Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.

Accredited with A^{++} by NAAC - V Cycle (CGPA 3.53)

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli

DEPARTMENT OF MATHEMATICS

TEACHING PLAN
EVEN SEMESTER
2025-2026

Department : Mathematics
Class : I B. Sc.
Title of the Course : Coordinate and Spatial Geometry
Semester : II
Course Code : MU232CC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MU232CC1	4	-	-	3	4	75	25	75	100

Objectives

- To analyze characteristics and properties of two- and three-dimensional geometric shapes.
- To develop mathematical arguments about geometric relationships.
- To solve real world problems on geometry and its applications.

Course outcomes

CO	Upon completion of this course, the students will be able to:	Cognitive Level
CO - 1	recall the definitions and formulae of key concepts in coordinate and spatial geometry	R
CO - 2	describe the relationships between geometric shapes and their equations and summarize the properties of different transformations on the coordinate plane	U
CO - 3	solve real world problems involving lines, planes and spheres using analytical geometry concepts	Ap
CO - 4	analyze the properties of equations of lines, planes and spheres	An
CO - 5	evaluate complex problems that require the application of coordinate and spatial geometry concepts.	E

Total Contact hours: 60 (Including instruction hours, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive Level	Pedagogy	Student-Centric Methods	E-Resources	Assessment/ Evaluation Methods
I	**Polar and Pole, Diameters**								
	1	Polar and pole- definition, illustration, conjugate points and conjugate lines - definition & illustration	3	1	K2	Lecture with Derivation	Problem-solving pairs	E-notes	Classwork problems
	2	Diameters - examples, conjugate diameters - definition – remark, Exercise	4		K3	Diagram-based teaching	Group discussion with Chart making	PPT with diagrams	Quiz (short answers)
	3	Eccentric angles of the ends of a pair of conjugate semi-diameters of an ellipse - examples, conjugate diameters of a hyperbola	3	1	K3	Step-by-step derivation	Small groups	E-notes	Concept Explain
II	**Polar Coordinates, Equation of Line, Circle, Conic, Chord, Tangent, Normal, Hyperbola**								
	1	Polar coordinates - introduction, general polar equation of a straight line, polar equation of circle, equation of straight line - illustration, remark, exercise	4	1	K2	Comparative teaching	Peer Discussion	Google Form	Simple Test
	2	Equation of a circle, equation of a conic - illustration - remarks - examples, equations of the	3	1	K3	Derivation with examples	Worksheet solving	PPT using Gamma	Class test

		asymptotes of hyperbola - examples							
	3	Equation of a chord, equation of a tangent, equation of a normal, remark, exercise	3		K3	Geometric approach	Peer assessment	Quizizz	Problem-solving
III	**The Plane (3D Geometry)**								
	1	General equation of first degree - related theorems	2	1	K2	Introductory Session	3D model observation	CalcPlot3D, MATLAB	Spot quiz
	2	Transformation to the normal form, direction cosines of the normal to a plane, angle between two planes, parallelism and perpendicularity of two planes	2		K3	Problem Solving	Real-life applications	Quiz using Claude AI	MCQ
	3	Determination of plane under given conditions - intercept form of the equation of plane - finding the equation of plane through three points	2	1	K3	Lecture with PPT	Group problem solving	PPT using Napkin	Class test
	4	System of planes - examples, two sides of a plane, length of the perpendicular from a point to a plane - examples	2		K2	Interactive Lectures	Case studies	E-notes	Assignment submission
	5	Bisectors of angles between two planes - examples, joint equation of two planes, orthogonal projection on a plane - examples, volume of a tetrahedron – examples	2		K3	Collaborative Learning	Debate on methods	-	Recall Steps

IV	**Representation of Line**								
	1	Representation of line - equation of the line through a given point drawn in a given direction - equation of a line through two points – examples	2	1	K2	Lecture with chalk and talk	Think-pair-share	YouTube videos	Concept Explain
	2	Two forms of equation of a line, transformation from the unsymmetrical form to symmetrical form - examples, angle between a line and a plane	3		K3	Lecture with Discussion	Brainstorming	SLO	MCQ
	3	Conditions for a line to lie in a plane - examples, coplanar lines - conditions for the coplanarity of lines - examples - remarks, number of arbitrary constants in the equations of a straight line, determination of lines satisfying given conditions – example.	3	1	K3	Interactive Method	Learning Circles	Problem set	Suggest formulae
	4	The shortest distance between two lines - examples, length of the perpendicular from a point to a line - examples, intersection of three lines – examples	2		K3	Problem Solving	Team based learning	-	Peer Discussion
V	**The Sphere**								
	1	Equation of a sphere, general equation of a sphere - examples, the sphere	2	1	K3	Blended Learning	Analyse problem situations	MATLAB	Quiz through Nearpod

		through four given points – examples							
	2	Plane section of a sphere, intersection of two spheres, sphere with a given diameter, equation of a circle - examples, sphere through a given circle – examples	3		K3	Heuristic Method	Discussion	Simulation Software	Debating
	3	Intersection of a sphere and a line, power point, equation of a tangent plane - examples, plane of contact, polar plane, pole of a plane, some results concerning poles and polars, conjugate points, conjugate planes, polar lines - examples,	3	1	K2	Problem Solving	Group work	Videos	Solve Problems
	4	Angle of intersection of two spheres, condition for orthogonality of two spheres, radical plane, radical line, radical centre	2		K3	Gamification	Formulating questions	-	Class Test

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities: **Quiz, Problem Solving, Group Discussion**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): -

Activities related to Cross Cutting Issues: -

Assignment: **Problem Solving from the plane and sphere sections (03-02-2026)**

Sample Questions

Part A

1. The product of the slope of the pair of conjugate diameter of a hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is _____. (CO 1, Ap)

   (a) $-\frac{b}{a^2}$ (b) $-\frac{a^2}{b^2}$ (c) $\frac{a^2}{b^2}$ (d) $\frac{b^2}{a^2}$

2. The equation $\frac{l}{r} = 1+e\cos\theta$ represents the branch of a hyperbola if _____. (CO 2, U)

   (a) e>1 (b) e=1 (c) e <1 (d) e >0

3. **State True or False:** The slope of a straight line parallel to the x-axis is infinity and that of a line parallel to the y-axis is zero. (CO 3 – An)

4. For every point *(x, y, z)* on x-axis: (CO 4, U)

   a) y = 0, z = 0 b) x = 0, z = 0 c) x = 0, y = 0 d) y = 0, z = 0

5. The section of a sphere by a plane is a _____. (CO 5, R)

Part B

1. Find the locus of the midpoints of a system of parallel chords of the parabola $y^2-4ax=0$ whose slope is m. (CO 1, An)

2. Find the equation of the straight line. (CO 2, U)

3. Find the equation of the plane through the intersection of the planes $x + y + z = 6$ and $2x + 3y + 4z + 5 = 0$ and the point (1,1,1). (CO 3, Ap)

4. Obtain the symmetrical form of the equations of the line $x-2y+3z=4$, $2x-3y+4z=5$. (CO 4, E)

5. Find the equation of the sphere through the points (0, 0,0), (0, 1,-1), (-1, 2,0), (1, 2,3). (CO 5, Ap)

Part C

1. Derive the formula for the conjugate diameter of the parabola. (CO 1, Ap)

2. Find the equation of the chord AB where $A(x_1, y_1)$ and $B(x_2, y_2)$ are two points on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and hence obtain the equation of the tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at (x_1, y_1). (CO 2, An)

3. Find the bisector of the acute angle between the planes $2x-y+2x+3=0$, $3x-2y+6z+8=0$. (CO 3, Ap)

4. Find the equation to the plane containing the line $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ and the point (0, 7, -7) and show that the line $\frac{x}{1} = \frac{y-7}{-3} = \frac{z+7}{2}$ also lies in the same plane. (CO 4, An)

5. Show that the spheres $x^2+y^2+z^2-2x+4y-4z=0$, $x^2+y^2+z^2+10x+2z+10=0$ touch externally and find the point of contact. (CO 5, An)

Head of the Department | Course Instructor

Dr. M.K. Angel Jebitha | Antin Mary S

Department : Mathematics
Class : I B.Sc Mathematics
Title of the Course : Core Course IV: Integral Calculus
Semester : II
Course Code : MU232CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232CC2	4	–	–	–	4	4	**60**	**25**	**75**	**100**

Learning Objectives

1. Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.
2. Knowledge about Beta and Gamma functions and skills to determine Fourier series expansions.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.	**K1**
2.	evaluate double and triple integrals and problems using change of order of integration.	**K2**
3.	Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution	**K3**
4.	explain beta and gamma function sand to use them in solving problems of integration.	**K2**
5.	Explain Geometric and Physical applications of integral calculus.	**K2**

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**Reduction formulae –Types**								
	1	Reduction formulae -Types Integration of product of powers of algebraic and trigonometric functions	3	1	K1(R) & K2(U)	Lecture with Illustration Method, Inquiry-Based Learning	Group Discussion	E- Content	Questioning, Quiz, CIA I
	2	Integration of powers of trigonometric functions	2		K2(U) & K3(Ap)	Problem-Solving Method, Inquiry-Based Method	Collaborative Learning, Brainstorming	Interactive PPT	Slip Test, CIA I
	3	Integration of product of powers of algebraic functions	2	1	K2(U) & K3(Ap)	Heuristic Method	Peer Learning	Interactive PPT	Problem Solving Assignment, CIA I
	4	Integration of logarithmic functions	1		K2(U) & K3(Ap)	Integrative method, Inductive Method,	Mind map	-	Class Test, CIA I

	5	*i*ntegration of product of powers of trigonometric functions	2		K2(U), K4(An) & K5(C)	Inductive Method, Problem-solving method	Analyze problem situations, Peer Teaching	Interactive PPT	Slip Test, CIA I, Homework
II	**Double Integrals**								
	1	definition of double integrals	1	1	K1(R) & K2(U)	Lecture with discussion, Deductive Method	Think-Pair-Share, memory game	-	Conceptual Quiz, CIA I
	2	evaluation of double integrals	3		K1 (R), K3(Ap)	Group Discussion	Logical reasoning	-	Conceptual Assignment CIA I
	3	double integrals in polar coordinates	3	1	K3(Ap) & K1(R)	Flipped Classroom	Inquiry Based Learning	PPT	Slip Test, Peer Review, CIA I
	4	Change the order of integration.	3		K3(Ap)	Integrative method	Problem Based Learning	-	MCQs, CIA I
III	**Triple Integrals**								
	1	applications of multiple integrals	3	1	K1(R) & K2 (U)	Observation-Based Learning	Peer Teaching	Video Lectures	Conceptual MCQs, CIA I
	2	volumes of solids of revolution	2		K3(Ap)	Illustration Method	Problem Based Learning	-	Discussion-based evaluation
	3	areas of curved surfaces	3	1	K2(U)	Blended Learning, Synthetic Method	Creative thinking	-	Slip Test, CIA II

	4	Change of variables	2		K3(Ap)	Problem-solving method	Think Pair Share	-	CIA II
IV	**Beta and Gamma functions**								
	1	Beta and Gamma functions – definitions	2	1	K1(R) & K2(U)	Inquiry-Based Learning	Think-Pair-Share	Interactive PPT	Problem Solving, CIA II
	2	recurrence formula of Gamma functions	2		K3(Ap)	Blended Learning, Problem-solving method	Creative thinking, Concept Mapping	Interactive PPT	Slip Test, CIA II
	3	properties of Beta and Gamma functions	2		K2(U)	Lecture Method, Problem-solving method	Concept Mapping, Group Problem Solving	-	Peer discussion, CIA II, Class Test
	4	relation between Beta and Gamma functions	2	1	K3(Ap) & K2(U)	Problem-solving method	Logical reasoning	-	Conceptual Assignment, CIA II
	5	Applications.	2		K3(Ap)	Collaborative learning, Problem-solving method	Brainstorming	E-notes	Surprise Test CIA II
V	**Fourier Series**								
	1	Fourier Series – Definition	1	1	K1(R)	Interactive Lecture with board	Peer Instruction	-	Peer Review, CIA II
	2	The Cosine Series	2		K2(U)	Analytic Method	Peer Learning	-	Problem Solving

									Assignment, CIA II
	3	The Sine Series	2		K3(Ap)	Problem Solving	Problem-Based Learning	Interactive PPT	Open Book Exam, CIA II
	4	Half range Fourier Cosine and Sine Series	3	1	K3(Ap)	Lecture Method	Concept Mapping	-	Peer discussion, CIA II
	5	Half range Fourier Sine Series	2		K3(Ap)	Problem-solving in groups	Group Problem Solving	E-Content	Slip Test, CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Skill Development**

Activities (Em / En /SD): **Hands on Training on Problem solving**

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - Professional Ethics

Assignment: Problems on Fourier Sine Series (Last date to submit: 15-03-2026)

Sample Questions

Part A

1. The reduction formula for $\int x^n e^{ax} dx$ where n $\in N$ is ---------(CO 1, K1)

2. The value of $\int_0^{\pi} \int_0^1 r^2 sin\theta \, dr \, d\theta$ is ------(CO 2, K2)

a) 2/3 b) 1/3 c) 1 d) 3

3. Under suitable conditions a given triple integral can be expressed as an integrated integral in ------ other ways by permuting the variables (CO 2, K1)

a) 3 b) 4 c) 5 d) 6

4. **State true or false:** The Beta function β(m,n) can be expressed as a definite integral with 0, ∞ as limits (CO4, K1)

5. **State true or false:** f(x) cos nx is an even function (CO 1, K1)

Part B

1. Evaluate the reduction formula for $I_n = \int \sec^n x dx$ (CO 1, K3)
2. Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{\infty} \frac{r}{(r^2+a^2)^2}\, dr\, d\theta$ (CO 2, K3)
3. Evaluate $\int_0^a \int_0^x \int_0^y xyz\, dz\, dy\, dx$ (CO 2, K3)
4. Express $\int_0^1 x^m (1-x^n)^p dx$ in terms of Gamma functions. (CO 4, K2)
5. Find the Fourier series for $f(x) = x^2$ in $-1 < x < 1$. (CO 4, K3)

Part C

1. Evaluate a reduction formula for $I_{m,n} = \int \sin^m x \cos^n x dx$ where m,n ≥ 1 (CO 1, K3)
2. Evaluate $\int_1^4 \int_{\sqrt{y}}^2 (x^2 + y^2)\, dx\, dy$ by changing the order of integration. (CO 2, K2)
3. Evaluate $\int_0^{loga} \int_0^x \int_0^{x+y} e^{x+y+z}\, dz\, dy\, dx$ (CO 3, K3)
4. Evaluate in terms of Gamma functions the integral $\iiint x^p y^q z^r dxdydz$ taken over the volume of the tetrahedron given by $x \geq 0$, $y \geq 0$, $z \geq 0$ and $x+y+z \leq 1$ (CO 4, K3)
5. Show that in the range 0 to 2π,the Fourier series expansion for e^x is $\frac{e^{2\pi}-1}{\pi}\left\{\frac{1}{2} + \sum_{n=1}^{\infty}\left(\frac{\cos nx}{n^2+1}\right) - \sum_{n=1}^{\infty}\left(\frac{n\sin nx}{n^2+1}\right)\right\}$ (CO 5, K2)

Head of the Department | **Course Instructor**

Dr. M.K. Angel Jebitha | **Dr. K. Jeya Daisy**

Department : Mathematics

Class : I B.Sc. Physics

Title of the Course : ELECTIVE COURSE II: VECTOR CALCULUS AND FOURIER SERIES

Semester : II

Course Code : MU232EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232EC1	5	1	-	-	5	6	90	25	75	100

Learning Objectives:

1. To understand the concepts of vector differentiation and vector integration.
2. To apply the concepts in their respective disciplines.

Course Outcomes

COs	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO - 1	remember the formulae of vector differentiation, integration and Fourier series	PSO-1	K_1
CO - 2	understand various theorems related to vector differentiation, integration and Beta, Gamma functions	PSO-2	K_2

CO - 3	solve problems on vector differentiation, integration, Beta, Gamma functions and Fourier series	PSO-2	K_2
CO - 4	compare double and triple integrals, line, surface integrals, Beta, Gamma functions and Fourier series for even and odd functions	PSO-3	K_3

Total contact hours: 90 (Including instruction hours, assignments, and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student-Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**Vector differentiation**								
	1	Vector differentiation, Gradient	3	1	K_1 (R)	Recall the basic definitions, Discussions	Discussions, Brainstorming, Problem solving	YouTube-Vector differentiation, E-Note	Questioning
	2	Divergence and curl	4		K_2 (U)	Transmissive method with illustration	Group Discussion, Problem-solving	PPT	Summarize the concepts
	3	Directional Derivative, Normal to a surface	4	1	K_3 (Ap)	Illustrative Method, Transmissive Method	Defining problems, Group discussion	E-Note	Questioning
	4	Solenoidal, irrotational, and harmonic vectors.	4	1	K_3 (Ap)	Transmissive Method, Illustrative Method	Think -Pair-Share, Peer teaching	E-Book, YouTube-harmonic vectors	Assignment
II	**Evaluation of double and triple integrals**								
	1	Evaluation of double integrals	3	1	K_1 (R)	Problem solving, Transmissive method	Brainstorming, Debate	PPT	Slip Test

	2	Examples of double integrals	4		K_2 (U)	Transmissive method	Defining problems, Group discussion	E-Note	Collecting MCQ
	3	Evaluation of triple integrals	4	1	K_3 (Ap)	Flipped Classroom	Think-Pair-Share, Debate	E-Note, YouTube-triple integrals	Quiz
	4	Examples of triple integrals	4	1	K_2 (U)	Illustrative Method	Real-world problems, Group Discussion	E-Note	Questioning
III	**Vector integration**								
	1	Vector integration	3	1	K_2 (U)	Transmissive method	Group Discussion, Basic concepts recap	E-Book, YouTube-Vector integration	Slip Test
	2	Work done by a force	4		K_2 (U)	Illustrative Method	Real-world problems, Group Discussion	E-Note	Questioning, CIA-I, Quiz
	3	Evaluation of line integrals and surface integrals	4	1	K_3 (Ap)	Problem Solving	Defining problems, Group discussion	E-Note	Collecting MCQ
	4	Green's and Stokes' theorems (Statement only) with problems.	4	1	K_3(Ap)	Transmissive method	Think-Pair-Share, Problem-solving	E-Book	Quiz
	Beta and Gamma Function								

IV	1	Beta Function	4	1	K_2 (R)	Illustrative Method	Peer Instruction, Group Discussions	E-Book, PPT	Slip Test
	2	Examples of the Beta Function	4	1	K_3 (Ap)	Illustrative Method	Problem solving, Think -Pair- Share	E-Book, PPT	MCQ
	3	Gamma Function	4	1	K_2 (R)	Illustrative Method	Think-Pair-Share, Group discussion	E-Book, YouTube-Gamma Function	Quiz
	4	Examples of the Gamma Function	3		K_3 (Ap)	Transmissive Method	Defining problems, Group discussion	E-Book, PPT	Questioning
V	**Fourier series**								
	1	Fourier series	5	1	K_1 (U)	Transmissive Method	Presentation, Peer Instruction, Group Discussions	E-Book, YouTube-Fourier series	Questioning
	2	Even and odd functions	5	1	K_2 (R)	Group Discussion, Illustrative Method	Presentation, Think-Pair-Share	E-Book,	MCQ, CIA-II, Quiz
	3	Half-range Fourier series	5	1	K_3 (Ap)	Illustrative Method	Defining problems, Group discussion	E-Book	Quiz

Course Focusing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities : **Problem-solving, Seminar Presentation, Group Discussion**

Course Focusing on Cross-Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): -

Activities related to Cross-Cutting Issues: -

Assignment: **Evaluation of line integrals and surface integrals**

Sample questions

Part A

1. Let **r** = x **i** + y **j** + z **k**, div **r** = ----------and curl r = ----------. (CO1,K1)

(a) 3, 0 (b) 0, 3 (c) 0, 0 (d) 3, 3

2. **Say true or false:** The Beta function β(m, n) can be expressed as a definite integral with 0, ∞ as limits. (CO 3, K2)

3. **Say true or false:** f(x) cos (n x) is an even function. (CO 1, K1)

4. $\iint dxdy$ represent the --------of the region S. K_3 (CO 4, K3)

5. The value of $\int_0^{\pi} \int_0^1 r^2 sin\theta \, dr \, d\theta$ is ------ . (CO 4, K3)

a) 2/3 b) 1/3 c) 1 d) 3

Part B

1. Find $\iint (x + 3y) dxdy$, limits from 0 to 1 and x to 1. (CO 4, K3)

2. Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{\infty} \frac{r}{(r^2 + a^2)^2} \, dr \, d\theta$. (CO 4, K3)

3. Evaluate $\int_0^a \int_0^x \int_0^y xyz \, dz \, dy \, dx$. (CO 4, K3)

4. Express $\int_0^1 x^m (1 - x^n)^p \, dx$ in terms of Gamma functions. (CO 3, K2)

5.Find the Fourier series for $f(x) = c$ in $-1 < x < 1$. (CO 3, K2)

Part C

1. Show that div (**r**/r) = 2/r. (CO 4, K3)

2. Find the equation of the (i) tangent plane, (ii) normal line to the surface xyz = 4 at the point (1, 2, 2). (CO 1, K2)

3. If $\nabla\varphi = 2xyz^3\mathbf{i} + x^2 z^3 \mathbf{j} + 3x^2yz^2\mathbf{k}$, then find $\varphi(x, y, z)$ if $\varphi(1, -2, 2) = 4$. (CO 3, K2)

4. Find the unit normal to the surface $x^3 - xyz + z^3 = 1$. (CO 4, K3)

5.Find the Fourier series for $f(x) = x^2$ in $-1 < x < 1$. (CO 4, K3)

Head of the Department | **Course Instructor**

Dr. M. K Angel Jebitha | **Mrs. J C Mahizha**

Department : Chemistry

Class : I B.Sc. Chemistry

Title of the Course : Allied Mathematics II: Vector Calculus and Fourier Series

Semester : II

Course Code : MU232EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232EC1	5	1	-	-	5	6	90	25	75	100

Learning Objectives:

1. To understand the concepts of vector differentiation and vector integration.
2. To apply the concepts in their respective disciplines.

Course Outcomes

COs	Upon completion of this course, the students will be able to:	Cognitive Level
CO - 1	remember the formulae of vector differentiation, integration and Fourier series	K1
CO - 2	understand various theorems related to vector differentiation, integration and Beta, Gamma functions	K2

CO - 3	solve problems on vector differentiation, integration, Beta, Gamma functions and Fourier series	**K3**
CO - 4	compare double and triple integrals, line, surface integrals, Beta, Gamma functions and Fourier series for Even and odd functions	**K4**

K1 - Remember; **K2** - Understand; **K3**- Apply; **K4** - Analyze

Teaching Plan

Total Contact hours*: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive Level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**VECTOR DIFFERENTIATION**								
	1.	Vector Algebra	2	1	K1(R), K2(U)	Lecture Method Illustrative Method Game-Based Learning	Guided Note-taking Visualize the Images Memory Game (Vector Operations)	E-material – Google Classroom Interactive PPT Video Lectures	Formula Recall Check Slip Test Exit Ticket CIA I
	2.	Differentiation of Vectors	3		K2(U), K3(Ap)	Demonstration Algorithmic Approach Problem Solving	Step-by-step Problem Solving Peer Discussion Students Re-demonstrate Steps Think Aloud	E-material – Google Classroom Interactive PPT Video Lectures	Step-by-step Solutions In-class Practice Surprise Test CIA I

	3.	Gradient	4	1	K2(U), K3(Ap)	Analytical Method Heuristic Method Interactive Method	Breakdown the Problem **Analyze the Problem** Think-Pair-Share	E-material – Google Classroom Interactive PPT Video Lectures	Concept Explanation Live Problem Solving Quiz One Minute Paper CIA I
	4.	Equation of Tangent Plane	4		K3(Ap), K4(An)	Constructive Method Problem-Based Learning Socratic Method Computational Thinking	Hands-on Creation Group Work Q&A Session Lateral Thinking	E-material – Google Classroom Interactive PPT Video Lectures	Construction of Examples Spot Check In-class Practice Class Test Exit Ticket CIA I
	5.	Divergence and Curl	5	1	K2(U), K3(Ap), K4(An)	Comparative Study Illustrative Method Inquiry-Based Learning Problem Solving	Compare & Contrast Visualize Vector Fields Analyze the Situations Solving Problems	E-material – Google Classroom Interactive PPT Video Lectures	Comparative Analysis Concept Mapping Oral Quiz Assignment Problem Solving CIA I
II	DOUBLE AND TRIPLE INTEGRALS								
	6.	Double Integrals	1	2	K1(R), K2(U)	KWL Method Lecture Method Inductive Method	Think-Pair-Share (KWL) Guided Note-taking Observing Patterns	E-material – Google Classroom Interactive PPT Video Lectures	Concept Explanation Formula Check One Minute Paper CIA I

	7.	Solved Problem on Double Integrals	6		K3(Ap)	Problem Solving Demonstration Trial & Error Method Algorithmic Approach Inquiry based Learning	Solving Problems Lateral Thinking Peer Teaching Using Techniques for Solving Problems Group Work	E-material – Google Classroom Interactive PPT Video Lectures	In-class Practice Step-by-step Solutions Peer Assessment Surprise Test Assignment Exit Ticket CIA I
	8.	Triple Integrals	1	1	K2(U), K4(An)	Analytical Method Synthetical Method Comparative Study	Breakdown the Problem Compare with Double Integrals Group Discussion	E-material – Google Classroom Interactive PPT Video Lectures	Identify Cases/Problems Generate Solutions MCQ CIA I
	9.	Solved Problem on Triple Integrals	6		K3(Ap), K4(An)	Problem Solving Heuristic Method Algorithmic Approach Inquiry based Learning Computational Thinking	Solving Problems Creating Solutions Using Techniques for Solving Problems Group Work Analyze the Problem	E-material – Google Classroom Interactive PPT Video Lectures	Assignment Step-by-step Solutions Class Test One Minute Paper Spot Check In-class Practice Exit Ticket CIA I
III	LINE AND SURFACE INTEGRALS								
	10.	Line Integrals	1	1	K1(R), K2(U)	Lecture Method Illustrative Method Interactive Method	Guided Note-taking Visualize Paths Q&A Session	E-material – Google Classroom Interactive PPT Video Lectures	Concept Explanation Slip Test Quick Quiz CIA I
	11.	Evaluation of Line Integrals	5		K3(Ap)	Problem Solving Demonstration	Step-by-step Solving Students Re-	E-material – Google Classroom	In-class Practice

						Algorithmic Approach Inquiry based Learning Computational Thinking	demonstrate Think-Pair-Share Group Work Analyze the Problem	Interactive PPT Video Lectures	Assignment Spot Check Slip Test Exit Ticket One Minute Paper CIA I
	12.	Surface Integrals	1	1	K2(U), K4(An)	Comparative Study Analytical Method Constructive Method	Compare with Line Integrals Analyze 3D Surfaces Create Surface Models	E-material – Google Classroom Interactive PPT Video Lectures	Concept Mapping Group Discussion CIA I
	13.	Evaluation of Surface Integrals	5		K3(Ap), K4(An)	Problem Solving Heuristic Method Computational Thinking Algorithmic Approach	Solving Problems Decomposing Problems Testing Hypotheses Using Techniques for Solving Problems	E-material – Google Classroom Interactive PPT Video Lectures	Step-by-step Solutions Understanding Check Slip Test Exit Ticket Class Test CIA I
	14.	Theorems of Green, Gauss and Stokes	1	1	K2(U), K4(An)	Comparative Study Socratic Method Case Study Method	Compare Three Theorems Q&A Deep Dive Physical Case Analysis	E-material – Google Classroom Interactive PPT Video Lectures	Comparative Table Oral Test Spot Check CIA II
	15.	Evaluation of Integrals using Green, Gauss and Stokes	5		K3(Ap), K4(An)	Problem Solving Deductive Method Game-Based Learning Computational Thinking Algorithmic Approach	Using Techniques Theorem Application Relay Race (Theorem Choice) Testing Hypotheses Using Techniques for Solving Problems	E-material – Google Classroom Interactive PPT Video Lectures	Assignment Quiz-like Games Exit Ticket Live Problem Solving Oral Test Peer Assessment Understanding Check CIA II

IV	BETA AND GAMMA FUNCTION								
	16.	Properties of Beta and Gamma Functions	2	1	K1(R), K2(U)	Lecture Method Inductive Method Game-Based Learning	Guided Note-taking Observing Patterns Memory Game	E-material – Google Classroom Interactive PPT Video Lectures	Formula Recall Oral Quiz Slip Test Exit Ticket CIA II
	17.	Results on Beta and Gamma Functions	3		K2(U)	Synthetical Method Analytical Method Interactive Method	Mind Map Step-by-step Explanation Peer Discussion	E-material – Google Classroom Interactive PPT Video Lectures	Concept Mapping Oral Quiz Class Test Peer Assessment CIA II
	18.	Evaluation of Integrals using Beta Functions	5	1	K3(Ap)	Problem Solving Algorithmic Approach Trial & Error Method Computational Thinking	Solving Problems Step-by-step Approach Lateral Thinking Analyze the Problem	E-material – Google Classroom Interactive PPT Video Lectures	Exercise Problems Assignment Live Problem Solving Understanding Check CIA II
	19.	Evaluation of Integrals using Gamma Functions	5		K3(Ap)	Problem Solving Algorithmic Approach Trial & Error Method Computational Thinking	Solving Problems Step-by-step Approach Lateral Thinking Analyze the Problem	E-material – Google Classroom Interactive PPT Video Lectures	Exercise Problems Assignment In-class Practice Spot Check CIA II
	20.	Relation between Beta and Gamma Functions	3	1	K2(U), K4(An)	Analytical Method Inquiry-Based Learning Socratic Method	Derive the Relation Formulating Questions Q&A Session	E-material – Google Classroom Interactive PPT Video Lectures	Concept Mapping Understanding Check Slip Test One Minute Paper CIA II

V	FOURIER SERIES								
	21.	Even and Odd Functions	3	1	K1(R), K2(U)	Inductive Method Interactive Method Socratic Method	Observing Patterns Think-Pair-Share Narrating Concepts	E-material – Google Classroom Interactive PPT Video Lectures	Function Classification Quick Quiz One Minute Paper CIA II
	22.	Fourier Series Coefficients	3	1	K1(R), K2(U)	Lecture Method Algorithmic Approach Demonstration	Guided Note-taking Step-by-step Derivation Students Re-demonstrate	E-material – Google Classroom Interactive PPT Video Lectures	Formula Recall Check Dictation Slip Test MCQ CIA II
	23.	Problems on Fourier Coefficients	4		K3(Ap)	Problem Solving Heuristic Method Computational Thinking	Solving Problems Analyze the Problem Pattern Recognition	E-material – Google Classroom Interactive PPT Video Lectures	Assignment Step-by-step Solutions In-class Practice Class Test CIA II
	24.	Half Range Expansion	4	1	K3(Ap), K4(An)	Comparative Study Analytical Method Problem Solving	Compare with Full Range Breakdown the Problem Solve Problems	E-material – Google Classroom Interactive PPT Video Lectures	Comparative Analysis Problem Solving Exit Ticket Live Problem Solving CIA II
	25.	Sine Series	4		K3(Ap), K4(An)	Deductive Method Problem Solving Interactive Method	Using Techniques Solving Problems Peer Discussion	E-material – Google Classroom Interactive PPT Video Lectures	Exercise Problems Quick Check Peer Teaching Slip Test In-class Practice CIA II

	26.	Cosine Series	4		K3(Ap), K4(An)	Comparative Study Problem Solving Synthetical Method	Compare Sine vs Cosine Solve Problems Mind Map Creation	E-material – Google Classroom Interactive PPT Video Lectures	Assignment Comparative Table Understanding Check CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities (SD): **Quiz, MCQ, Slip Test, Problem Solving, Formula Relay, Riddles**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): -

Activities related to Cross Cutting Issues: -

Assignment: Exercise Problems in the Text Book (Last date to submit – 31-03-2026)

Sample questions

Part A (1 mark)

1. If $\vec{r} = x\vec{\imath} + y\vec{\jmath} + z\vec{k}$, then what is the value of $\nabla.\vec{r}$? **(K1-R, CO-1)**
2. Evaluate the integral $\int_0^1 \int_0^2 dy\, dx$. **(K3-Ap, CO-3)**
3. If C is the straight line joining (0,0,0) and (1,1,1), then $\int_C \vec{r}d\vec{r}$ **(K3-Ap, CO-3)**
   (a) 1/2 (b) 1 (c) 3/2 (d) 2
4. Say True or False: The beta and gamma functions are connected by the equation $\beta(m,n) = \frac{\Gamma(m+n)}{\Gamma(m)\Gamma(n)}$. **(K1-R, CO-1)**
5. Fill in the Blanks: If $f(x)$ is an even function in $(-\pi, \pi)$, then the Fourier coefficient b_n for $f(x)$ is given by …….. **(K1-R, CO-1)**

Part B (6 marks)

1. Prove that $div(r^n\vec{r}) = (n+3)r^n$. Deduce that $r^n\vec{r}$ is solenoidal if and only if $n = -3$. **(K2-U, CO-2)**
2. Evaluate $\iint_D x^2y^2 dx\, dy$, where D is the circular disc $x^2 + y^2 \leq 1$. **(K3-Ap, CO-3)**

3. Evaluate $\int_C \vec{f}\, d\vec{r}$, where $\vec{f} = (x^2 + y^2)\vec{\imath} - 2xy\vec{\jmath}$ and the curve C is the rectangle in the $x - y$ plane bounded by $y = 0, y = b, x = 0, x = a$. **(K3-Ap, CO-3)**
4. Prove that $\beta(m, n) = \beta(n, m)$. **(K3-Ap, CO-3)**
5. Determine the Fourier expansion of $f(x) = x, -\pi < x < \pi$. **(K3-Ap, CO-3)**

Part C (12 marks)

1. Find the equation of the (i) tangent plane (ii) normal line to the surface $xyz = 4$ at the point $(1,2,2)$. **(K3-Ap, CO-3)**
2. Evaluate $\int_0^2 \int_1^3 \int_1^2 xy^2 z\, dz\, dy\, dx$. **(K3-Ap, CO-3)**
3. Using Green's theorem evaluate $\int_C (xy - x^2)dx + x^2 y\, dy$ along the closed curve C formed by $y = 0, x = 1$ and $y = x$. **(K4-An, CO-4)**
4. Prove that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. Hence find the value of $\beta\left(5, \frac{7}{2}\right)$. **(K3-Ap, CO-3)**
5. Find the Fourier (i) cosine series (ii) sine series for the function $f(x) = \pi - x$ in $(0, \pi)$. **(K3-Ap, CO-3)**

Head of the Department
[Dr. M. K. Angel Jebitha]

Course Instructor
[Dr. A. Anat Jaslin Jini]

Department : **Mathematics**
Class : **I B.Sc Mathematics**
Title of the Course : **Skill Enhancement Course - SEC-I: Introduction to Computational Mathematics**
Semester : **II**
Course Code : **MU232SE1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232SE1	2	-	-	-	2	2	30	25	75	100

Learning Objectives:

1) To study and design mathematical models for the numerical solution of scientific problems.
2) To acquire the skills and confidence to learn new mathematical knowledge as becomes necessary in the course of a lifetime.

Course Outcomes

On the successful completion of the course, student will be able to**:**		
CO1	gain an appreciation for the role of computers in mathematics, science, and engineering as a complement to analytical and experimental approaches.	**K1 & K2**
CO2	acquire a strong foundation in numerical analysis, enabling students to evaluate and analyze numerical solutions for mathematical problems.	**K2**
CO3	use and evaluate alternative numerical methods for the solution of systems of equations.	**K3**
CO4	foster critical thinking skills in assessing computational methods for problem solving.	**K3**
CO5	apply mathematical concepts to practical problems through computational approaches.	**K3**

K1 - Remember; **K2** - Understand; **K3**- Apply

Teaching plan

Total Contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**ERRORS IN NUMERICAL CALCULATIONS**								
	1	Computer and Numerical Software	1	1	K1(R) & K2(U)	Lecture with Illustration Method	Group Discussion	YouTube Video	Slip Test, CIA I
	2	Computer Languages, Software Packages	1		K2(U) & K3(Ap)	Inquiry-Based Method	Collaborative Learning, Brainstorming	Interactive PPT	Conceptual Quiz, CIA I

	3	Mathematical Preliminaries	1		K2(U) & K3(Ap)	Heuristic Method, Jigsaw Learning,	Peer Learning	Interactive PPT	Problem Solving Assignment, CIA I
	4	Errors and their computations, A general error formula	2		K2(U) & K3(Ap)	Inductive Method,	Mind map	-	Class Test, CIA I
II	**SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS**								
	1	Introduction	1	1	K1(R) & K2(U)	Lecture with discussion,	Think-Pair-Share, memory game	YouTube Video	Conceptual Quiz, CIA I
	2	Bisection method, Problems on Bisection method	2		K2 (U), K3(Ap) &	Deductive Method	Logical reasoning	-	Conceptual Assignment CIA I
	3	Method of False Position, Problems on Method of False Position	2		K2(U) & K3(Ap)	Heuristics Method	Concept Mapping	-	Surprise Test, CIA I
III	**INTERPOLATION**								
	1	Finite differences	1	1	K1(R) & K2 (U)	Observation-Based Learning	Peer Teaching	Video Lectures	Conceptual MCQs, CIA I
	2	Forward Differences, Backward Differences	2		K2(U) & K3(Ap)	Comparative Case Method	Guided problem solving sessions, memory game	-	Discussion-based evaluation on implications, CIA I
	3	Central Differences	2		K2(U) & K3(Ap)	Flipped Classroom	Inquiry Based Learning	YouTube Video	Slip Test, CIA II

IV	**NUMERICAL DIFFERENTIATION AND INTEGRATION**								
	1	Errors in Numerical Differentiation, Cubic Splines Method	2	1	K1(R) & K2(U)	Inquiry-Based Learning	Think-Pair-Share, Worksheet-Based Learning	Interactive PPT	Problem Solving, CIA II
	2	Differentiation formulae with function values	1		K2(U) & K3(Ap))	Blended Learning	Creative thinking, Concept Mapping	Interactive PPT	Slip Test, CIA II
	3	Trapezoidal Rule	2		K2(U) & K3(Ap)	Problem-solving method	Concept Mapping, Group Problem Solving	YouTube Video	Peer discussion, CIA II,
V	**NUMERICAL LINEAR ALGEBRA**								
	1	Introduction, Triangular Matrices, Problems on Triangular Matrices	1	1	K1(R) & K3(Ap)	Interactive Lecture with board	Peer Instruction	YouTube Video	Peer Review, CIA II
	2	LU Decomposition of a Matrix, Vector and Matrix Norms	1		K2(U)	Flipped Classroom	Peer Learning	Self Prepared Video	Problem Solving Assignment, CIA II
	3	Solution of linear systems – Direct methods	1		K3(Ap)	Problem Solving	Problem-Based Learning	Interactive PPT	Open Book Exam, CIA II
	4	Gauss Elimination, Problems on Gauss Elimination	2		K3(Ap)	Lecture Method	Concept Mapping	YouTube Video	Class Test CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities (Em / En /SD): Quiz, MCQ, Slip Test, Problem Solving, Relay Race, Riddles, PPT Presentation

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - Professional Ethics

Assignment: Problems on Trapezoidal Rule (Last date to submit: 20-02-2026)

Sample questions

Part A

1. The number 0.00023 has how many significant digits? (K1(R), CO-1)
   a) 5 b) 2 c) 3 d) 4
2. Every polynomial equation of the n^{th} degree has ---------- roots. (K1(R), CO-1)
3. The derivation of the error formula uses which theorem repeatedly? (K1(R), CO-1)
   a) Taylor's theorem b) Lagrange's theorem
   c) Rolle's theorem d) Mean value theorem
4. Write a formula for Trapezoidal rule. (K2(U), CO-2)

5. Choose the best answer: Back substitution method is useful in

   a) Gauss Jacobi method b) Gauss Seidel method

   c) Gauss elimination method d) Gauss Jordan method (K1(R), CO-1)

Part B

1. Find the difference $\sqrt{6.37} - \sqrt{6.36}$ to three significant figures. (K3(Ap), CO-3)
2. Explain the bisection method for finding a real root of the equation $f(x) = 0$. (K2(U), CO-2)
3. Locate and correct the error in the following table: (K3(Ap), CO-3)

x	2.5	3.0	3.5	4.0	4.5	5.0	5.5
y	4.32	4.83	5.27	5.47	6.26	6.79	7.23

4. From the following table of values of x and y, obtain $\frac{dy}{dx}$ for x=1.2. (K3(Ap), CO-3)

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

5. Use Gauss elimination method to solve the system (K3(Ap), CO-3)

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16.$$

Part C

1. Given that $u = \frac{5xy^2}{z^3}$, find the relative error at $x = y = z = 1$ when the errors in each of $x.y,z$ is 0.001. (K3(Ap), CO-3)

2. Find a real root of the equation $x^3 - 2x - 5 = 0$ correct to three decimal places using Bisection method. (K3(Ap), CO-3)

3. Find the cubic polynomial which takes the following values: $y(1) = 24,\ y(3) = 120,\ y(5) = 336$ and $y(7) = 720.$ Hence obtain the value of $y\ (8)$. (K3(Ap), CO-3)

4. Evaluate $I = \int_0^1 \frac{1}{1+x} dx$, correct to three decimal places by the trapezoidal rule. (K3(Ap), CO-3)

5. Solve the equations $2x + 3y + z = 9;$ $x + 2y + 3z = 6;$ $3x + y + 2z = 8$ by the method of LU decomposition. (K3(Ap), CO-3)

Head of the Department **Course Instructor**

Dr. M.K. Angel Jebitha Dr. V. Sujin Flower

Class : **I UG**

Semester : **II**

Name of the Course : **Non-Major Elective Course : Mathematics for Competitive Examinations II**

Course Code : **MU232NM1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232NM1	2	–	–	–	2	2	30	50	50	100

Learning Objectives:

1. To understand the problems stated in various competitive examinations and realize the approach to get solution.
2. To acquire skill in solving quantitative aptitude by simple methods.

Course Outcomes

On the successful completion of the course, students will be able to:

CO1	understand the problems and remember the methods to solve problems.	**K2**
CO2	identify the appropriate method to solve problems.	**K1**
CO3.	apply the best mathematical method and obtain the solution in short.	**K3**
CO4	apply fundamental mathematical concepts to calculate simple interest, compound interest.	**K3**
CO5	develop problem-solving skills and critical thinking by effectively solving real-world scenarios involving financial calculation	**K2**

K1 - Remember; **K2** - Understand; **K3**- Apply; **K4** - Analyse; **K5-** Evaluate

Teaching plan

Total Contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**Simple Interest and Compound Interest**								
	1	Finding simple interest and principal amount	3	1	K2(U)	Brainstorming	Think–Pair–Share, numerical practice	YouTube aptitude videos	Slip test, Assignment
	2	Annual compound interest	1		K2(U)	Problem-solving approach	Guided practice, peer learning	PPT	Quiz, Assignment

	3	Half-yearly compound interest and Quarterly Compound interest	2		K2(U)	Inquiry-based approach	Step-by-step problem solving	PPT	Oral questioning, In-class Practice
II	**Time and work**								
	1	Work sharing and Individual work .	2	1	K2(U)	Brainstorming	Group discussion, collaborative learning	Aptitude videos	Homework
	2	Combined work	1		K2(U)	Flipped classroom	Real-life application discussion		Assignment In-class Practice
	3	Time taken for work	2		K2(U)	Error Analysis based teaching	Solved examples	Online solved problems	Problem solving test
III	**Time and Distance**								
	1	Comparing speed and Average speed	2	1	K1(R)	Brainstorming	Numerical drills, peer discussion	YouTube tutorials, e-content	Home Work Surprise Test
	2	Distance travelled by vehicles	2		K1(R)	Inquiry-based learning	Real-life application discussion	Online aptitude notes	Group discussion
	3	Travelling Time	1		K1(R)	Flipped classroom	Recall formulas, quick problem solving	Interactive PPT	Formula recall test
IV	**Chain Rule**								
	1	Direct Proportion	2	1	K3(Ap)	Gamification method	Quiz games, competitive problem solving	Online quiz tools, videos	Homework
	2	Indirect Proportion	2		K3(Ap)	Simulation-based teaching	Virtual examples, hands-on practice	Simulation apps, e-notes	Slip test

V	Pipes and Cisterns								
	1	Filling the tank	2	1	K3(Ap)	Blended learning	Step-by-step problem solving	YouTube aptitude channels	Assignment
	2	Emptying the tank	3		K3(Ap)	Problem-solving method	Individual practice, peer correction	Online practice platforms	Slip test

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability, Skill Development**

Activities (Em / En /SD): **Hands on Training on Problem solving**

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): -

Environment Sustainability activities related to Cross Cutting Issues:-

Assignment: Solving Problems in Simple Interest, Compound Interest and Time & Work (Last date to submit – example: 04-02-2026)

Sample questions

Part A

1. At what rate of simple interest a certain sum will be double in 15 years? (CO-4, K2)
2. A and B together can complete a piece of work in 15 days and B alone in 20 days. In how many days can A alone complete the work? (CO-1, K2)
3. A train travels 82. 6 km/hr. How many meters will it travel in 15 minutes? (CO-2, K1)
4. 35 women can do a piece of work in 15 days. How many women would be required to do the same work in 25 days? (CO-3, K3)
5. Pipe A can fill a tank in 30 hours and pipe B in 45 hours. If both the pipes are opened in an empty tank, how much time will they take to fill it? (CO-5, K2)

Part B

1. The simple interest on a sum of money is 4/9 of the principal. Find the rate percent and time if both are numerically equal. (CO-4, K2)

2. A can do a piece of work in 7 days of 9 hours each and B can do it in 6 days of 7 hours each. How long will they take to do it, working together $8\frac{2}{5}$ hours a day? (CO-1, K2)
3. While covering a distance of 24 km, a man noticed that after walking for 1 hour and 40 minutes, the distance covered by him was $\frac{5}{7}$ of the remaining distance. What was his speed in meters per second? (CO-2, K1)
4. 8 men working for 9 hours a day complete a piece of work in 20 days. In how many days can 7 men working for 10 hours a day complete the same piece of work? (CO-3, K3)
5. Two pipes can fill a cistern in 14 hours and 16 hours respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom it took 32 minutes more to empty it? When the cistern is full, in what time will the leak? (CO-5, K2)

Part C

1. The difference between compound and simple interests on a certain sum of money at the interest rate of 10% per annum for $1\frac{1}{2}$ years is Rs. 183, when the interest is compounded semi-annually. Find the sum of money. (CO-4, K2)
2. A can complete a work in 10 days, B in 12 days and C in 15 days. All of them began the work together, but A had to leave the work after 2 days of the start and B, 3 days before the completion of the work. How long the work last? (CO-1, K2)
3. A man covers a certain distance on a toy train. Had the train moved 4 km/hr faster, it would have taken 30 minutes less. If it moved 2 km/hr slower, it would have taken 20 minutes more. Find the distance. (CO-2, K1)
4. A contract is to be completed in 50 days and 105 men were set to work, each working 8 hours a day. After 25 days, $\frac{2}{5}$ of the work is finished. How many additional men be employed so that the work may be complete on time, each man now working 9 hours a day? (CO-3, K3)
5. A cistern has three pipes A, B and C. A and B can fill it in 3 hours and 4 hours respectively while C can empty the completely filled cistern in 1 hour. If the pipes are opened in order at 3, 4 and 5 p.m. respectively, at what time will the cistern be empty? (CO-5, K2)

Head of the Department

[Dr. M. K. Angel Jebitha]

Course Instructor

[Dr. M. K. Angel Jebitha]

Department : **Mathematics**

Class : **II B.Sc Mathematics**

Title of the Course : **Core Course VII Groups and Rings**

Semester : **IV**

Course Code : **MU234CC1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU234CC1	5	-	-	-	5	5	75	25	75	100

Objectives: 1. To introduce the concepts of Group theory and Ring theory.

2. To gain more knowledge essential for higher studies in Abstract-algebra.

CO	Upon completion of this course the students will be able to:	CL
CO – 1	recall the definitions of groups ,rings, functions and also examples of groups and rings	K1
CO – 2	explain the properties of groups, rings and different types of groups and rings	K2
CO - 3	develop proofs of results on Permutation groups ,Cyclic groups, Quotient group, Subgroups, subrings , quotient rings	K3
CO - 4	test the homomorphic and isomorphic properties of groups and rings	K4
CO - 5	examine the properties of Ideals-Maximal and Primei deals- Cosets-order of an element	K5

Teaching plan

Total Contact hours: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/Evaluation Methods
I	**Groups**								
	1	Definition and examples on Groups	3	1	K1(R)	Lecture with Illustration Method, Inquiry-Based Learning	Group Discussion	E- Content	Questioning, Quiz, CIA I
	2	Definition and examples on Permutation Groups	2		K1(R) & K2(U)	Problem-Solving Method, Inquiry-Based Method	Collaborative Learning, Brainstorming	Interactive PPT	Slip Test, CIA I
	3	Definition of cycle and theorem based on cycles	2	1	K3(Ap) & K2(U)	Heuristic Method	Peer Learning	Interactive PPT	Problem Solving, CIA I
	4	Theorems on even and odd permutations	1		K2(U)	Integrative method, Inductive Method	Mind map	-	Class Test, CIA I

	5	Definition examples, theorems and problems of sub groups	2	1	K3(Ap) & K2(U)	Inductive Method, Problem-solving method	Analyze problem situations, Peer Teaching	Interactive PPT	Slip Test, CIA I, Homework
	6	Theorems on cyclic groups and problems based on cyclic groups	2		K3(Ap) & K2(U)	Lecture with discussion, Deductive Method	Interactive Learning	-	CIA I
II	**Subgroups**								
	1	Definition and Theorems on order of an Element	2	1	K1(R) & K2(U)	Lecture with discussion, Deductive Method	Think-Pair-Share, memory game	-	Conceptual Quiz, CIA I
	2	Problems on order of an element	2		K1 (R), K3(Ap)	Group Discussion	Logical reasoning	-	Conceptual Assignment, CIA I
	3	Definition of Cosets and problems on cosets	2	1	K3(Ap) & K1(R)	Flipped Classroom	Inquiry Based Learning	PPT	Slip Test, Peer Review, CIA I
	4	Lagrange's Theorem, Euler's Theorem, Fermats theorem	2		K3(Ap)	Lecture, Integrative method	Problem Based Learning	-	MCQs, CIA I
	5	Normal subgroups - Definition and Examples	2	1	K3(Ap) & K2(U)	Group Discussion	Interactive Learning	-	Brainstorming, CIA I
	6	Problems and theorems on Normal Subgroups	2		K3(Ap) & K2(U)	Problem-solving method	Problem-solving method	-	CIA I

III	**Normal Subgroups**								
	1	Definition, theorems and Examples of Isomorphism	3	1	K4(An) & K2 (U)	Observation-Based Learning	Peer Teaching	Video Lectures	Conceptual MCQs, CIA I
	2	Cayley's Theorem and Theorem on Automorphism and generators	3		K3(Ap)	Illustration Method	Problem Based Learning	-	Discussion-based evaluation
	3	Definition of Homomorphism and Examples	2	1	K2(U)	Blended Learning, Synthetic Method	Participative learning	-	Slip Test, CIA II
	4	Fundamental Theorem of Homomorphism	2		K4(An)	Problem-solving method	Think Pair Share	PPT	CIA II
	5	Problems on Kernel	2	1	K5(E)	Flipped Classroom	Problem solving	-	CIA II
IV	**Rings**								
	1	Definition, Elementary properties and examples of Rings	2	1	K1(R) & K2(U)	Inquiry-Based Learning	Think-Pair-Share	Interactive PPT	Problem Solving, CIA II
	2	Problems based on Isomorphism of Rings	2		K3(Ap)	Blended Learning, Problem-solving method	Creative thinking, Concept Mapping	Interactive PPT	Slip Test, CIA II

	3	Types of Rings and Theorems	2	1	K4(An) & K5 (E)	Lecture Method, Problem-solving method	Concept Mapping, Group Problem Solving	-	Peer discussion, CIA II, Class Test
	4	Examples of Skew fields and Theorems based on Skew fields	2		K3(Ap) & K2(U)	Problem-solving method	Logical reasoning	-	Conceptual Assignment, CIA II
	5	Definition and Theorems on integral Domains	2	1	K3(Ap) & K2(U)	Collaborative learning, Problem-solving method	Brainstorming	E-notes	Brainstorming CIA II
	6	Characteristic of a Ring	2		K4(An) & K2 (U)	Inquiry-Based Learning	Collaborative Learning, Brainstorming	Interactive PPT	CIA II
V	**Ideals**								
	1	Definition and Examples of Left and Right Ideal	2	1	K1(R)	Interactive Lecture with board	Peer Instruction	-	Peer Review, CIA II
	2	Problems and Theorems on Left and Right Ideal	2		K2(U)	Analytic Method	Peer Learning	-	Problem Solving Assignment, CIA II
	3	Definition, Theorems and Examples , Principal Ideals	2	1	K4(An) & K5 (E)	Problem Solving	Problem-Based Learning	Interactive PPT	Open Book Exam, CIA II
	4	Ordered integral Domains	2	1	K2(U)	Inquiry-Based Learning	Seminar	-	Brainstorming ,CIA II

	5	Maximal and Prime Ideals	2		K3(Ap)	Lecture Method	Concept Mapping	-	Peer discussion, CIA II
	6	Homomorphism of Rings	2		K3(Ap)	Problem-solving in groups	Group Problem Solving	E-Content	Slip Test, CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities (Em / En /SD): **Online Quiz**

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - Professional Ethics

Assignment: Problems on Left and Right Ideal (Last date to submit: 18-03-2026)

Sample questions

Part A

1. The number of elements in the symmetric group S_n is **(CO- 5, An)**

   a) n b) 1 c) n! d) 0
2. How many elements in the symmetric group S_n ? **(CO- 2, U)**

   $(a) n$ (b) 1 $(c) n!$ (d) 0
3. State whether it is true or false. **(CO- 5, An)**

   Every subgroup of $(Z_n, \oplus)$ is normal.

4. Which of the following is not a field **(CO- 4, E)**

a) (N,+,.) b) (C, +,.) c) (Q,+, .) d) (R,+,.)

5. An integral domain R is said to be a_. **(CO- 1, R)**

Part B

1. Prove that a non empty subset H of a group G is a subgroup of G iff a, b $\in$ H $\Longrightarrow$ $ab^{-1} \in$ H. **(CO- 3, Ap)**
2. State and prove Lagrange's Theorem. **(CO- 2, U)**
3. Prove that any ordered integral domain D is of characteristic zero.
4. Prove that Z 7 is an integral domain. **(CO- 3, Ap)**
5. Define Ideal in the context of rings and describe the difference between left, right, and two-sided ideals. **(CO- 5, An)**

Part C

1. Prove that the union of two subgroups of a group G is a subgroup if and if one is contained in the other. **(CO- 2, U)**
2. Explain the Fundamental Theorem of Finite Abelian Groups. Classify the abelian groups of order 12. **(CO- 5, An)**
3. State and prove the fundamental theorem of homomorphism of Rings. **(CO- 2, U)**
4. Prove that the set F of all real numbers of the form $a+b\sqrt{2}$ where a,b$\in$ Q is a field under the usual addition and multiplication of real numbers.**(CO- 3, Ap)**

Head of the Department **Course Instructor**

Dr. M.K.Angel Jebitha **Dr. J.Befija Minnie**

Department : **Mathematics**
Class : **II B.Sc**
Semester : **IV**
Name of the Course : **Core Course VIII : Elements of Mathematical Analysis**
Course Code : **MU234CC2**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232CC2	5	-	-	-	5	5	75	25	75	100

Learning Objectives

1. To introduce the primary concepts of sequences and series of real numbers.
2. To develop problem solving skills.

Course Outcomes

On the successful completion of the course, students will be able to:		
CO 1	recall the basic concepts of real numbers, definitions on sequences and series of real numbers	**K1**
CO 2	explain the primary concepts of sequences and series of real numbers	**K2**
CO 3	calculate limit of the sequences and determine the convergence of the series by applying Cauchy's principles, root test and ratio tests	**K3**
CO 4	analyse the properties of real numbers, nature of sequences and series	**K3,K4**
CO 5	evaluate the behavior of sequences and the convergence of series using different types of tests	**K5**

Teaching plan

Total Contact hours: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Methods	E-Resources	Assessment/ Evaluation
I		**The Real Numbers- Preliminaries**							
	1.	Finite and Infinite Sets	4	1	K1, K2	Brain Storming	Concept Mapping Peer Teaching	E-material Interactive PPT	MCQ and Oral Q&A, CIA I
	2.	The algebraic and order properties of R	4	1	K1, K2	Gamification	Jigsaw Method, Mind Mapping	YouTube Video	Teach-back, Slip Test, Concept Recalling, CIA I
	3.	Absolute value and the real line	4	1	K3	Interactive Method	Experiential Learning, Group Work and Presentations	Interactive PPT	Think-Pair-Share, Questioning, CIA I
II	**The Real Numbers**								

	1.	The completeness property of R.	4	1	K2	KWL	Jigsaw Method, Peer Teaching	Interactive PPT	Concept explanations, CIA I
	2.	Applications of the supremum property	4	1	K2, K3	Inquiry based approach	Problem solving		Solved Problem, CIA I
	3.	Intervals	4	1	K2	Context based	Participative Learning, Concept-mapping	E-Content	Slip Test, CIA I
III	**Sequences**								
	1.	Sequences-Definitions Range of Sequences	2	1	K1	Brain Storming	Think-Pair-Share Concept Mapping Peer Teaching	E-material Interactive PPT	MCQ and Oral Q&A, CIA I
	2.	Limit of a Sequence	2		K2	Inquiry based	Jigsaw Method, Mind Mapping	YouTube Video	Slip Test, Concept Recalling, CIA I
	3.	Bounded Sequence	2	1	K2	Flipped classroom	Experiential Learning, Group Work and Presentations	Interactive PPT	Think-Pair-Share, Questioning, CIA II

	4.	Monotonic Sequence	2		K1, K2	Lecture with Interactive PPT	Hands on training, Peer Teaching, Concept mapping	E-Content, Interactive Quizzes	MCQ and Oral Q&A, CIA II
	5.	Convergent Sequence	2	1	K2	Blended Learning	Jigsaw Method, Peer Teaching	Interactive PPT	Slip test, CIA II
	6.	Behavior of monotonic sequence	2		K4	Problem Solving	Problem Solving		Quiz, CIA II
IV	**Cauchy's Sequences**								
	1.	Subsequences	3	1	K1, K2	Gamification	Experiential Learning, Peer Discussion	E-notes, Interactive PPT	Simple Programme Writing, CIA II
	2.	Peak points	3		K2	Simulation	Participative Learning, Mind Mapping	E-notes, Interactive PPT	Small-group discussion around conceptual MCQs, CIA II
	3.	Limit points	3	1	K2	Lecture with Interactive PPT	Think-Pair-Share Concept Mapping Peer Teaching	E-material Interactive PPT	Concept Explanation, Slip Test, Simple Questions

	4.	Cauchy's sequences	3	1	K2, K3	Context based	Jigsaw Method, Mind Mapping	YouTube Video	Discussion
V	**Series**								
	1.	Series-Definition& Examples	2	1	K1, K2	Blended Learning	Hands on training, Peer Teaching, Concept mapping	E-Content, Interactive Quizzes	Concept Recalling Socrative Poll, CIA II
	2.	Infinite series	2		K6	Lecture with Illustration	Experiential Learning, Group Work and Presentations	E-Content, Interactive Quizzes	Slip Test, CIA II
	3.	Theorems and problems based on Comparison Test	2	1	K4, K5	Brainstorming	Problem solving	Interactive PPT	Recall steps, MCQ, Questioning, CIA II
	4.	Problems based on Kummer's Test	2		K4	Flipped classroom	Participative Learning, Concept-mapping	E-Content, Interactive Quizzes	Recall steps
	5.	Problems based on Ratio Test	2	1	K5	Problem Solving	Problem solving	Interactive PPT	Online Assignment

	6.	Problems based on Root Test and Condensation Test	2		K5	Problem Solving	Participative Learning, Concept-mapping	E-Content, Interactive Quizzes	Recall steps

Course Focussing on Employability/Entrepreneurship/Skill Development: **Entrepreneurship** and **Skill Development**

Activities (Em/ En/SD): **Poster Presentation, Interactive PPT and Memory game**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): -

Activities related to Cross Cutting Issues: -

Assignment: **Solving Exercise problems**

Sample questions

Part A

1. The set $\mathbb{N} \times \mathbb{N}$ is (CO-1-K1)

(a) countable
(b) uncountable
(c) denumerable
(d) none of the above

2. Suppose that A and B are subsets of $\mathbb{R}$ that satisfy the property: $a \leq b$ for all $a \in A$ and all $b \in B$. (CO-2-K2)

(a) $sup\ A \leq inf\ B$ (b) $sup\ A \geq inf\ B$

(b) $sup\ A = inf\ B$ (d) None of the above

3. The peak points of the sequence 1,1/2,1/3,-1,-1,-1,…… are (CO-3-K3)

(a) 1,-1,0 (b) 1,1/2,1/3 (c) 1,2,3 (d) no peak points

4. The value of $\lim_{n\to\infty} n^{\frac{1}{n}}$ is ---------- (CO-4-K4)

5. $\sum (-1)^n \frac{1}{n}$ is ----------. (CO-5-K5)

Part B

1. Define denumerable and give two examples of denumerable sets. (CO-1-K1)

2. State and prove Archimedean property. (CO-2-K2)

3. Describe the boundedness of the sequence which is diverging to ∞.(CO-3-K3)

4. Every bounded sequence has at least one limit point. (CO-4-K4)

5. Test the convergence of $\sum\left(1+\frac{1}{n}\right)^{-n}$ (CO-5-K5)

Part C

1. Show that the following statements are equivalent: (CO-1-K1)

(i) S is a countable set

(ii) There exists a surjection of ℕ onto S

(iii) There exists an injection of S into ℕ

2. If $I_n = [a_n, b_n], n \in \mathbb{N}$ is a nested sequences of closed and bounded intervals such that the length $b_n - a_n$ of I_n satisfy $\inf\{b_n - a_n : n \in \mathbb{N}\} = 0$, then prove that the number ξ contained in I_n for all $n \in \mathbb{N}$ is unique. (CO-2-K2)

3. Discuss the behaviour of geometric sequence. (CO-3-K3)

4. Prove that a sequence (a_n) converges to l if and only if (a_n) is bounded and l is the only limit point of the sequence. (CO-4-K4)

5. (i) Discuss the convergence of $\sum \frac{1^2 + 2^2 + ...n^2}{n^3 + 5n + 2}$ (CO-5-K5)

(ii) Show that $\sum \frac{4^n + 5^n}{6^n}$ converges

Head of the Department

[Dr. M. K. Angel Jebitha]

Course Instructor

[Dr. L.Jesmalar]

Department : Mathematics
Class : II B.Sc. Mathematics
Title of the Course : Elective Core IV : Transform Techniques
Semester : IV
Course Code : MU234EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU234EC1	4	-	-		3	4	60	25	75	100

Learning Objectives:

1. To develop proficiency in solving Mathematical problems and analyzing signals using transform techniques.
2. To build a strong foundation in transform techniques and develop problem-solving skills applicable to a wide range of mathematical and engineering contexts.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	recall basic knowledge about Laplace transforms, inverse Laplace transforms, Fourier series, Fourier transform, and Z-transforms, including their definitions, properties, and fundamental concepts.	**K1**
2	demonstrate a solid understanding of the principles and concepts underlying Laplace transforms, inverse Laplace transforms, Fourier series, Fourier transform, and Z-transforms, including their applications in mathematical analysis and signal processing.	**K2**
3	apply Fourier sine and cosine transforms to solve difference equations.	**K3**
4	apply transform techniques to evaluate integrals, and solve ordinary and partial differential equations with constant and variable coefficients.	**K3, K4**
5	analyze and decompose periodic functions using the Fourier series, including expansion of periodic functions of period 2π, expansion of even and odd functions, and representation of functions over half intervals.	**K5**

K1 - Remember; **K2** - Understand; **K3**- Apply; **K4** - Analyze; **K5 -** Evaluate

Teaching Plan

Total Contact hours*: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive Level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**The Laplace Transforms**								
	1.	Introduction, Definitions	1	1	K1(R)	Socratic Method Lecture Method	Q&A Session Guided Note-taking	E-material – Google Classroom Interactive PPT Video Lectures	Concept Explanation Slip Test Questioning CIA I
	2.	Sufficient Conditions for the Existence of the Laplace Transform	3		K2(U), K3(Ap)	Inquiry-Based Learning Case Study Method Analytical Method	Analyze the Problem/Situation Group Discussion of Case Breakdown the Problem	E-material – Google Classroom Interactive PPT Video Lectures	Generate Solutions Surprise Test MCQ Live Problem Solving CIA I
	3.	Laplace Transform of Periodic Functions	2		K2(U), K3(Ap)	Flipped Classroom Heuristic Method Demonstration	In-class Q&A with Instructor Peer Teaching Students Re-demonstrate Steps	E-material – Google Classroom Interactive PPT Video Lectures	Step-by-step Solutions Class Test Peer Assessment Spot Check CIA I

	4.	Some General Theorems	2	1	K2(U), K3(Ap)	Gamification Deductive Method Synthetical Method	Relay Race Using Techniques for Solving Problems Creating Questions	E-material – Google Classroom Interactive PPT Video Lectures	Concept Relay Quiz-like Games Assignment One Minute Paper CIA I
	5.	Evaluation of Integrals using Laplace Transform	2		K3(Ap), K5(E)	Problem Solving Trial & Error Method Constructive Method	Solving Problems Lateral Thinking Hands-on Creation	E-material – Google Classroom Interactive PPT Video Lectures	Construction of Examples Exercise Problems Solving Dictation Slip Test Spot Check CIA I
II	**The Inverse Transforms**								
	1.	The Inverse Transform Definition and Examples	2	1	K2(U), K3(Ap)	Algorithmic Approach Blended Learning Interactive Method	Step-by-step Problem Solving *Discussion on the material referred* Peer Discussion	E-material – Google Classroom Interactive PPT Video Lectures	Quiz Step-by-step Solutions Slip Test Formula Recall Check Surprise Test CIA I

	2.	Applications of Laplace Transform of Ordinary Differential Equations with Constant Coefficient	3		K3(Ap), K4(An)	Problem-Based Learning Analytical Method Socratic Method	Group Work Breakdown the Problem Narrating Proof or Concepts	E-material – Google Classroom Interactive PPT Video Lectures	Proof Construction Class Test Generate Solutions Class Test CIA I
	3.	Applications of Laplace Transform of Ordinary Differential Equations with Variable Coefficient	3	1	K3(Ap), K4(An)	Inquiry-Based Learning Demonstration Computational Thinking	Formulating Questions Live Demonstration of Concepts Breakdown the Problem	E-material – Google Classroom Interactive PPT Video Lectures	Assignment Identify the Cases or Problems Surprise Test In-class Practice CIA I
	4.	Simultaneous Equations and Equations involving Integrals	2		K3(Ap), K4(An)	Synthetical Method Heuristic Method Algorithmic Approach	Think-Pair-Share Jigsaw Method Problem Solving	E-material – Google Classroom Interactive PPT Video Lectures	Group Discussion Relay Race Live Problem Solving Exit Ticket CIA I
III	**Fourier series**								
	1.	Fourier Series, Introduction	2	1	K1(R), K2(U)	Inductive Method Lecture Method Illustrative Method	Observing Patterns from Examples Guided Note-taking Visualize the Concept	E-material – Google Classroom Interactive PPT Video Lectures	Concept Explanation Questioning Formula Check One Minute Paper CIA I

	2.	Expansion of Periodic Functions of Period 2π	3		K3(Ap)	Constructive Method Problem Solving Deductive Method	Creating Solutions Group Work Using Techniques for Solving Problems	E-material – Google Classroom Interactive PPT Video Lectures	Step-by-step Solutions Assignment Surprise Test Exit Ticket CIA I
	3.	Expansion of Even and Odd Functions	2	1	K4(An)	Analytical Method Comparative Study Socratic Method	Analyze the Problem Group Discussion Brainstorming	E-material – Google Classroom Interactive PPT Video Lectures	Concept Mapping Peer Assessment Live Problem Solving Exit Ticket CIA I
	4.	Half Range Fourier Series	2		K5(E)	Heuristic Method Blended Learning Computational Thinking	Jigsaw Method Collaborative Online Documents Breakdown the Problem	E-material – Google Classroom Interactive PPT Video Lectures	Seminar Presentation Rubric-based Peer Assessment Construction of Examples Hands-on Practice CIA II
	5.	Change of Interval	3		K3(Ap)	Algorithmic Approach Gamification Peer Teaching	Using Techniques for Solving Problems Memory Game Peer Teaching	E-material – Google Classroom Interactive PPT Video Lectures	Assignment In-class Practice Problems Solving Understanding Check Class Test CIA II

IV	**Fourier Transform**								
	1.	Complex Form of Fourier Integral Formula	2	1	K2(U)	Deductive Method Analytical Method Illustrative Method	Deriving Steps for Proof Breakdown the Problem Mind Map	E-material – Google Classroom Interactive PPT Video Lectures	Concept Explanation Deriving Steps for Proof Home Work Spot Check CIA II
	2.	Fourier Integral Theorem	2		K2(U), K4(An)	Inquiry-Based Learning Socratic Method Flipped Classroom	Formulating Questions Peer Discussion In-class Q&A with Instructor	E-material – Google Classroom Interactive PPT Video Lectures	Proof Explanation Understanding Check Step-by-step Solutions Exit Ticket CIA II
	3.	Properties of Fourier Transform	4	1	K3(Ap), K4(An)	Synthetical Method Game-Based Learning Comparative Study	Creating Questions Relay Race Group Discussion	E-material – Google Classroom Interactive PPT Video Lectures	Concept Relay Oral Test Memory Check MCQ CIA II
V	**Fourier cosine and sine Transform**								
	1.	Fourier Cosine Transform	2	1	K3(Ap)	Deductive Method Problem Solving Peer Teaching	Using Techniques for Solving Problems Think-Pair-Share Peer Teaching	E-material – Google Classroom Interactive PPT Video Lectures	Exercise Problems Solving In-class Practice Slip Test CIA II

	2.	Fourier Sine Transform	2		K3(Ap)	Inductive Method Heuristic Method Analytical Method	Observing Patterns from Examples Brainstorming Lateral Thinking	E-material – Google Classroom Interactive PPT Video Lectures	Generate Solutions Peer Assessment Slip Test CIA II
	3.	Properties of F_c and F_s	2		K2(U)	Gamification Synthetical Method Interactive Method Lecture Method	Quiz Creation Group Work Memory Game Mind Map Q & A Session	E-material – Google Classroom Interactive PPT Video Lectures	Quiz-like Games Concept Mapping Assignment One Minute Paper CIA II
	4.	Parseval's Identity	2	1	K4(An), K5(E)	Problem-Based Learning Constructive Method Computational Thinking	Case Studies Hands-on Creation Testing Hypotheses	E-material – Google Classroom Interactive PPT Video Lectures	Class Test Proof Explanation Exit Ticket Class Test CIA II
	5.	Convolution Theorem	2		K4(An)	Illustrative Method Inquiry-Based Learning	Hands-on Creation Visualize the Concepts Think-Pair-Share	E-material – Google Classroom Interactive PPT Video Lectures	Construction of Examples Step-by-step Solutions Home Work CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities : **Quiz, MCQ, Slip Test, Problem Solving, Formula Relay, Poster Presentation, Riddles, PPT Presentation, Theorem Relay**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): -

Activities related to Cross Cutting Issues: -

Assignment: **Change of Interval, Fourier Cosine Transform** (Last date to submit – 31-03-2026)

Sample questions

Part A

Unit I

1. What is the value of $F(s)$, the Laplace transform of $f(t)$, when $s \to \infty$? **(K1-R, CO-1)**
   (a) 1 (b) 0 (c) $F(t)$ (d) ∞
2. True or False: The value of $L(cos\ at) = \frac{s}{s^2+a^2}$. **(K1-R, CO-1)**

Unit II

1. Write the relationship between Laplace transform and inverse Laplace transform. **(K1-R, CO-1)**
2. Find $L^{-1}\left[\frac{1}{s}\right]$. **(K1-R, CO-1)**

Unit III

1. $\int_0^{\pi} \sin^2 mx dx =$ ---------- if $m = n$ **(K1-R, CO-1)**

   (a) 0 (b) 2 (c) $\frac{\pi}{2}$ (d) 2π

2. Say True or False: $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + ... = \frac{\pi}{8}$ **(K1-R, CO-1)**

Unit IV

1. $F(s)$ is a purely imaginary function if $f(t)$ is a ---------- **(K2-U, CO-1)**
   (a) real function (b) real even function (c) real odd function (d) none of these.
2. $F\{F(x)\}$= ---------- **(K1-R, CO-1)**
   (a) $f(s)$ (b) $f(-s)$ (c) $f(-x)$ (d) $f(x)$

Unit V

1. The value of $F_s\{F_s(x)\} =$ …… **(K1-R, CO-1)**
2. The convolution of two functions $f(x)$ and $g(x)$ is defined by **(K1-R, CO-1)**
   (a) $\frac{1}{\sqrt{2\pi}}\int f(x)g(x-t)dt$ (b) $\frac{1}{\sqrt{2\pi}}\int f(t)g(x-t)dt$ (c) $\frac{1}{\sqrt{2\pi}}\int f(t)g(t)dt$ (d) $\frac{1}{\sqrt{2\pi}}\int f(t)g(x)dt$

Part B

Unit I

1. Find the value of (a) $L(e^{at})$ (b) $L(cosh\ at)$ (c) $L(sin\ at)$. **(K2-U, CO-2)**
2. Find the value of the following Laplace transform. (a) $L(te^{-t}sin\ t)$ (b) $L(t\ cos^2 t)$ **(K2-U, CO-2)**

Unit II

1. Derive the value of the inverse Laplace transform $L^{-1}\left[\frac{s}{s^2a^2+b^2}\right]$. **(K2-U, CO-2)**
2. Derive the value of $L^{-1}\left[\frac{1}{(s+1)(s^2+2s+2)}\right]$. **(K3-Ap, CO-4)**

Unit III

1. Express $f(x) = x(-\pi < x < \pi)$ as a Fourier Series with period 2π. **(K5-E, CO-5)**
2. Express $f(x) = \frac{1}{2}(\pi - x)$ as a Fourier series with period 2π. **(K5-E, CO-5)**

Unit IV

1. Prove that $F[f(ax)] = \frac{1}{|a|}F(\frac{s}{a})$. **(K2-U, CO-2)**
2. Prove the following. (a) $F\{\overline{f(x)}\} = \overline{F(-s)}$ (b) $F\{\overline{f(-x)}\} = \overline{F(s)}$ **(K2-U, CO-2)**

Unit V

1. Prove the following properties of Fourier Transforms. **(K2-U, CO-2)**
   (a) $F_c\{f(x)cos(ax)\} = \frac{1}{2}[F_c(s+a) + F_c(s-a)]$. (b) $F_c\{f'(x)\} = -sF_c(s)$.
2. Solve the integral equation $\frac{1}{2}\int_{-\infty}^{\infty} f(t)e^{-|x-t|}dt = h(x)$ where $h(x)$ is a given function. **(K2-U, CO-2)**

Part C

Unit I

1. Evaluate the following integrals. **(K4-An, CO-4)**
   (a) $\int_0^\infty \frac{e^{-t}-e^{-2t}}{t}dt$. (b) $\int_0^\infty \frac{e^{-t}sin\ t}{t}dt$.
2. Prove the following. **(K2-U, CO-2)**
   (a) If $L\{f(t)\} = F(s)$, then $L\{t\ f(t)\} = -\frac{d}{ds}F(s)$.

(b) If $L\{f(t)\} = F(s)$ and if $\frac{f(t)}{t}$ has a limit as $t \to 0$, then $L\left\{\frac{f(t)}{t}\right\} = \int_s^\infty F(s)ds$.

Unit II

1. Solve the equation $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = sin\ t$, given that $y = \frac{dy}{dt} = 0$ when $t = 0$. **(K3-Ap, CO-4)**
2. Solve the equation $t\frac{d^2y}{dt^2} - (2+t)\frac{dy}{dt} + 3y = t - 1$ when $y(0) = 0$. **(K3-Ap, CO-4)**

Unit III

1. Show that $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty}(-1)^n \frac{\cos nx}{n^2}$ in the interval ($-\pi \leq x \leq \pi$). **(K5-E, CO-5)**
2. A function f(x) is defined within the range$(0,2\pi)$ by the relations

   $f(x) = x$ in the range $(0, \pi)$

   $= 2\pi - x$ in the range $(\pi, 2\pi)$. Express f(x) as a Fourier series in the range $(0, 2\pi)$. **(K5-E, CO-5)**

Unit IV

1. Prove the following. **(K2-U, CO-2)**

   (a) $F\left\{\frac{d^n}{dx^n}f(x)\right\} = (-is)^n F(s)$ (b) $F\{x^n f(x)\} = (-i)^n \frac{d^n}{dx^n}F\{f(x)\}$
2. State and prove the Fourier Integral Theorem. **(K2-U, CO-2)**

Unit V

1. Prove that (a) $F_c\{xf(x)\} = \frac{dF_s}{ds}$ (b) $F_s\{x\,f(x)\} = -\frac{dF_c}{ds}$. Determine $F_c\{x\,e^{-ax}\}$ and $F_s\{xe^{-ax}\}$. **(K3-Ap, CO-3)**
2. Find the Fourier Cosine transform for F(x) if $f(x) = 1\ when\ |x| < 1\ \ and\ \ 0\ when\ |x| > 1$. **(K3-Ap, CO-3)**

Head of the Department
[Dr. M. K. Angel Jebitha]

Course Instructor
[Dr. A. Anat Jaslin Jini]

Department : Mathematics
Class : III B.Sc. Mathematics
Title of the Course : Core Course XII : Complex Analysis
Semester : VI
Course Code : MU236CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU236CC1	6	-	-	-	5	6	90	25	75	100

Learning Objectives:

1. To analyze complex functions using limits, continuity, differentiability, and analytic properties using Cauchy-Riemann equations and harmonic functions.
2. To apply complex analysis techniques such as Cauchy's theorems, Series expansion, and the residue theorem to evaluate integrals and solve problems.

Course Outcomes

COs	Upon completion of this course, the students will be able to:	Cognitive Level
CO - 1	recall and understand the fundamental concepts and results, and describe transformations and summarize Taylor's and Laurent's series, singularities.	K_1, K_2
CO - 2	compute limits, continuity, and differentiability, determine analyticity using C.R equations, apply transformations to map functions, and evaluate complex integrals using Cauchy's theorem, integral formula, and residues.	K_3
CO - 3	analyze the conditions for a function to be analytic or harmonic, conformal, compare different types of singularities, examine the properties of transformationsalong with their geometric interpretations, and investigate various cases of Cauchy's residue theorem.	K_4

CO - 4	evaluate definite integrals using contour integration techniques and justify the use of Taylor's and Laurent's series for function expansion.	K_5
CO - 5	construct analytic functions that satisfy given boundary conditions and design contour integration methods for evaluating definite integrals.	K_6

Teaching Plan

Total contact hours: 75 (Including instruction hours, assignments, and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student-Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**Analytic Functions**								
	1	Functions of Complex Variables, Limits	3	1	K_1 (R)	Recall the basic definitions, Discussions	Discussions, Brainstorming, Problem solving	YouTube-Limits, E-Note	Questioning
	2	Continuous Functions, Differentiability	3		K_2 (U)	Transmissive method with illustration	Group Discussion, Problem-solving	PPT	Summarize the concepts
	3	The Cauchy-Riemann Equations	3	1	K_3 (Ap)	Illustrative Method, Transmissive Method	Defining problems, Group discussion	E-Note	Questioning
	4	Analytic Functions, Harmonic Functions	3	1	K_4 (An)	Transmissive Method, Illustrative Method	Think -Pair-Share, Peer teaching	E-Book, YouTube-Analytic Functions	Assignment

II	**Bilinear Transformation**								
	1	Conformal Mapping	3	1	K_1 (R)	Problem solving, Transmissive method	Brainstorming, Debate	PPT	Slip Test
	2	Elementary Transformations	3	1	K_2 (U)	Transmissive method	Defining problems, Group discussion	E-Note	Collecting MCQ
	3	Bilinear Transformations	3	1	K_3 (Ap)	Flipped Classroom	Think-Pair-Share, Debate	E-Note, YouTube-Bilinear Transformations	Quiz
	4	Cross Ratio	3		K_4 (An)	Illustrative Method	Real-world problems, Group Discussion	E-Note	Questioning
III	**Complex Integration**								
	1	Definite Integral	3	1	K_2 (U)	Transmissive method	Group Discussion, Basic concepts recap	E-Book, YouTube-Definite Integral	Slip Test
	2	Cauchy's Theorem	3	1	K_4 (An)	Illustrative Method	Real-world problems, Group Discussion	E-Note	Questioning, CIA-I, Quiz
	3	Cauchy's Integral Formula	3		K_3 (Ap)	Problem Solving	Defining problems, Group discussion	E-Note	Collecting MCQ
	4	Higher Derivatives	3	1	K_5 (E)	Transmissive method	Think-Pair-Share, Problem-solving	E-Book	Quiz

IV	**Series Expansions**								
	1	Taylor's Series	3	1	K_3 (Ap)	Illustrative Method	Peer Instruction, Group Discussions	E-Book, PPT	Slip Test
	2	Laurent's Series	3		K_4 (An)	Illustrative Method	Problem solving, Think -Pair- Share	E-Book, PPT	MCQ
	3	Zeros of an Analytic Function	3	1	K_5 (E)	Illustrative Method	Think-Pair-Share, Group discussion	E-Book, YouTube-Zeros of an Analytic Function	Quiz
	4	Singularities (Definitions and Examples only)	3	1	K_6 (C)	Transmissive Method	Defining problems, Group discussion	E-Book, PPT	Questioning
V	**Calculus of Residues**								
	1	Residues	4	1	K_3 (Ap)	Transmissive Method,	Presentation, Peer Instruction, Group Discussions	E-Book	Questioning
	2	Cauchy's Residue Theorem	4	1	K_4 (An)	Group Discussion, Illustrative Method	Presentation, Think-Pair-Share	E-Book, YouTube-Cauchy's Residue Theorem	MCQ, CIA-II, Quiz
	3	Evaluation of Definite Integral Type 1, Type 2, Type 3 (First two examples in each type)	4	1	K_5 (E)	Illustrative Method	Defining problems, Group discussion	E-Book	Quiz

Course Focusing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities (SD): **Problem-solving, Seminar Presentation, Group Discussion**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Professional Ethics**

Activities related to Cross Cutting Issues: - **Open Book Test**

Assignment: **Elementary Transformation, Bilinear Transformations, Cross Ratio**

Sample questions

Part A

1. An analytic function in a region with constant modulus is ----------. (CO1, K1)

(a) non-constant (b) constant (c) zero (d) non-zero

2.The transformation T(Z) = $(\frac{1}{r})e^{i\theta}$ represents the ---------- w.r.t the unit circle $|z| = 1$. (CO3, K3)

3. Isolated singularities are --------. (CO1, K1)

4. A point is called a singular point if f(z) is not analytic at **a** and f is ----------.(CO1,K1)

5. State True or False: A bounded entire function in the complex plane is not constant. (CO2,K2)

Part B

1. Prove that the function f(z) = $\bar{z}$ is nowhere differentiable. (CO3, K3)

2. Prove that the real and imaginary parts of an analytical function and harmonic functions. (CO2, K2)

3. Explain Cauchy's theorem for multiply connected regions. (CO4, K4)

4. Expand $\frac{1}{Z^2-3Z+2}$ in Laurent's series valid in the region $1 < |z| < 2$. (CO3, K3)

5. State and Prove Rouche's Theorem. (CO4, K4)

Part C

1.(i) Any analytic function f(z) = u + iv with arg f(z) constant is itself a constant. (CO5,K5)

(ii) Prove that the function f(z) and f ($\bar{z}$) are simultaneously analytic. (CO5,K5)

2. State and prove Cauchy's theorem. (CO3,K3)

3. State and prove Taylor's theorem. (CO4,K4)

4. State and prove Laurent's theorem. (CO4,K4)

5. Find the poles of a function f (z) = $\frac{z^2+4}{z^{3+}2z^2+2z}$ and determine the residues at the poles. (CO5,K5)

Head of the Department **Course Instructor**

Dr. M. K Angel Jebitha, **Mrs. J C Mahizha**

Department : Mathematics
Class : III B.Sc Mathematics
Title of the Course : Core Course XIII: Mechanics
Semester : VI
Course Code : MU236CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU236CC2	6	–	–	–	5	6	90	25	75	100

Pre-requisite:

A basic understanding of vectors, Newton's laws of motion, fundamental mechanics, trigonometry, and calculus is required.

Learning Objectives:

1. To understand the fundamental principles of forces, equilibrium, friction, projectile motion, and central force motion.
2. To analyze and apply mathematical techniques to solve problems related to force systems, moments, friction, projectiles, and central orbits.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall fundamental concepts related to forces, moments, couples, friction, projectiles, and motion under central forces.	**K1**
2.	explain the principles governing equilibrium, force systems, friction, projectile motion, and central orbits.	**K2**
3.	apply the concepts of forces, friction, projectiles, and central motion to solve real-world problems.	**K3**
4.	analyze various mechanical systems involving forces, equilibrium, motion, and central orbits.	**K4**
5.	evaluate and justify the mathematical formulations and physical interpretations of forces, motion, and mechanical principles.	**K5**

K1 - Remember; **K2** - Understand; **K3**- Apply; **K4** - Analyse; **K5-** Evaluate

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**FORCES ACTING AT A POINT, PARALLEL FORCES AND MOMENTS**								
	1	Forces Acting at a Point: Resultant and Components - Sample cases of finding the resultant - Parallelogram of forces - Analytical expression for the resultant of two forces acting at a point - Triangle forces Perpendicular Triangular forces - Converse of the Triangle of Forces- The Polygon of Forces	2	1	K1(R) & K2(U)	Lecture with Illustration Method, Demonstration Method, Inquiry-Based Learning	Group Discussion	YouTube Video, E-Content	Slip Test, Quiz, CIA I

	2	Lami's Theorem, Problems based on Lami's Theorem	4		K2(U) & K3(Ap)	Lecture with Illustration Method, Problem-Solving Method, Activity-Based Learning, Inquiry-Based Method	Collaborative Learning, Brainstorming	Interactive PPT	Conceptual Quiz, CIA I
	3	Resultant of two like parallel forces, two unlike and unequal parallel forces, Resultant of number ofparallel forces, equilibrium of three coplanar parallel forces	3	1	K2(U) & K3(Ap)	Heuristic Method, Jigsaw Learning, Case-Based Learning	Peer Learning	Interactive PPT	Problem Solving Assignment, CIA I
	4	Moment of a force, Geometrical representation, Varigon's theorem of moments	3		K2(U) & K3(Ap)	Integrative method, Heuristic Method, Inductive Method,	Mind map	-	Class Test, CIA I

	5	Generalised theorem of moments, Problems based on Varigon's theorem of moments, Generalised theorem of moments	3	1	K2(U), K4(An) & K5(C)	Inductive Method, Case-Based Method, Problem-solving method	Analyze problem situations, Peer Teaching	Interactive PPT	Slip Test, CIA I, Homework
II	**COUPLES, COPLANAR FORCES**								
	1	Couples – Equilibriumof two couples – Representation of a couple by a vector – Resultant of coplanar couples – Resultant ofcouple and a force – Problems based on Couples, Introduction and reduction of any number of coplanar forces, Analytical proof	3	1	K1(R) & K2(U)	Inquiry-Based Learning, Lecture with discussion, Deductive Method	Think-Pair-Share, memory game	YouTube Video	Conceptual Quiz, CIA I
	2	Conditions for forces to reduce a single force or	3		K2 (U), K3(Ap) & K4(An)	Contextual Based Learning, Socratic	Logical reasoning	-	Conceptual Assignment CIA I

		couple, Change of the base point & Equation to the line of action of the resultant				Method, Group Discussion			
	3	Problems based on reduction of number of coplanar forces	3	1	K3(Ap) & K4(An)	Flipped Classroom	Inquiry Based Learning	YouTube Video	Slip Test, Peer Review, CIA I
	4	Problems based on forces to reduce a single force or couple	3		K3(Ap) & K4(An)	Integrative method	Problem Based Learning	-	MCQs, CIA I
	5	Problems based on Equation to the line of action of the resultant	3	1	K3(Ap) & K4(An)	Heuristics Method	Concept Mapping	-	Surprise Test, CIA I
III	**FRICTION**								
	1	Introduction, Statical, Dynamical, Limiting friction and Laws of friction, Coefficient of friction	2	1	K1(R) & K2 (U)	Observation-Based Learning, Contextual Based Learning	Peer Teaching	Video Lectures	Conceptual MCQs, CIA I
	2	Angle of friction, Cone of friction, Equilibrium of a particle on a rough inclined plane	3		K3(Ap) & K4(An)	Comparative Case Method, Illustration Method	Guided problem solving sessions, memory game	-	Discussion-based evaluation on implications, CIA I

	3	Equilibrium of a bodyon a rough inclined plane under a force parallel to the plane, Equilibrium of a body on a rough inclined plane under any force	2	1	K2(U)	Blended Learning, Synthetic Method	Creative thinking	-	Slip Test, CIA II
	4	Problems based on Coefficient of friction, angle of friction	4		K3(Ap)	Problem-solving method	Think Pair Share	-	CIA II
	5	Problems based on Equilibrium of a particle on a rough inclined plane and equilibrium of a bodyon a rough inclined plane under a force parallel to the plane	4	1	K3(Ap) & K4(An)	Problem-solving method, Flipped Classroom	Inquiry Based Learning	YouTube Video	Slip Test, CIA II
IV	**PROJECTILES**								
	1	Fundamental principles, Path of a projectile,	2	1	K1(R) & K2(U)	Inquiry-Based Learning,	Think-Pair-Share, Worksheet-	Interactive PPT	Problem Solving, CIA II

		Characteristics of the motion of a projectile				Visualization using diagrams	Based Learning		
	2	Path of a projectile at a certain height above the ground, Problems based on Path of a projectile	3		K3(Ap)	Blended Learning, Problem-solving method	Creative thinking, Concept Mapping	Interactive PPT	Slip Test, CIA II
	3	Problems based on Characteristicsof the motion of a projectile Maximum horizontal range, Two possible directions of projection,	4	1	K2(U)	Lecture Method, Problem-solving method	Concept Mapping, Group Problem Solving	YouTube Video	Peer discussion, CIA II, Class Test
	4	Problems based on maximum horizontal range and Two possible directions of projection	3	1	K3(Ap) & K4(An)	Blended Learning, Problem-solving method	Logical reasoning, Worksheet-Based Learning	-	Conceptual Assignment, CIA II
	5	Velocity of the projectile,Velocity of the projectile falling freely from the directrix, Problems based on Velocity of the projectile	3		K3(Ap) & K4(An)	Collaborative learning, Problem-solving method	Brainstorming	E-notes	Surprise Test CIA II

V	MOTION UNDER THE ACTION OF CENTRAL FORCES								
	1	Motion under the action of central forces - Introduction – Velocity and Acceleration in Polar Coordinates	3	1	K1(R)	Interactive Lecture with board, Blended classroom	Peer Instruction	YouTube Video	Peer Review, CIA II
	2	Equation of Motion in Polar Coordinates – Note on the equiangular spiral – Motion under a central force	3		K2(U)	Flipped Classroom, Analytic Method	Peer Learning	Self Prepared Video	Problem Solving Assignment, CIA II
	3	Differential Equation of central orbits – Perpendicular from the pole on the tangent – Pedal equation of the central orbit – Pedal equation of some of the well-known curves	3	1	K3(Ap)	Problem Solving	Problem-Based Learning	Interactive PPT	Open Book Exam, CIA II
	4	Velocities in a central orbit - Two	3	1	K3(Ap)	Lecture Method	Concept Mapping	YouTube Video	Peer discussion, CIA II

		– fold problems in central orbits							
	5	Problems based on motion under the action of central forces.	3		K4(An)	Group Discussion, Problem-solving in groups, Blended Learning	Group Problem Solving, Creative thinking	E-Content	Slip Test, CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities (Em / En /SD): **Hands on Training on Problem solving**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Professional Ethics**

Activities related to Cross Cutting Issues: - **Open Book Test**

Assignment: Problems on Couples (Last date to submit: 20-01-2026)

Sample questions

Part A

1. In a system where forces acting on a body maintain equilibrium, what is the algebraic sum of their moments about any line in the body? (K3-Ap, CO3)

   a) zero b) one c) infinite d) finite

2. Forces lying on a same plane are called as ---------- forces. (K2-U, CO-2)
3. When a body is sliding over another, what type of friction is exerted? (K3-Ap, CO-3)

a) Static friction b) Limiting friction c) Dynamic friction d) Maximum friction

4. **Say true or false:** Greatest height attained by a projectile is $u^2 \sin^2 \alpha$. (K2-U, CO-2)
5. What is the path described by a particle under the influence of a central force called? (K4-An, CO-4)

a) Linear trajectory b) Circular orbit c) Tangential path d) Central orbit

Part B

1. Show that the resultant of couples in the same plane on a rigid body is a single couple whose moment is equal to the algebraic sum of the moments of the several couples. (K3-Ap, CO-3)
2. Two men carry a load of 224kg at which hangs from a light pole of length 8m each end of which rests on a shoulder of one of the men. The point from which the load is hung is 2m nearer to one man than the other what is the pressure on each shoulder. (K3-Ap, CO-3)
3. A uniform ladder is in equilibrium with one end resting on the ground and the other against vertical wall; if the ground and wall be both rough, the coefficients of friction being μ and μ^1 respectively, and if the ladder be on the point of slipping at both ends, show that θ, the inclination of the ladder to the horizon is given by $tan\ \theta = \frac{1-\mu\mu^1}{2\mu}$. (K2-U, CO-2)
4. If h and h^1 be the greatest heights in the two paths of a projectile with a given velocity for a given range R. Prove that $R = 4\sqrt{hh^1}$. (K3-Ap, CO-3)
5. A particle moves in a curve under a central attraction so that its velocity at any point is equal to that in a circle at the same distance and under the same attraction. Show that the path is an equiangular spiral and that the law of force is that of the inverse cube. (K4-An, CO-4)

Part C

1. State and prove Lami's theorem. (K3-Ap, CO-3)

2. Forces 3, 2, 4, 5 kg wt act respectively along the sides AB, BC, CD and DA of a square. Find the magnitude of their resultant and the points where its line of action meets AB and AD. (K4-An, CO-4)

3. A weight can be supported on a rough inclined plane by a force P acting along the plane or by a force Q acting horizontally. Show that the weight is $\frac{PQ}{\sqrt{Q^2 sec^2\lambda - P^2}}$ where λ is the angle of friction. (K5-C, CO-5)

4. Show that the greatest height which a particle with initial velocity v can reach on a vertical wall at a distance a from the point of projection is $\frac{v^2}{2g} - \frac{ga^2}{2v^2}$. Prove also that the greatest height above the point of projection attained by the particle in its flight is $V^{6/}\!\!\diagup 2g(v^4 + g^2a^2)$. (K2-U, CO-2)

5. A particle moves in an ellipse under a force which is always directed towards its focus. Find the law of force, the velocity at any point of the path and its periodic time. (K3-Ap, CO-3)

Head of the Department

Dr. M.K. Angel Jebitha

Course Instructor

Dr. V. Sujin Flower

Department : Mathematics
Class : III B.Sc Mathematics
Semester : VI
Name of the Course : Core Course XIV: Theory of Celestial Sphere and Indian Mathematics
Course Code : MU236CC3

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU236CC3	6	-	-	-	4	6	90	25	75	100

Learning Objectives

1. To provide a foundational understanding of spherical astronomy, celestial coordinate systems, and related astronomical phenomena.
2. To explore the rich contributions of classical Indian mathematicians, emphasizing their methods in algebra, geometry, and combinatorics.

Course Outcomes

	On the successful completion of the course, students will be able to:	Cognitive Level
CO 1	recall fundamental concepts of the spherical trigonometry of the celestial sphere, zones of the Earth, Geometry, Combinations, and series.	**K1**
CO 2	explain the Celestial sphere, Dateline, Duration of Twilight, the method of false assumption in Egyptian mathematics, and Gross estimation of plane figures.	**K2**
CO 3	apply concepts such as hour angle**,** azimuth at rising**,** terrestrial latitude and longitude, and astronomical refraction to determine celestial positions accurately. It is also important to apply methodsforfindingunknownsfromsumsanddifferencesandforconstructingrationaltriangles whose sides differ by unity in solving geometric problems related to celestial observations.	**K3**

CO 4	explore the Four systems of coordinates, the Dip of Horizon General effects of refraction, and the geometry of quadrilaterals.	**K4**
CO 5	evaluate the Diurnal motion and sidereal Time, Cassini's Formula, the Pythagorean theorem, and Constructing 4 x 4 pan-diagonal magic squares.	**K5**

Teaching plan

Total contact hours*: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Methods	E-Resources	Assessment/ Evaluation
I	**Celestial sphere**								
	1.	Spherical trigonometry (only the four formulae) - Celestial sphere	3	1	K1 & K2	Brainstorming	Participative Learning	Interactive Power Point Presentation	Evaluation through short test, MCQ, True/False
	2.	Four systems of coordinates	3		K3	Transmissive method using Chalk and talk, Group Discussion	Group Discussion	Interactive Power Point Presentation, E-notes	Simple definitions, Recall steps, Slip Test
	3.	Diurnal motion, Sidereal Time	3	1	K1 & K3	Discussion, Analytic method,	Experiential Learning: Simulation-	Power Point Presentation,	Think-Pair-Share, Questioning

						Heuristic method	Based Exploration, Group Work and Presentations	E-notes, Video Tutorials	
	4.	Hour angle and Azimuth at rising	3	1	K3	Transmissive method using Chalk and talk, Problem-solving, Group Discussion.	Peer Teaching, Concept mapping	Interactive Power Point Presentation, E-notes, Interactive Quizzes	Interactive quizzes
	5.	Morning and Evening stars, Circumpolar stars	3		K3	Collaborative learning, Analytic Method, Lecture with Illustration	Participative Learning, Compare and Connect.	Interactive Power Point Presentation, E-notes, Interactive Quizzes	Slip Test, Quiz
II	**The Earth**								
	1.	The Earth-Zones of the earth	3	1	K1	Brainstorming & Discussion	Problem-solving, Demonstration .	Power Point Presentation, E-notes	Assignment
	2.	Perpetual Day and Perpetual night	3		K2	Flipped Classroom, Analytic Method	Participative Learning, Problem-solving	Power Point Presentation	Short summary MCQ, True/False.

	3.	Terrestrial latitude and longitude	3	1	K2 & K3	Chalk-and-talk, Flipped Classroom, Inquiry-Based Learning, Group Discussion	Think–Pair–Share Peer teaching, collaborative board work	Power Point Presentation	Concept explanation, Peer-assessed problem explanation
	4.	Date line	3	1	K3	Illustrative Method, Lecture, Collaborative Learning	Experiential Learning, Peer discussions and Presentation	Power Point Presentation, E-notes	Concept Recalling, Evaluation through short test
	5.	Dip of Horizon,	3		K3	Inductive Method, Problem-solving, Analytic Method	Participative Learning, Problem-solving	Power Point Presentation, Video Tutorials	Slip Test, Assignment
III	**Twilight, Refraction**								
	1.	Twilight, Duration of Twilight	3	1	K1 & K2	Flipped Classroom,, Analytic Method	Participative Learning: Group discussion, peer learning	E-notes	Quiz, CIA I

	2.	Twilight throughout the night, Shortest Twilight.	3		K3	Chalk-and-talk, Analytic Method, Inductive Method	Participative Learning, Problem-solving	Power Point Presentation, E-notes	Concept-check quiz
	3.	Refraction–Astronomical Refraction	3	1	K3	Lecture with discussion, Deductive Method, Group Discussion	Simulation-Based Exploration, Group Work and Presentations,	Power Point Presentation, E-notes	Slip Test, Teach-back
	4.	Tangent Formula for Refraction	2		K5	Socratic Method, Group Discussion, Problem-solving	Experiential Learning, Peer teaching	Power Point Presentation, E-notes	Recall steps, MCQ, Questioning
	5.	General effects of refraction	2	1	K5	Problem-Solving Method, Heuristic Method, Deductive Method	Participative Learning: Group discussion, peer learning	Power Point Presentation, E-notes	Small-group discussion around conceptual MCQs
	6.	Cassini’s Formula	2		K5	Chalk-and-talk, Analytic Method	Experiential Learning	Power Point Presentation, E-notes	Concept Explanation, Slip Test, Simple Questions

IV	**The 500-year Climax: Bhaskaracharya and His Legacy**								
	1.	The 500-year Climax: Bhaskaracharya and His Legacy: Introduction, Method of inversion	3	1	K1 & K2	Brainstorming, Group Discussion	Think–Pair–Share Peer teaching collaborative board work	Power Point Presentation, E-notes	Think-Pair-Share. Small-group discussion
	2.	To find an unknown quantity A digression: the method of false assumption in Egyptian mathematics	3	1	K3 & K4	Chalk-and-talk, Case-Based Learning, Illustrative method, Flipped Classroom	Experiential Learning: discover results through systematic solving steps	Power Point Presentation, E-notes	Concept mapping, Recalling Steps, Recalling Formula
	3.	Finding unknowns from sums and differences, Quadratic equations and right-angled triangles, Solution of cubic and biquadratic equations by reduction	3	1	K4 & K5	Illustrative method, Analytic Method, Socratic Method, Inductive Method, Problem-Solving Method	Participative Learning: Group discussion, peer learning	Power Point Presentation, E-notes	Recalling Formula, Home assessment, Group problem-solving

	4.	Rule of quantities and its Variations, A Medley of Mixed Quantities, Combinations, Series	3		K4 & K5	Collaborative learning, Illustrative method, Flipped Classroom	Participative Learning, Problem-solving	Power Point Presentation, E-notes	Worksheets, Assignment, Concept-check quiz, Assignment,
	5.	Geometry of Triangles and Quadrilaterals, The Pythagorean theorem	3	1	K5	Problem-Solving Method, Heuristic Method, Deductive Method	Participative Learning: Group discussion, peer learning	Power Point Presentation, E-notes	Small-group discussion around conceptual MCQs
V	**Navigating the Ocean of Mathematics: Narayana Pandita and Successors**								
	1.	Navigating the Ocean of Mathematics: Narayana Pandita and Successors – Introduction	2	1	K1 & K2	Flipped Classroom,, Analytic Method	Participative Learning: Seminar Presentation Discussion, Problem-solving	Power Point Presentation, Video presentation	Collaborative worksheet, Peer-assessed problem explanation, CIA II
	2.	The contents of Ganitakaumudi– Sequences and Progressions: The Cow Problem, Geometry	2		K4	Chalk-and-talk, Analytic Method, Inductive Method	Experiential learning: Seminar Presentation, Discussion	Power Point Presentation, Video presentation	Concept explanations, Oral presentation, CIA II

	3.	Sequences and Progressions: The Cow Problem – Geometry – Gross estimation of plane figures – Gross area of a regular polygon –	2	1	K4 & K5	Lecture with discussion, Deductive Method, Group Discussion	Problem-solving: Seminar Presentation, Discussion	Power Point Presentation, Video presentation	Questioning, Mid-unit test, Concept-check, Group quiz, CIA II
	4.	Gross circumference or area of a circle, Area of a triangle – Construction of rational triangles whose sides differ by unity	3	1	K2 & K3	Socratic Method, Group Discussion, Problem-solving	Participative Learning: Seminar Presentation, Discussion Peer learning	Power Point Presentation, Video presentation	Recall steps, Teach-back, Open Seminar, Home Assessment, CIA II
	5.	Geometry of a quadrilaterals – Combinations: Magic squares (Bhadraganita)	3		K2 & K5	Problem-Solving Method, Heuristic Method, Deductive Method	Seminar Presentation, Discussion	Power Point Presentation, Video presentation	Concept explanations
	6.	Properties of pan-diagonal magic square – Constructing 4 x 4	3		K4	Chalk-and-talk, Analytic Method	Seminar Presentation, Discussion Peer learning	Power Point Presentation, Video presentation	Evaluation through short test

		pan-diagonal magic squares.							

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability, Entrepreneurship and Skill Development**
Activities (Em/ En/SD): **Poster Presentation, Open Book Test, Group Discussions**
Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Professional Ethics**
Activities related to Cross Cutting Issues: - **Open Book Test**
Assignment: **Make an interactive PPT for the seminar (Due Date 27-01-2026)**

Sample questions

Part A

1. A star of declination δ is a circumpolar star at a place of latitude φ if ----------**(K1, CO1)**

(a) $\delta \geq 90^o - \varphi$ (b) $\delta > 90^o - \varphi$ (c) $\delta < 90^o - \varphi$ (d) $\delta \leq 90^o - \varphi$

2. The secondaries to the terrestrial equator are called----------.**(K2, CO2)**
3. What is "twilight"? **(K1, CO1)**
   a) Complete darkness b) Light just before sunrise or after sunset
   c) Afternoon Sunlight d) Midnight glow
4. Who was Bhaskaracharya, and what is his major contribution to Indian mathematics? **(K2, CO2)**
5. Name the main mathematical text written by Narayana Pandita.**K2, CO2)**

Part B

6. Find the maximum azimuth of a star. **(K2, CO2)**
7. Define Dip of horizon and derive an expression for Dip. **(K2, CO2)**
8. Derive the tangent formula for refraction..**(K4, CO4)**
9. Explain the method of inversion with an example from Bhaskaracharya's work. **(K4, CO4)**
10. Explain the contents of *Ganitakaumudi* and its significance. **(K5, CO5)**

Part C

1. Find the time taken by a star to rise when it is x" vertically below the horizon. **(K5, CO5)**

2. Trace the variations in the durations of day and night during the year for a place on the equator and at the north pole. **(K4, CO4)**
3. Derive Cassini's formula for refraction **. (K5, CO5)**
4. Examine Bhaskaracharya's contributions to the geometry of triangles and quadrilaterals. **(K2, CO2)**
5. Solve and explain the Cow Problem presented in Ganitakaumudi. **(K4, CO4)**

Head of the Department
Dr. M.K. Angel Jebitha

Course Instructor
Dr.T. Sheeba Helen

Teaching Plan

Department : Mathematics
Class : III B.Sc. Mathematics
Title of the Course : Discipline Specific Elective III: A) Data Structures
Semester : VI
Course Code : MU236DE1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MU236DE1	3	-	2	3	5	75	25	75	100

Learning Objectives

1. To introduce the fundamental concepts of data structures and to understand their role in problem-solving and algorithm development.
2. To develop the ability to implement various data structures efficiently using programming techniques and apply them in solving real-world computational problems.

Course outcomes

CO	Upon completion of this course, the students will be able to:	Cognitive level
CO1	recall fundamental concepts of data structures, including arrays, strings, pointers, structures, linked lists, stacks, queues, and trees, along with their basic operations, representations, and applications	K1
CO2	explain the fundamental concepts of data structures, including arrays, strings, pointers, structures, linked lists, stacks, queues, and trees, and demonstrate their operations, implementations, and applications	K2

CO3	apply appropriate data structures such as arrays, strings, pointers, linked lists, stacks, queues, and trees to solve computational problems.	**K3**
CO4	analyze various data structures, including arrays, pointers, linked lists, stacks, queues, and trees, to differentiate their characteristics and evaluate their efficiency in problem-solving	**K4**
CO5	evaluate the efficiency of various data structures, including arrays, pointers, linked lists, stacks, queues, and trees, by applying appropriate algorithms and justifying their suitability for different computational problems.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate;

Total contact hours*: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assess-ment Hours	Cognitive level	Pedagogy	Student Centric Methods	E-Resources	Assessment/ Evaluation
I	**Arrays**								
	1.	Arrays – One Dimensional Array, Array Initialisation	2	1	K1& K2	Brainstorming & Interactive Lecture with board	Participative Learning: Students list real-life applications of arrays	-	Oral Q&A, CIA I

	2.	Two Dimensional Array, Initialisation of Two dimensional Arrays	2		K2 & K3	Case-Based Method, Problem-solving, Lecture with Illustration	Hands-on lab exercises on arrays & strings, Visualization of memory layout using diagrams	Interactive Power Point Presentation, Video Tutorials	Teach-back, Slip Test, Writing a basic C language coding using array, CIA I
	3.	Two Dimensional Sorting, Multidimensional Arrays	2		K2 & K3	Discussion, Live coding demonstration	Experiential Learning: Write programs to perform custom sorting, Group Work and Presentations, Compare and Connect.	Power Point Presentation, Video Tutorials	Think-Pair-Share, Questioning, Create and compile a program, CIA I
	4.	Strings – Declaration of String Variables	1	1	K1, K3 & K5	Heuristic Method, Inductive Method, Deductive Method	Hands on training, Peer Teaching, Concept mapping	Interactive Power Point Presentation, Video Tutorials, Interactive Quizzes	Interactive quizzes on tokens; identify errors Worksheets and Homework, CIA I
	5.	Reading Strings, Writing Strings, String Handling Functions, Array of Functions	2	1	K1, K3, K4 & K5	Chalk-and-talk, Flipped Classroom, Inquiry-Based Learning,	Participative Learning: Error-hunt activity	Interactive Power Point Presentation, Video Tutorials, Interactive Quizzes	Slip Test, Quiz and Short Coding writing, CIA I

						Group Discussion			
II	**Pointers**								
	1.	Pointers – Pointer Definition, Pointer Operators	1	1	K1	Brainstorming & Discussion	Participative Learning: Concept-mapping for relationships between pointers, arrays, functions	Interactive Power Point Presentation, Video Tutorials,	Oral presentation, CIA I
	2.	Accessing Variables, Pointer Expressions, Call by value, Call by Reference	2		K2, K3 & K5	Flipped Classroom, Case-Based Method, Analogy method (house address → pointer address)	Experiential Learning: Code swap using call by reference	Power Point Presentation, E-notes, Video Tutorials	Short summary, Code Recalling, Quiz, CIA I
	3.	Pointers in Arithmetic Operations, Pointers and Arrays, Pointers and Character Strings	2	1	K2, K3 & K5	Chalk-and-talk, Flipped Classroom, Inquiry-Based Learning,	Participative Learning: Write programs using pointers & structures, Problem-solving.	Power Point Presentation, E-notes, Video Tutorials	Concept explanation, Peer-assessed problem explanation, Mid-unit test, CIA I

						Group Discussion			
	4.	Pointer to Pointers, Function Pointers. Structures and Unions – Structure Definition	2	1	K2, K3 & K5	Illustrative Method, Lecture, Collaborative Learning	Experiential Learning: Predict output of pointer expressions	Power Point Presentation, E-notes, Video Tutorials, Live Demos	Debugging Code, Socrative Poll, CIA I
	5.	Giving Values to Structure Elements, Structure Initialisation, Arrays of Structures	2		K2, K3 & K5	Inductive Method, Case-Based Method, Problem-solving, Analytic Method	Participative Learning: **Problem-based learning-** Students write pointer versions of existing array programs	Power Point Presentation, E-notes, Video Tutorials	Mini program Review, CIA I
III	**Linked List**								
	1.	Linked List	1	1	K1, K2 & K4	Flipped Classroom, Activity-Based Method, Problem-solving,	Participative Learning: Build linked list, Peer review	Interactive Power Point Presentation, Video Tutorials,	Quiz, CIA I

						Live coding			
	2.	Doubly Linked List	2		K2, K4 & K5	Chalk-and-talk, Programme Writing, Analytic Method, Inductive Method	Participative Learning: Hands-on coding practice in lab	SLO, Power Point Presentation, E-notes, Video Tutorials, Live Demos	Concept-check quiz, Group Code writing, Reflective writing, CIA I
	3.	Circularly Linked List	2		K3, K4 & K5	Lecture with discussion, Deductive Method, Programme Writing, Group Discussion	Experiential Learning: Debugging marathon for linked list segmentation faults	Power Point Presentation, E-notes, Video Tutorials, Live Demos	Slip Test, Teach-back, Mini-programme writing, CIA II
	4.	Header Linked List	2	1	K3, K4 & K5	Socratic Method, Group Discussion, Problem-solving in groups	Experiential Learning: Hands-on coding practice in lab	Power Point Presentation, E-notes, Video Tutorials, Live Demos	Simple Programme Writing, CIA II

	5.	Grounded Header Linked List	2	1	K2 & K5	Problem-Solving Method, Heuristic Method, Deductive Method	Participative Learning: Hands-on coding practice in lab	Power Point Presentation, E-notes, Video Tutorials, Live Demos	Small-group discussion around conceptual MCQs, CIA II
IV	**Stacks and Queues**								
	1.	Stacks, Implementation of Stack using Linked List	2	1	K1	Brainstorming & Group Discussion	Participative Learning: Think-pair and share, simulate queue movement	-	Think-Pair-Share. Small-group discussion, CIA II
	2.	Application of Stacks, Queue, Implementation of Queue using Array	2		K2, K3, K4 & K5	Chalk-and-talk, Simulation & modelling Flipped Classroom	Experiential Learning: Group coding**:** Implement priority queue	SLO, Power Point Presentation, E-notes, Video Tutorials	Concept mapping, Recalling Steps, Recalling Formula, CIA II
	3.	Implementation of Queue using Linked List, Circular Queue	2	1	K3 & K5	Illustrative method, Coding demonstration Problem-	Participative Learning: Peer instruction: Students explain	Interactive PPT, E-notes, Video Tutorials, Live Demos	Recalling Formula, Home assessment, Group problem-solving, Practical test. CIA II

						Solving Method	enqueue/dequeue to classmates		
	4.	Applications of Queue-Recursion, Priority Queue.	3		K2, K3, K4 & K5	Collaborative learning, Project-Based Learning, Coding demonstration, Flipped Classroom	Participative Learning: Role-play activity: Students act as “stack frames” for recursion	SLO, Power Point Presentation, E-notes, Video Tutorials, Live Demos	Viva: Applications of stack & queue, Assignment, Concept-check quiz, Assignment, CIA II
V	**Tree**								
	1.	Tree Introduction, Binary Trees	2	1	K2 &K3	Interactive Lecture, Concept Mapping, Flipped Classroom	Participative Learning: create a concept map of terms, Discussion, Problem-solving	Power Point Presentation, E-notes, Video Tutorials, Live Demos	Collaborative worksheet, Search for values in a sample BST, CIA II
	2.	Binary Search Tree-Insertion	2		K2, K3, K4 & K5	Visualization using diagrams Group Discussion, Problem-	Experiential learning: draw binary tree examples, Discussions, peer learning	Power Point Presentation, E-notes, Video Tutorials, Live Demos	Concept explanations, Implement BFS using queue, CIA II

						solving in groups			
	3.	Tree Traversal, Deletion	2	1	K4 & K5	Lecture with illustration, Real-life analogy, Live coding demonstration	Problem-solving: Group work, Project based learning to build binary search tree	Power Point Presentation, E-notes, Video Tutorials, Live Demos	Questioning, debugging sample BST programs, CIA II
	4.	Searching an Element, Breadth First Traversal	3	1	K2, K3, K4 & K5	Chalk-and-talk , Hands-on coding, Step-by-step demonstration, queue-based explanation	Participative Learning: practice inserting nodes, trace traversals for sample trees	Power Point Presentation, E-notes, Video Tutorials, Live Demos	Recall steps, Teach-back, Build & Traverse a Tree CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability and Skill Development**
Activities (Em/ En/SD): **Poster Presentation and Short Video Presentation**
Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Professional Ethics**
Activities related to Cross Cutting Issues: - **Open Book Test**

Assignment: **Linked Lists (Due Date 01-09-2025)**

Sample questions

Part A

1. Which of the following correctly declares a 2D array in C? **(K1-R, CO-1)**

a) int arr[10,10]; b) int arr[10][10]; c) int arr(10)(10); d) array int arr[10][10];

2. Which operator is used to access the value stored at a pointer variable? **(K2-U, CO-2)**

a) & b) * c) $ d) %

3. In a singly linked list, each node contains: **(K2-U, CO-2)**

a) Data only b) Data and a pointer to the next node c) Data and two pointers d) Only pointer to next node

4. Which data structure is used in implementing recursive function calls? **(K2-U, CO-2)**

a) Queue b) Stack c) Linked List d) Tree

5. Which traversal of a Binary Search Tree results in sorted order of elements? **(K1-R, CO-1)**

a) Preorder b) Post order c) Inorder d) Level-order

Part B

1. What is the difference between gets() and scanf() for reading strings? **(K4-An, CO-4)**
2. Explain pointer to a structure with a small example. **(K2-U, CO-2)**
3. What is a doubly linked list? Mention its advantages. **(K3-Ap, CO-3)**
4. What is a circular queue? How does it differ from a linear queue? **(K4-An, CO-4)**
5. Define a Binary Search Tree. How does it differ from a Binary Tree? **(K4-An, CO-4)**

Part C

1. Compare one-dimensional and two-dimensional arrays with examples. **(K2-U, CO-2)**

2. Describe call by value and call by reference with suitable examples. Write a C program to illustrate call by reference using pointers.. **(K2-U, CO-2)**
3. Explain the different types of linked lists (singly, doubly, circular). Write a C program to create a singly linked list and display its elements. **(K3-Ap, CO-3)**
4. Explain the implementation of stack using arrays. Write a C program to perform push and pop operations. **(K5-E, CO-5)**
5. Explain the insertion and deletion operations in a Binary Search Tree with suitable examples. Write a C program to perform inorder, preorder and postorder traversals. **(K4-An, CO-4)**

Head of the Department
Dr. M.K. Angel Jebitha

Course Instructor
Dr. S.Sujitha

Department : Mathematics
Class : III B.Sc Mathematics
Title of the Course : DISCIPLINE SPECIFIC ELECTIVE III: a) LINEAR PROGRAMMING
Semester : VI
Course Code : MU236DE4

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU236DE4	5	-	-	-	4	5	75	25	75	100

Learning Objectives:

1. To solve Linear Programming Problems using optimization techniques.
2. To apply algorithms for transportation, assignment, and sequencing problems.

Course Outcomes

On the successful completion of the course, students will be able to:		
6.	recall the fundamental principles, mathematical formulations, and solution methods of LPP, Duality, Transportation, Assignment, and Job Sequencing problems.	**K1**
7.	understand the theoretical concepts, problem structures, and computational techniques of LPP, Duality, Transportation, Assignment, and Job Sequencing problems for optimization analysis	**K2**
8.	apply appropriate optimization techniques, duality concepts, and solution approaches to solve real-world problems related to LPP, Transportation, Assignment, and Job Sequencing	**K3**
9.	analyze different optimization methods, duality strategies, and problem-solving techniques to assess their efficiency, feasibility, and relevance in decision-making.	**K4**
10.	evaluate various optimization models and solution methodologies in LPP, Duality, Transportation, Assignment, and Job Sequencing to determine their effectiveness in achieving optimal solutions	**K5**

Teaching plan

Total Contact hours*: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assignment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**Formulation of L.P.P**								
	1	Meaning & Formulation of LPP	2	1	K1(R)	Lecture, Use of real-life case illustrations (production, diet problems, transportation cost), Interactive Problem Solving, Classroom illustrations	Think–Pair–Share for problem formulation, Gallery Walk , Group Discussion	PPT, Video Lectures, Online Notes	Quiz, Written Assignment, Oral Presentation, CIA I
	2	Mathematical Modelling of LPP	2		K2(U)	Chalk & Talk for formulation, Problem-Based Learning, Logical reasoning technique for constraint handling.	Group discussions, Puzzle solving, Guided Worksheets, Group Activity: Convert real situations into LPP models	PPTs, Video Lectures	Quiz, Worksheet, Weekly problem sheets, CIA I
	3	Solution of LPP	2	1	K3(Ap)	Inquiry-Based Learning, Lecturing, Guided	Collaborative Learning,	PPT Presentation	Class Test, CIA I

						discovery through small real-world optimization tasks.	Formulating questions		
	4	Graphical Method	3		K2(U)	Flipped Classroom , Problem-based learning for graphical method	Group Discussion, Worksheets on graphical solutions, group activities, Q&A with instructor	Online Notes	Concept-based short viva questions, Short Quiz, CIA I
	5	Simplex Method (Standard form, Slack variables)	3	1	K2(U)	Step-by-step algorithm explanation, Problem-based learning for simplex method, Use of flowcharts to explain simplex algorithm, Demonstration of simplex method using tableau animations.	Guided Worksheets, Online discussions, Peer solving of simplex steps	E-notes, Simulation: Simplex method online calculator.	Surprise board test, Assignment, CIA I
II	**Big-M Method**								

	1.	Big-M Method: Introduction	2	1	K2 (U)	Step-by-step algorithm interpretation using algorithmic flow diagrams,	Think-Pair-Share, Peer Teaching, Reflective writing	PPT, Video Lectures, Online Notes	Quiz, Written Assignment, Oral Presentation, CIA I
	2.	Artificial Variables	2		K3 (Ap)	Interactive Lecturing, Digital simulation of artificial variable elimination, Analytical teaching	Inquiry-Based Learning, Concept Mapping, Hands-on worksheet	PPT Presentation	Quiz, Worksheet, Group Presentation, CIA I
	3.	Algorithm for Big-M Method	2	1	K3 (Ap)	Illustration, Practice Problems, Flipped Classroom, Algorithmic teaching with flowcharts	In-class discussions, Team-based problem solving with time limits	PPT Presentation	Slip Test, CIA I
	4.	Two-Phase Method (Phase I)	3		K4 (An)	Problem-Based Learning, Lecturing, Board problem solving	Group discussions, defining problems, Hands-on worksheet	E-notes	Quiz, Written Assignment, Oral Presentation, CIA I
	5.	Two-Phase Method (Phase II)	3	1	K4 (An)	Flipped Classroom , Socratic Questioning, Interactive Problem Solving	In-class discussions, group activities,	E-notes, PPTs	Oral Presentation, CIA I

							Worked examples		
III	**Duality in L.P.P**								
	1.	Concept of Duality	2	1	K1 (R)	Lecturing, Interactive Problem Solving, Chalk & talk + decision-based examples	Brainstorming, Think-pair-share, Create-your-own-problem	Online Dual LPP calculator	Short Test, CIA II
	2.	Formation of Dual LPP	2		K3 (Ap)	Collaborative Learning, Step-by-step Derivation, cooperative activities involving pairs and small groups	Peer Teaching, Student-led board solving, Guided Worksheets	PPTs	Quiz, Worksheet, Oral Presentation, CIA II
	3.	Matrix Form of Primal and Dual	2	1	K3 (Ap)	Conceptual teaching with primal–dual examples, Inquiry-Based Learning	Matrix activity, Duality matching game	Notes, PPTs	Worksheet, CIA II
	4.	Fundamental Theorem of Duality	3	1	K4 (An)	Analytical Lecturing, Blended Learning, Symbolic teaching	Group Discussion, Online discussions, collaborative documents	Online PDFs	Surprise board test, CIA II
	5.	Dual Simplex Method & Algorithm	3		K3(Ap)	Problem solving on Dual Simplex, Group Discussion,	Peer Teaching, Think-Pair-	Video Lectures	Oral viva on dual simplex steps, CIA II

							Share, Discussion		
IV	**Transportation problems**								
	1.	Mathematical Formulation	2	1	K2 (U)	Lecturing, Flipped Classroom	Group Interaction, In-class discussions, group activities	PPT, NPTEL	Quiz, Written Assignment, Oral Presentation, CIA II
	2.	Dual of Transportation Problem	2		K3 (Ap)	Problem Solving, Flipped Classroom	Group discussions, defining problems, brainstorming, Group Activity	YouTube Videos	Quiz, Worksheet, Group Presentation, CIA II
	3.	North-West Corner Rule	2	1	K3 (Ap)	Inquiry-Based Learning, Lecturing	Peer Learning, Team challenge, discussing research plans	Video Lectures, Online Notes	Evaluation through quiz test using quizziz, , Recall steps, CIA II
	4.	Row/Column Minima & Least Cost Method	3	1	K4 (An)	Blended Learning , Worked Examples	Group Work, Online discussions, collaborative documents	Interactive PDFs	Class Test, CIA II
	5.	Vogel's Approximation Method (VAM)	3		K4 (An)	Demonstratio, Peer Teaching	Hands-on Problem Solving, Explaining	NPTEL	Quiz CIA II

							concepts, answering questions from peers		
V	**Assignment Problems**								
	1.	Mathematical Formulation	2	1	K2 (U)	Lecture, Chalk & talk, Interactive Problem Solving	Think-Pair-Share, Peer Teaching, Group Discussion	PPT, Video Lectures, Online Notes	Quiz, Written Assignment, Oral Presentation, CIA II
	2.	Hungarian Algorithm – Introduction	2		K3 (Ap)	Lecture, Algorithm teaching with examples	Jigsaw Method, Group solving of Hungarian algorithm	PPTs, Video Lectures,	Quiz, Worksheet, CIA II
	3.	Hungarian Algorithm – Steps	2	1	K4 (An)	Collaborative Learning , Problem-Based Learning, Step-by-step board solving	Group discussions, defining problems, Pair work on row & column reduction	PPT, Video Lectures, Online Hungarian algorithm simulators	Viva–voce on algorithm steps, Concept definitions, CIA II
	4.	Travelling Salesman Problem	3	1	K4 (An)	Lecture with Illustration, Active Learning, Use of reduced cost matrix	Think-Pair-Share, Peer Learning, Discussions, brainstorming	PPT Presentation	Evaluation through short test, CIA II

	5.	Applications of Assignment Problem	3		K5 (E)	Inquiry-Based Learning, Flipped Classroom	Formulating questions, Peer explaining step reductions, In-class discussions, group activities	Video Lectures	Final Evaluation, CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability** and **Skill Development**

Activities (Em/ En/SD): Solve same problem using different methods

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Professional Ethics**

Activities related to Cross Cutting Issues: - **Open Book Test**

Assignment : Problem Solving (Last date to submit – 22-02-2026)

Sample questions

Part A (1 mark)

1. In the graphical method, the optimal solution of an LPP is obtained at: (**CO-1, K1)**
   a) Any point in the feasible region
   b) The intersection of two constraints
   c) The extreme points of the feasible region
   d) The midpoint of the feasible region
2. In the Big-M method, the value of 'M' represents: (**CO-2, K2)**
   a) A small negative value
   b) A large positive value
   c) A variable coefficient
3. In the two-phase method, what is the primary objective of Phase I? **(CO-3, K3)**

a) To solve the original LPP directly
b) To find an initial basic feasible solution
c) To maximize the objective function
d) To identify unbounded solutions

4. The objective of a transportation problem is to: (**CO-4, K4)**
   a) Maximize profit
   b) Minimize transportation cost
   c) Balance supply and demand
   d) Allocate resources equally
5. In an assignment problem, the primary objective is to: **(CO-4, K4)**
   a) Minimize the total assignment cost or maximize the total profit
   b) Minimize transportation costs
   c) Balance supply and demand
   d) Assign all resources equally to tasks

Part B (6 marks)

1) Old hens can be bought at Rs.20 each and young ones Rs.50 each. The old hens lay 3 eggs per week and young ones lay 5 eggs per week, each egg being worth Rs.1.25. Each hen needs Rs.5 per week to feed. Mr.X has only Rs.800 to spend for hens. How many of each kind should Mr.X buy to get a profit of more than Rs.60 per week assuming that Mr.X cannot have more than 20 hens. Create a LPP for the above problem. (**CO-2, K2)**
2) Prove that Dual of the dual is the primal. (**CO-4, K4)**
3) Using Vogel's Approximation Method, find a basic feasible solution to the following transportation problem. (**CO-3, K3)**

	1	2	3	4	a_i
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
b_j	6	10	12	15	43

4) Solve the transportation problem. **(CO-3, K3)**

	1	2	3	4	a_i
I	6	4	1	5	14
II	8	9	2	7	16
III	4	3	6	2	5
b_j	6	10	15	4	35

5) Solve the following Assignment problem **(CO-3, K3)**

	A	B	C
X	19	28	31
Y	11	17	16
Z	12	15	13

Part C (12 marks)

1. Using Simplex Method. Solve the L.P.P **(CO-2, K2)**
   Maximize $Z = 30x_1+20x_2$

   Subject to $10x_1+8x_2 \leq 800$, $x_1 \leq 60$, $x_2 \leq 75$, $x_1,x_2 \geq 0$
2. Solve the following L.P.P by Two Phase a method **(CO-3, K3)**
   Maximize $Z = 5x_1+8x_2$
   Subject to $2x_1+3x_2 \geq 3$
   $x_1+4x_2 \geq 4$
   $x_1+x_2 \leq 5$ $x_1, x_2 \geq 0$

3. Solve the following L.P.P by Dual simplex method (**CO-4, K4)**

   Minimize $Z = 4x_1+x_2$

   Subject to $3x_1+x_2 \geq 3$

   $4x_1+3x_2 \geq 6$

   $x_1+x_2 \leq 4$ $x_1, x_2 \geq 0$

4. Solve the transportation problem (**CO-3,K3)**

	1		2	3	4	a_i
I	6		4	1	5	14
II	8		9	2	7	16
III	4		3	6	2	5
b_j	6		10	15	4	35

5. Solve the following Assignment problem (**CO-2, K2)**

	C1	C2	C3	C4
P1	2	10	9	7
P2	15	4	14	8
P3	13	14	16	11
P4	4	15	13	9

Head of the Department

Dr. M. K. Angel Jebitha

Course Instructor

Dr. A. Jancy Vini