN - Many-to-One, Many-to-Many	1
4.3	Vanishing/Exploding Gradient, Gated Recurrent Unit	1
4.4	Long-Short Term Memory Unit, LSTM Network	1
4.5	Bidirectional RNNs	1
4.6	Deep Recurrent Networks	1
5	Deep Learning Networks – Advanced Topics and Applications	6 Hours
5.1	Basics of Autoencoders	1
5.2	Basics of Generative Adversarial Networks	1
5.3	Building of deep learning models for Image Processing	1
5.4	Building of deep learning models for Image Processing (transfer learning)	1
5.5	Building of deep learning models for Natural Language Processing	1
5.6	Building of deep learning models for Natural Language Processing (transfer learning)	1



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VIII

MINOR



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITD482	MINIPROJECT	PWS	0	0	3	2

Preamble: This course is designed for enabling the students to apply the knowledge to address the real-world situations/problems and find solutions. The course is also intended to estimate the ability of the students in transforming theoretical knowledge studied as part of the curriculum so far in to a working model of a software system. The students are expected to design and develop a software/hardware project to innovatively solve a real-world problem.

Prerequisites: Subjects studied up to sixth semester.

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Make use of acquired knowledge within the selected area of technology for project development.	Level 3: Apply
CO 2	Identify, discuss and justify the technical aspects and design aspects of the project with a systematic approach.	Level 3: Apply
CO 3	Interpret, improve and refine technical aspects for engineering projects.	Level 3: Apply
CO 4	Associate with a team as an effective team player for the development of technical projects.	Level 3: Apply
CO 5	Report effectively the project related activities and findings.	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	3	3	3	3	-	-	-	3
CO 2	3	3	3	3	3	-	2	3	-	3	2	3
CO 3	3	3	3	3	3	2	3	3	-	2	3	3
CO 4	3	3	2	2	-	-	-	3	3	3	3	3
CO 5	3	-	-	-	2	-	-	3	2	3	2	3

3/2/1: high/medium/low

Assessment Pattern

The End Semester Evaluation (ESE) will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a 3-member committee appointed by Head of the Department comprising HoD or a senior faculty member, academic coordinator for that program and project guide/coordinator. The Committee will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, working knowledge and involvement.

The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the mini project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systems under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution. The review committee should assess the extent to which the implementation reflects the proposed design. A well coded, assembled and completely functional product is the expected output at this stage. The final CIE mark is the average of 1st and 2nd review marks.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest or problem domain or conduct open brain storming sessions for innovative ideas. Zeroth review will not be a part of the CIE evaluation process.

Marks Distribution

Total Marks	CIE	ESE
150	75	75

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Marks awarded by Guide : 15 marks
 Project Report : 10 marks
 Evaluation by the Committee : 40 Marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks.

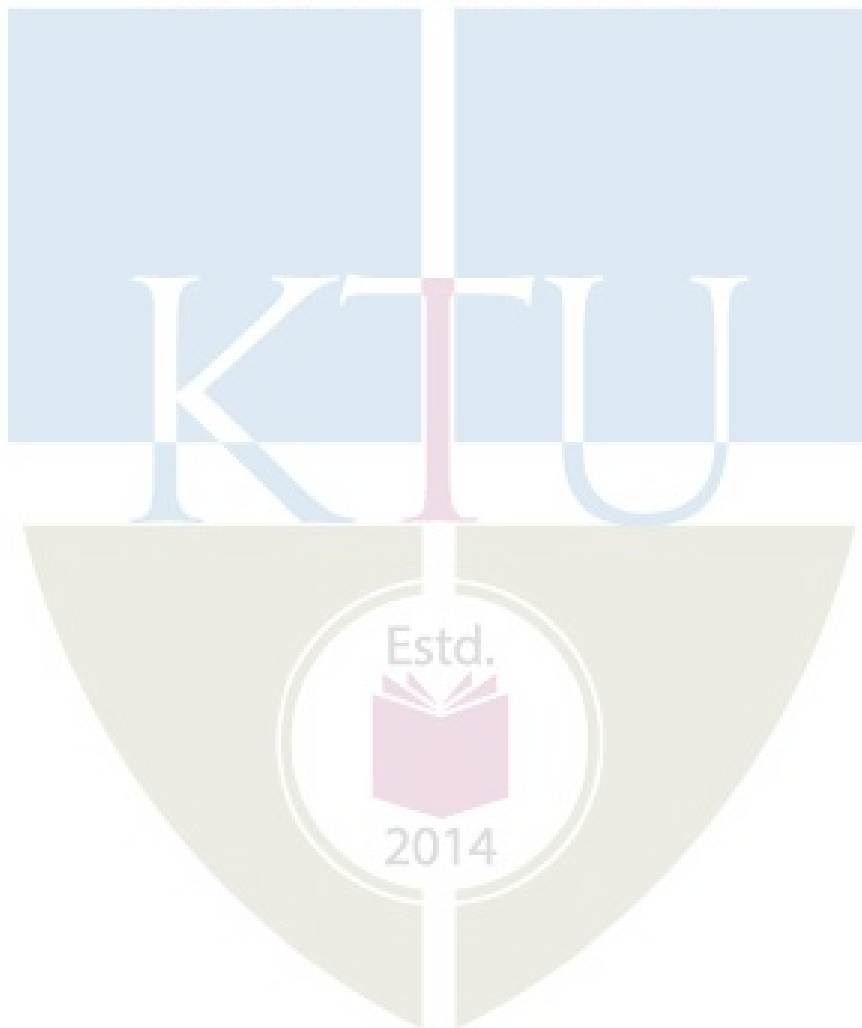
- (a) Demonstration : 50 Marks
- (b) Project report : 10 Marks
- (d) Viva voce : 15marks

Course Plan

In this course, each group consisting of three/four members is expected to design and develop a moderately complex software/hardware system with practical applications. This should be a working model. The basic concept of product design may be taken into consideration.

Students should identify a topic of interest in consultation with Faculty-in-charge of miniproject/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews.

The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight.



APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

SEMESTER VIII

HONOURS



CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITD496	MINIPROJECT	PWS	0	0	3	2

Preamble: This course is designed for enabling the students to apply the knowledge to address the real-world situations/problems and find solutions. The course is also intended to estimate the ability of the students in transforming theoretical knowledge studied as part of the curriculum so far in to a working model of a software system. The students are expected to design and develop a software/hardware project to innovatively solve a real-world problem.

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Mapping of course outcomes with program outcomes

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CO 2	3	3	3	3	3	-	2	3	-	3	2	3
CO 3	3	3	3	3	3	2	3	3	-	2	3	3
CO 4	3	3	2	2	-	-	-	3	3	3	3	3
CO 5	3	-	-	-	2	-	-	3	2	3	2	3

3/2/1: high/medium/low

Assessment Pattern

The End Semester Evaluation (ESE) will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a 3-member committee appointed by Head of the Department comprising HoD or a senior faculty member, academic coordinator for that program and project guide/coordinator. The Committee will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, working knowledge and involvement.

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