Department of Mathematics
UG Teaching Plan 23-24
Even Semester

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

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Polar and Pole, Diameters**					
	1.	Polar and pole- definition, illustration, conjugate points and conjugate lines - definition & illustration	3	K2	Introductory Session	Questioning
	2.	Diameters - examples, conjugate diameters - definition – remark, Exercise	3	K3	Lecture with Illustration	Simple Questions
	3.	Eccentric angles of the ends of a pair of conjugate semi-diameters of an ellipse - examples, conjugate diameters of a hyperbola	3	K3	Flipped Classroom	Recall Steps
II	**Polar Coordinates, Equation of Line, Circle, Conic, Chord, Tangent, Normal, Hyperbola**					
	4.	Polar coordinates - introduction, general polar equation of a straight line, polar equation of circle, equation of straight line - illustration, remark, exercise	3	K2	PPT using Gamma	MCQ
	5.	Equation of a circle, equation of a conic - illustration - remarks - examples, equations of the asymptotes of hyperbola - examples	3	K3	Lecture with Illustration	Group Discussion
	6.	Equation of a chord, equation of a tangent, equation of a normal, remark, exercise	3	K3	Blended Classroom	Simple Test
III	**The Plane**					
	7.	General equation of first degree - related theorems	2	K2	Introductory Session	Concept Explain

	8.	Transformation to the normal form, direction cosines of the normal to a plane, angle between two planes, parallelism and perpendicularity of two planes	3	K3	Problem Solving	Simple Questions
	9.	Determination of plane under given conditions - intercept form of the equation of plane - finding the equation of plane through three points	3	K3	Lecture with PPT	Recall Steps
	10.	System of planes - examples, two sides of a plane, length of the perpendicular from a point to a plane - examples	3	K2	Interactive Lectures	Home Assignment
	11.	Bisectors of angles between two planes - examples, joint equation of two planes, orthogonal projection on a plane - examples, volume of a tetrahedron - examples	3	K3	Collaborative Learning	Quiz
IV	**Representation of Line**					
	12.	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	K2	Lecture with chalk and talk	Concept Explain
	11.	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	Suggest formulae
	12.	Conditions for a line to lie in a plane -	4	K3	Interactive Method	MCQ

		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,				
	13.	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	Peer Discussion
V	**The Sphere**					
	14.	Equation of a sphere, general equation of a sphere - examples, the sphere through four given points - examples	3	K3	Blended Learning	Quiz through Nearpod
	15.	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	Debating
	16.	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	K2	Problem Solving	Solve Problems

	17.	Angle of intersection of two spheres, condition for orthogonality of two spheres, radical plane, radical line, radical centre	2	K3	Gamification	Class Test

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Skill Development
Activities (SD): Quiz, Problem Solving, Group Discussion
Assignment: Problem Solving from the plane and sphere sections

Sample questions (minimum one question from each unit)

PartA
1. The product of the slope of the pair of conjugate diameter is.............
2. The equation of the conic is.........
3. The number of arbitrary constants in the equation $Ax + By + Cz + D = 0$ is:
(a) 4 (b) 3 (c) 2 (d) 1
4. For every point (x, y, z)on x-axis:
(a) y = 0, z = 0 (b) x = 0, z = 0 (c) x = 0, y = 0 (d) y = 0, z = 0
5. State True or False: The curve of intersection of two spheres is a circle.

PartB
1. Find the eccentric angles of the ends of the poles of conjugate semi diameter of an ellipse.
2. Find the equation of the asymptotes of the hyperbola.
3. Prove that every equation of the first degree in x, y, zrepresents a plane.
4. Derive the conditions for the line to lie in a plane.
5. Find the equation of sphere through the points (0, 0,0), (0, 1,-1), (-1, 2,0), (1, 2,3).

PartC
1. Derive the formula for the conjugate diameter of the parabola.
2. Find the equation of circle.
3. Derive the formula for the volume of tetrahedron.
4. Derive the equation of line through the given point drawn in a given direction.
5. Find the equation of the circle circumscribing the triangle formed by three points (a, 0,0), (0, b, 0), (0, 0,c). Obtain also the co-ordinates of this circle.

Head of the Department **Course Instructor**

Dr. T. Sheeba Helen **Sr. S. Antin Mary**

Department: Mathematics
Class: I B.Sc
Title of the Course: 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 Outcome

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.	PSO - 1	K_1(R)
CO - 2	evaluate double and triple integrals and problems using change of order of integration.	PSO - 2	K_2(U)
CO - 3	solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution.	PSO - 5	K_3(An)
CO - 4	explain beta and gamma function sand to use them in solving problems of integration.	PSO - 4	K_2(U)
CO - 5	explain Geometric and Physical applications of integral calculus.	PSO - 3	K_2(U)

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

Unit	Module	Topics	Lecture hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Reduction formulae -Types					
	1.	Integration of product of powers of algebraic	3	K_2(U)	Introductory session, Group Discussion. PPT.	Simple definitions, MCQ, Recall formulae

		and trigonometric functions				
	2.	Integration of powers of trigonometric functions	3	K_3(Ap)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Quiz through Quizziz, MCQ, Recall formulae
	3.	Integration of product of powers of algebraic and logarithmic functions	2	K_3(Ap)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Suggest formulae, Solve problems, Home work
	4.	Integration of product of powers of algebraic functions	2	K_2(U)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Class test, Problem solving questions, Home work
	5.	integration of product of powers of trigonometric functions	2	K_3(Ap)	Lecture using Chalk and talk, Problem-solving, PPT.	Problem solving, Home work
II	**Double Integrals**					
	1	definition of double integrals	1	K_1(R)	Lecture using Chalk and talk, Problem-solving, PPT.	Check knowledge in specific situations.
	2	evaluation of double integrals	4	K_2(U)	Problem-solving, Demonstration.	Evaluation through short tests.
	3	double integrals in polar coordinates	4	K_3(Ap)	Problem-solving, Group Peer tutoring.	Formative Assessment.
	4	Change of order of integration.	3	K_3(Ap)	Lectures using videos, Problem-solving.	Online Quiz, Assignment
III	**Triple Integrals**					
	1	applications of multiple integrals	3	K_2(U)	Lectures using videos.	Evaluation through short tests.
	2	volumes of solids of revolution	2	K_2(U)	Introductory session, Group Discussion.	MCQ, True/False.
	3	areas of curved	2	K_3(Ap)	PPT, Review.	Evaluation through short

		surfaces				tests, Seminar.
	4	Change of variables	2	K_3(Ap)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Concept explanations.
IV	**Beta and Gamma functions**					
	1	Beta and Gamma functions – definitions	2	K_1(R)	Peer tutoring, Lectures using videos.	Evaluation through short tests.
	2	recurrence formula of Gamma functions	3	K_2(U)	Lecture using Chalk and talk, Problem-solving.	Concept definitions through Near pod.
	3	properties of Beta and Gamma functions	3	K_3(Ap)	Problem-solving, Group Discussion.	MCQ, True/False.
	4	relation between Beta and Gamma functions	2	K_3(Ap)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Concept definitions through Nearpod
	5	Application s.	2	K_3(Ap)	Group Discussion.	Slip Test
V	**Fourier Series**					
	1	Fourier Series – Definition	3	K_2(U)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Concept definitions
	2	The Cosine Series	3	K_1(R)	Peer tutoring, Lectures using videos.	Formative assessment
	3	The Sine Series	2	K_3(Ap)	Problem-solving, PPT.	SlipTest
	4	Half range Fourier Cosine and Sine Series	2	K_3(Ap)	Problem-solving, Group Discussion.	Assignment.
	5	Half range Fourier Sine Series	2	K_3(Ap)	Lecture through google meet	Quiz through Quizzes .

Course Focussing on Skill Development
Activities (Em/ En/SD): Quiz, MCQ, Slip Test, Problem Solving, Assignment, Presentation.
Assignment: Beta and Gamma functions

Sample questions (minimum one question from each unit)
Part A

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

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

   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

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

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

5. **Say true or false:** f(x) cos nx is an even function

Part B

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

Part C

1. Evaluate a reduction formula for $I_{m,n} = \int \sin^m x \cos^n x dx$ where m,n ≥ 1
2. Evaluate $\int_1^4 \int_{\sqrt{y}}^2 (x^2 + y^2) \, dx \, dy$ by changing the order of integration.
3. Evaluate $\int_0^{loga} \int_0^x \int_0^{x+y} e^{x+y+z} \, dz \, dy \, dx$
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 $x+y+z \leq 1$
5. Show that in the range 0 to 2π, the Fourier series expansion for e^x is $\frac{e^{2\pi-1}}{\pi}\left\{\frac{1}{2} + \sum_{n=1}^{\infty}\left(\frac{\cos nx}{n^2+1}\right) - \sum_{n=1}^{\infty}\left(\frac{n\sin nx}{n^2+1}\right)\right\}$

Head of the Department **Course Instructor**
Dr. T. Sheeba Helen **Dr. T. Sheeba Helen**

Department : **Mathematics**

Class : **I B. Sc Chemistry**

Title of the Course : **ELECTIVE – 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	-		4	6	90	25	75	100

Objectives

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

Course Outcomes

On the successful completion of the course, students will be able to:		PSO Addressed	Cognitive Level
1.	remember the formulae of vector differentiation, integration and Fourier series	PSO 1	K1
2.	understand various theorems related to vector differentiation, integration and Beta, Gamma functions	PSO 2	K2
3.	solve problems on vector differentiation, integration, Beta, Gamma functions and Fourier series	PSO 1	K3
4.	compare double and triple integrals, line, surface integrals, Beta, Gamma functions and Fourier series for Even and odd functions	PSO 3	K2

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I						
	1.	Revision of dot and cross product of vectors	2	K1	Brainstorming	Questioning
	2.	Gradient of a scalar function and its properties, Problems based on Gradient	3	K2	Heuristic Method	Recall Steps
	3.	Equation of tangent plane and normal line for a single surface	3	K3	Blended Learning	Slip Test
	4.	Equation of tangent line and normal plane for the intersection of two surfaces, Angle between two surfaces	3	K2	PPT	True or False
	5.	Divergence of vectors and its properties,	2	K3	Interactive Method	Peer Discussion with questions
	6.	Curl of vectors and its properties, Solenoidal and irrotational vectors	2	K3	Inductive Learning	Short Summary
II	**Evaluation of double and triple integrals**					
	7.	Introduction	2	K2	Blended Learning	Questioning
	8.	Definition of double integral and area of the region S	3	K2	Blended Learning	Slip Test
	9.	Solved Problems in double integrals	4	K3	Flipped Classroom	Short Answer
	10.	Definition of triple integral and volume of the region D	3	K3	Heuristic Method	MCQ
	11.	Solved Problems in triple integrals	3	K3	Analytic Method	Recall Steps
III	**Vector integration**					
	12.	Work done by a force	3	K3	Brainstorming	Questioning
	13.	Evaluation of line integrals	3	K3	Interactive	Slip Test

					Method	
	14.	Evaluation of surface integrals	3	K2	PPT	True or False
	15.	Green's theorems with problem	3	K2	Heuristic Method	Peer Discussion with questions
	16.	Stokes theorems with problems	3	K2	Blended Learning	Creating Quiz with Group Discussion
IV	**Beta and Gamma Function**					
	17.	Properties of Beta and Gamma functions	4	K2	Analytic Method	Quiz
	18	Results on of Beta and Gamma functions	3	K1	Interactive Method	Slip Test
	19	Evaluation of integrals using Beta and Gamma Functions	4	K3	PPT	True or False
	20	Relation between Beta and Gamma functions.	4	K2	Heuristic Method	Peer Discussion with questions
V	**Fourier series**					
	21.	Even and odd functions	2	K3	Brainstorming	Questioning
	22.	Fourier series and coefficients	2	K3	Interactive Method	Slip Test
	23.	Problems on Fourier coefficients	3	K4	PPT	True or False
	24.	Half range Expansion	2	K3	Heuristic Method	Peer Discussion with questions
	25.	Sine series and related Problems	3	K4	Blended Learning	Group Discussion
	26.	Cosine series and related Problems	3	K3	Analytic Method	MCQ

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

Activities (SD): Quiz, MCQ, Slip Test, Problem Solving, Presentation, Relay Race, Course

Assignment: Determine the Fourier expansion of the given function

Sample questions (minimum one question from each unit)

PART- A

1. A vector function $\vec{f}$ is said to be solenoidal if

   a) div $\vec{f}$ = 0 b) grad f = 0 c) curl $\vec{f}$ = 0 d) div f = 0

2. The value of $div\ curl\ f$ is …………

   a) f b) 1 c) 0 d) $\vec{0}$

3. If $\vec{f} = x^2\hat{i} - xy\hat{j}$ and C is the straight line joining the points (0, 0) and (1, 1) then $\int_C \vec{f}.d\vec{r}$ is …………..

   (a) 0 (b) -1 (c) 1 (d) 2

4. The work done by a force $\vec{f}$ in moving a particle along a curve C is ....

5. The value of beta and gamma functions are connected by--------------

   (a) $\beta(m,n) = \frac{\Gamma(m+n)}{\Gamma(m)\Gamma(n)}$ (b) $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ (c) $\beta(m,n) = \frac{\Gamma(m)+\Gamma(n)}{\Gamma(mn)}$ (d) $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(mn)}$

6. The value of $\Gamma\left(\frac{1}{2}\right)$ is --------------

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

7. For any integer n the value of cosnπ is---------------

   (a) 0 (b)1 (c)-1 (d)$(-1)^n$

8. If $f(x)$ is an even function in $(-\pi,\pi)$ the Fourier coefficient b_n for $f(x)$ is given by --------------

PART - B

9. In what direction from the point (1,3,2) is the directional derivative of $\varphi = 2xz - y^2$ maximum? What is the magnitude of this maximum?

10. Find curl curl $\vec{f}$ at the point (1,1,1) if $\vec{f} = x^2 y\hat{i} + zx\hat{j} + 2yz\hat{k}$

11. If $\vec{r} = \vec{a}\cos\omega t + \vec{b}\sin\omega t$ where $\vec{a},\vec{b}$ are constant vectors and ω is a constant, Prove that $div\left(\vec{r}\times\vec{a}\right) = 0$

12. Evaluate $\int_{(1,1)}^{(4,2)} \vec{f}.d\vec{r}$ if $\vec{f} = (x+y)\hat{i} + (y-x)j$ joining the parabola $y^2 = x$

13. Evaluate $\int_C \vec{f}.d\,\vec{r}$ where $\vec{f} = (x-y)\hat{i} + (y-2x)\hat{j}$ and C is the closed curve in the x-y plane x = 2cos t . y = 3sin t from t =0 to t = 2π

14. Prove that $\beta(m,n)=\beta(n,m)$.

15. Prove that $\int_0^\infty \frac{e^{-st}}{\sqrt{t}}dt=\sqrt{\left(\pi/s\right)}$ where $s>0$.

16. Determine the Fourier expansion of $f(x)=x$ where $-\pi<x<\pi$.

17. Show that when $0<x<\pi$

$$\pi-x=\frac{\pi}{2}+\frac{\sin 2x}{1}+\frac{\sin 4x}{2}+.......$$

PART - C

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

19. Find the angle between the surfaces $x^2 + y^2 + z^2 = 29$ and $x^2 + y^2 + z^2+4x - 6y - 8z - 47 = 0$ at (4, -3, 2).

20. If $\vec{r}$ is the position vector of any point P(x,y,z), prove that

(i) $grad\ r^n = nr^{n-2}\vec{r}$ (ii) $\nabla f(r)=\left(\frac{f'(r)}{r}\right)\vec{r}$

21. Prove that $div(r^n\vec{r})=(n+3)r^n$, Deduce that $r^n\vec{r}$ is solenoidal iff $n=-3$.

22. Evaluate $\int_C \vec{f}.d\vec{r}$ where $\vec{f}=(x^2+y^2)\hat{i}-2xy\hat{j}$ and the curve C is the rectangle in the x-y plane bounded by y = 0,y = b, x = 0, x = a.

23. Evaluate $\int_C \vec{f}.d\vec{r}$ where $\vec{f}=3x^2\hat{i}+(2xz-y)\hat{j}+z\hat{k}$ where C is

(i) the straight line from (0,0,0) and (0,1,0)

(ii) the curve defined by $x^2 = 4y$, $3x^2 = 8z$ from x = 0 to x = 2

24. Prove that $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. Hence find the value of $\beta\left(5,\frac{7}{2}\right)$

25. Evaluate (i) $\int_0^1 (x\ logx)^3\ dx$

(ii) $\int_0^\infty x^6 e^{-3x}dx$

26. Find the Fourier (i) Cosine series (ii) sine series for the function f(x) = π – x in (0,π).

27. Find the Fourier series for the function $f(x) = x^2$ where $-\pi \le x \le \pi$ and deduce that

(i) $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+......=\frac{\pi^2}{6}$ (ii) $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-......=\frac{\pi^2}{12}$ (iii) $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+......=\frac{\pi^2}{8}$

Head of the Department **Course Instructor**

Dr. T. Sheeba Helen **Dr. K.Jeya Daisy**

Department :Mathematics
Class : I B.Sc
Title of the Course: Mathematics for Competitive Examinations II

Semester : 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 theapproach to get solution.
2. To acquire skill in solving quantitative aptitude by simple methods.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
1.	understand the problems and remember the methods to solve problems.	PSO - 2	**K1**
2.	identify the appropriate method to solve problems.	PSO - 1	**K3**
3.	apply the best mathematical method and obtain the solution in short.	PSO - 2	**K1**
4.	apply fundamental mathematical concepts to calculate simple interest, compound interest	PSO - 5	**K2**
5.	develop problem-solving skills and critical thinking by effectively solvingreal-world scenarios involving financial calculation	PSO - 4	**K2**

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

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Simple Interest and Compound Interest**					
	1.	Simple Interest: Finding simple interest, principa lamount.	1	K1	Brainstorming	Questioning
	2.	Compound Interest: Annual compound interest, Half-yearly	2	K1	Inductiv e Learning	Recall Steps
	3.	Half-yearly Compound interest	1	K2	Blended Learnin g	True or False
	4.	Quarterly Compound interest	2	K1, K2	Lecture with Illustration	Slip Test
II	**Time and Work**					
	6.	Work sharing	2	K2	Brainstorming	Questioning
	7.	Individual work	2	K2	PPT using near pod	Short Answer – Google Form
	8.	Combined work , Time taken for work.	2	K2	Lecture with Illustration	Slip Test
III	**Time and Distance**					
	9.	**Time and Distance:** Comparing speed – Average speed- Distance travelled by vehicles – Travelling Time	2	K3	Heuristi cMethod	Solve Problem
	10.	Average speed- Distance travelled by vehicles	2	K3	Flipped Classroo m	Slip Test
	11.	Travelling Time	2	K3	Proble m Solving	Relay Race
IV	**Chain Rule**					
	12.	Chain Rule:	2	K2	Brainstorming	PPT Presentation
	13.	Direct Proportion	2	K3	Discussion	Riddles
	14.	Indirect Proportion	2	K2	Interactiv eMethod	MCQ

V	Pipes and Cisterns					
	15.	Pipes and Cisterns	2	K3	Blended Learnin g	Riddles
	16.	Filling the tank	2	K2	Heuristi cMethod	Relay Race
	17.	emptying the tank	2	K1	Proble m Solving	Solve Problems

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

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

Time and work
Self-Study: Chain rule problems.

Sample questions Part-A

1. The compound interest on rs.30000 at 7% per annum is Rs.4347. The period is-------
2. Find compound interest on Rs. 8000 at 15% per annum for 2 years 4 months, compoundedannually
3. A can do a work in 15 days and B in 20 days. If they work on it together for 4 days, then thefraction of the work that is left is--------------
4. A man covers a certain distance at 36 km/ph. How many meters does he cover in 2 minutes?

   (A) 1000 mt

   (B) 120 mt

   (C) 1200 mt

   (D) 600 mt

5. A pump can fill a tank with water in 2 hours. Because of a leak, it took $2\frac{1}{3}$ hours to fill thetank. The leak can drain all the water of the tank in

   a)4 1/3 b)7 c)14 d)8

Part-B

1. A sum of money amounts to Rs.6690 after 3 years and to Rs.10,035 after 6 years oncompound interest. find the sum.
2. What is the difference between the compound interests on Rs. 5000 for 1 1/2 years at 4% perannum compounded yearly and half-yearly?
3. A can lay railway track between two given stations in 16 days and B can do the same job in12 days. With help of C, they did the job in 4

days only. Then, C alone can do the job

4. If 36 men can do a work in 25 hours in how many hours will 15 men do it?
5. Three pipes A, B and C can fill a tank from empty to full in 30 minutes, 20 minutes, and 10 minutes respectively. When the tank is empty, all the three pipes are opened. A, B and C discharge chemical solutions P,Q and R respectively. What is the proportion of the solution Rin the liquid in the tank after 3 minutes?

Part-C

1. What is the rate of interest p.c.p.a.?

   I. An amount doubles itself in 5 years on simple interest.

   II. Difference between the compound interest and the simple interest earned ona certain amount in 2 years is Rs. 400.

   III. Simple interest earned per annum is Rs. 2000.
2. A tank is filled by three pipes with uniform flow. The first two pipes operating simultaneously fill the tank in the same time during which the tank is filled by the third pipe alone. The secondpipe fills the tank 5 hours faster than the first pipe and 4 hours slower than the third pipe. The time required by the first pipe

3. A alone can do a piece of work in 6 days and B alone in 8 days. A and B undertook to do it for Rs. 3200. With the help of C, they completed the work in 3 days. How much is to be paid to C?
4. 2 Walking 5/6 of its usual speed, a train is 10 minutes late. Find its usual time to cover thejourney?
5. If 2 kg sugar contains 7×10^6 crystals, then find how many sugar crystals are present in 4 kg ofsugar?

Head of the Department | **Course Instructor**

Dr. T. Sheeba Helen | **Dr. L. Jesmalar,**
Mrs. J.C. Mahizha

Department: Mathematics
Class: I B. Sc
Title of the Course: 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**

Prerequisites: Students should have basic knowledge on Mathematical calculations.

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 necessaryin 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, enablingstudents to evaluate and analyze numerical solutions for mathematical problems.	**K2**
CO3	use and evaluate alternative numerical methods for the solutionof systems of equations.	**K3**
CO4	foster critical thinking skills in assessing computational methodsfor problem solving.	**K3**
CO5	apply mathematical concepts to practical problems throughcomputational approaches.	**K3**

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

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

Unit	**Module**	**Topic**	**Teaching Hours**	**Cognitive level**	**Pedagogy**	**Assessment/ Evaluation**
I	**Errors in Numerical Calculations**					
	1.	Computer and Numerical Software	1	K1	Brainstorming	Questioning
	2.	Computer Languages,Software Packages	2	K1	Inductive Learning	Recall Steps
	3.	Mathematical Preliminaries	1	K2	Blended Learning	True or False
	4.	Errors and their computations, A general error formula	2	K1, K2	Lecture with Illustration	Slip Test
II	**Solution of Algebraic and Transcendental Equations**					
	6.	Introduction	2	K2	Brainstorming	Questioning
	7.	Bisection method,	2	K2	PPT using near pod	Short Answer – Google Form
	8.	Method of False Position	2	K2	Lecture with Illustration	Slip Test
III	**Interpolation**					
	14.	Finite differences	2	K3	Heuristic Method	Solve Problem
	15.	Forward Differences, Backward Differences	2	K3	Flipped Classroom	Slip Test
	16.	Central Differences	2	K3	Problem Solving	Relay Race
IV	**Numerical Differentiation and Integration**					
	17.	Errors in Numerical Differentiation, Cubic Splines Method	2	K2	Brainstorming	PPT Presentation
	18.	Differentiation formulae with function values	2	K3	Discussion	Riddles
	19.	Trapezoidal Rule	2	K2	Interactive Method	MCQ
V	**Numerical Linear Algebra**					
	21.	Triangular Matrices, LU Decomposition of a Matrix	2	K3	Blended Learning	Riddles

	22.	Vector and Matrix Norms, Solutions of linear systems DirectMethod	2	K2	Heuristic Method	Relay Race
	23.	Gauss Elimination Method	2	K1	Problem Solvingm Solving	Solve Problems

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/EnvironmentSustainability/ Gender Equity): -
Activities (SD): Quiz, MCQ, Slip Test, Problem Solving, Relay Race, Poster Presentation, Riddles,PPT Presentation

Assignment: Central Differences
Self-Study: Solutions of linear systems Direct Method-Gauss Elimination Method.

Sample questions
Part A

1. Which is the oldest method for finding the real root of a nonlinear equation
2. Which one of the following is a linear transformation
   y = ax + b b) x y^a = b c) y = ax + ^{b}d) y = a b^x
3. Choose the best answer: Back substitution method is useful in
   a) Gauss Jacobi method b) Gauss Seidal method c) Gauss elimination method d) Gauss Jordan method
4. The total error in Euler's method is -------------
5. State Trapezoidal rule.

Part: B

6. Derive Trapezoidal formula.
7. Find the Forward difference formula
8. Find the backward difference formula
9. Find the solutions of Cubic Splines Method
10. Explain Errors in Numerical Differentiation.

Part: C

11. Use Gauss elimination method to solve the system
$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16.$$
12. Take a problem and find a solution by using Bisection method.
13. Differentiation formulae – Derive.
14. Explain with example-Cubic Splines Method
15. Derive some of the properties of Finite difference.

Head of the Department | **Course Instructor**

Dr. T. Sheeba Helen | **Dr. L. Jesmalar, Mrs. J.C. Mahizha**

Department : **Mathematics**
Class : **II B.Sc**
Semester **IV**
Name of the Course : **Groups and Rings**
Course Code : **MC2041**

CourseCode	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MA2041	5	1	-	-	5	6	90	30	70	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:	PSO addressed	CL
CO–1	Recall the definitions of groups, rings, functions and also examples of groups and rings	PSO -1	K1
CO–2	Explain the properties of groups, rings and different types of groups and rings	PSO -1	K2
CO-3	Develop proofs of results on Permutation groups, Cyclic groups, Quotient group, Subgroups, subrings, quotient rings	PSO -5	K6
CO-4	Examine the properties of Ideals-Maximal and Prime ideals- Cosets - order of an element	PSO -5	K5
CO-5	Test the homomorphic and isomorphic properties of groups and rings	PSO -4	K4
CO-6	Develop the concepts of ordered integral domains and Unique Factorisation Domains	PSO -5	K5

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation

I	**Groups.**					
	1.	Definition and examples on Groups	4	K1	Brainstorming	Evaluation through test
	2.	Definition and examples on Permutation Groups	3	K1 & K6	Illustrative Method	Questioning
	3.	Definition of cycle And theorem based on cycles	3	K1& K6	Content based	Open Book Assignment
	4.	Theorems on even and odd permutations	2	K2& K6	Chalk and Talk	Quiz
	5.	Definition examples, theorems and problems of subgroups	3	K2& K6	Illustrative method	Group Discussion
	6.	Theorems on cyclic groups and problems based on Cyclic groups	3	K2& K6	Content based	Questioning
II	**Order of an element and Normal Sub Groups**					
	1.	Definition and Theorems on order of an Element	3	K1 & K2	Brainstorming	Test
	2.	Problems on order of an element	3	K2	Flipped Class	Open book assignment
	3.	Definition of Cosets and Problems on cosets	3	K2	Illustrative Method	Questioning
	4.	Lagrange's Theorem, Euler's Theorem, Fermats theorem	3	K2& K3	Content based	MCQ
	5.	Normal subgroups-Definition and Examples	3	K2	Collaborative learning	Home work
	6.	Problems and theorems on Normal Subgroups	3	K2 & K3	Content Based	Slip Test

III	**Isomorphism**					
	1.	Definition, theorems and Examples of Isomorphism	5	K1	Brainstorming	Quiz
	2.	Cayley's Theorem and Theorem on Automorphism and generators	4	K4	Content Based	Slip Test
	3.	Definition of Homomorphism and Examples	3	K1	Illustrative Method	Test
	4.	Fundamental Theorem of Homomorphism	3	K4	Chalk and Talk	Questioning
	5.	Problems on Kernel	3	K2 & K3	Collaborative learning	MCQ
IV	**Rings**					
	1.	Definition, Elementary properties and examples of Rings	3	K1	Brainstorming	Quiz
	2.	Problems basedon Isomorphism of Rings	3	K4	Collaborative learning	Questioning
	3.	Types of Rings and Theorems	3	K2 & K3	Content based	Slip Test
	4.	Examples of Skew fields and Theorems based on Skew fields	3	K2	Illustrative Method	Home Work
	5.	Definition and Theorems on integral Domains	3	K1 & K5	Chalk and Talk	Assignment
	6.	Characteristic of a Ring	3	K3	Flipped Class	Recall Concepts
V	**Sub Rings**					
	1.	Definition and Examples of Sub Rings	2	K1	Brainstorming	Open book test
	2.	Problems and Theorems on SubRings	2	K6	Collaborative learning	Questioning
	3.	Definition, Theorems and Examples on ideals	3	K1 & K3	Content based	Slip test
	4.	Ordered integral Domains	3	K3	Flipped Class	Assignment
	5.	Maximal and Prime Ideals	3	K5	Chalk and Talk	MCQ
	6.	Homomorphism of Rings	2	K4	Blended learning	Concept Explanation
	7.	Unique factorisation Domain	3	K6	Content based	Quiz and Test

CourseFocussingonEmployability/Entrepreneurship/SkillDevelopment:**Employability.**
Activities (Em/ En/SD): **Poster Presentation, Model Making (Application of algebraic concept).**
Assignment: **Solving Algebraic Problems.**

Sample questions

PartA

1. The number of elements in the symmetric group S_n is

   a. n   b. 1   c. n!   d. 0

2. Any group which is cyclic has proper________________
3. State whether it is true or false.

Every subgroup of (Z_n, ⊕) is normal.

4. Which of the following is not a field

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

5. An integral domain R is said to be a ______________.

PartB

1. Prove that anon empty subset H of a group G is a subgroup of G iff a, b ∈ H ⟹

   $ab^{-1} \in$ H.

2. State and prove Lagrange's Theorem.
3. Prove that any ordered integral domain D is of characteristic zero.
4. Prove that Z_7 is an integral domain.
5. Find the kernel of f: C→ C defind by f(z)=2z.

PartC

1. Prove that the union of two subgroups of a group G is a subgroup if and if one is contained in the other.
2. Let H and K be two finite subgroups of a group G. Prove that |HK| = $\frac{|H||K|}{|H\cap K|}$
3. State and prove the fundamental theorem of homomorphism of groups.
4. Prove that the set F of all real numbers of the form a+b√2 where a,b∈ Q is a field under the usual addition and multiplication of real numbers.
5. Prove that(i)The field of complex numbers is not an ordered field.
   (ii) Z is an Euclidean domain

Head of the Department   **Course Instructor**

Dr. T. Sheeba Helen   **Dr.M.K.Angel Jebitha**

Department : Mathematics
Class : II B.Sc.
Title of the Course :Analytical Geometry-3 Dimensions
Semester : IV
Course Code: MC2042

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2042	5	-	-	4	5	75	30	70	100

Objectives

- To gain deeper knowledge in three-dimensional Analytical Geometry.
- To develop creative thinking, innovation and synthesis of information.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO - 1	recall the basic definitions and concepts of planes and lines	PSO - 1	R
CO - 2	demonstrate the projection of the line joining two points, cosines of the line joining two points and will be able to solve problems	PSO - 3	C
CO - 3	calculate the distance between points, planes and the angles between lines and planes	PSO - 2	An
CO - 4	draw three dimensional surfaces from the given information	PSO - 4	An
CO - 5	discuss the characteristics and properties of three-dimensional objects like sphere, cube, cone etc	PSO - 1	U
CO - 6	develop the skill in three-dimensional geometry to gain mastery in related courses	PSO - 5	Ap

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Rectangular cartesian coordinates: Direction Cosines of a Line**					
	1.	Rectangular cartesian coordinates, Distance between points, examples, the coordinates of the points dividing the line joining two points in the ratio *m:n*	3	K3	Introductory Session	Questioning
	2.	The centroid of a triangle when the coordinates of the vertices of the triangle are known, examples, exercises, Angle between two lines, Projections and its results	2	K3	Blended Learning	Simple Questions
	3.	Direction cosines related results, Direction ratios of the join of two points, Projection of the line joining two points, Direction cosines of the line joining two points	3	K3	Flipped Classroom	Recall Steps
	4.	Angle between the lines whose direction cosines are (l_1, m_1, n_1) and (l_2, m_2, n_2), Conditions for perpendicularity and parallelism, examples, exercise	4	K3	Problem Solving	MCQ
II	**The Plane**					
	5.	Equation of a plane in different forms- Intercept and normal form, the equation of a plane passing through three points, Direction cosines of line which is perpendicular to	4	K2	PPT using Gamma	Home Assignment

		plane				
	6.	Angle between the planes, results,examples,exercises, the ratio in which the plane divides the line joining the points	4	K3	Problem Solving	Group Discussion
	7.	Equation of plane through line of intersection of two given points, examples,exercises, Length of perpendicular, Equation of planes bisecting the angle between two planes, examples,exercises	4	K4	Lecture using chalk and talk	Quiz through Quizizz
III	**The Straight Line**					
	8.	Equation of a line in different forms, examples,exercises, Condition for the line to be parallel to the plane, examples	5	K3	Integrative Method	Solve Problem
	9.	Angle between the plane and the line, exercises,Coplanar lines- the condition that two given straight lines to becoplanar, examples,exercises	4	K5	Flipped Classroom	Short Test
	10.	The intersection of three planes, exercises, Volume of tetrahedron in terms of the coordinates of its vertices, examples,exercises	3	K5	Problem Solving	Relay Race
IV	**The Sphere**					
	11.	Equation of sphere in its general form, Determination of the center and radius of a sphere, examples,exercises,Le	4	K3	Brainstorming	PPT Presentation

		ngth of tangent from the points to the sphere, examples,exercises				
	12.	Section of sphere by a plane, Equation of circle on a sphere, Equation of sphere passing through a given circle, Intersection of two spheres, examples,exercises	4	K5	Lecture with Discussion	Simple Questions
	13.	Equation of tangent plane to the sphere at a given point, examples,exercises	4	K3	Interactive Method	MCQ
V	**The Central Quadrics and Cone**					
	14.	Cone,cylinder and central quadrics- equation of a surface, Cone-right circular cone, examples,exercises	4	K2	Blended Learning	Class Participation
	15.	Intersection of straight line and a quadric cone, Tangent plane and normal, Condition for the plane to touch the quadric cone, examples	4	K4	Interactive Lectures	Relay Race
	16.	Angle between the lines in which a plane cuts the cone, Conditions that the cone has three mutually perpendicular generators, examples,exercises	4	K3	Problem Solving	Solve Problems

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Skill Development Activities (SD): Quiz, Slip Test, Problem Solving, Relay Race, Model Making

Assignment: Problem Solving from the Plane and Straight-line Sections

Sample questions (minimum one question from each unit)

Part A

1. True or False. The projection of a sphere on the XY axis is a circle.
2. Normal form of the equation of the plane is
   (i) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$ (ii) $lx+my+nz=p$ (iii) $ax+by+cz+d=0$
3. Find the equation of a straight line joining the points (2, 5, 8) and (-1, 6, 3).
4. If the plane passes through the center of the sphere, then circle is of radius r is called …….
5. What is the condition for the plane $lx+my+nz=0$ to touch the quadric cone?

PART B

1. Show that if two pairs of opposite edges of a tetrahedron be at right angles, then the third pair is also at right angles.
2. Find the equation of the plane through (1, 1, 1) and the line of intersection of the planes $x+2y-z+1=0,\ 3x-y+4z+3=0$.
3. Find the image of the point (1, -2, 3) in the plane $2x-3y+2z+3=0$.
4. Show that the plane $2x-y-2z=16$ touches the sphere $x^2+y^2+z^2-4x+2y+2z-3=0$ and find the point of contact.
5. Show that the equation of a right circular cone whose vertex is O, axis OZ and semi-vertical angle α is $x^2+y^2=z^2tan^2\alpha$.

PART C

1.If the direction cosines of the two lines satisfy the equations $l+m+n=0;\ 2lm+2ln-mn=0$, then find the angle between the lines.

2. Show that the origin lies in the acute angle between the planes $x+2y+2z=9,\ 4x-3y+12z+13=0$. Find the planes bisecting the angles between them and point out which bisects the obtuse angle.

3. Prove that the lines $\frac{x+1}{-3}=\frac{y+10}{8}=\frac{z-1}{2};\ \frac{x+3}{-4}=\frac{y+1}{7}=\frac{z-4}{1}$ are coplanar. Also find their point of intersection and the plane through them.

4. A sphere of constant radius k passes through the origin and meets the axes in A, B, C. Prove that the centroid of the triangle ABC lies on the sphere $9(x^2+y^2+z^2)=4k^2$.

5. Find the equation to the cone through the coordinate axes and the lines in which the plane $lx+my+nz=0$ cuts the cone $ax^2+by^2+cz^2+2fyz+2gzx+2hxy=0$.

Head of the Department **Course Instructor**

Dr. T. Sheeba Helen **Sr. S. Antin Mary**

Department : Mathematics
Class : II B.Sc
Semester : IV
Name of the Course :Applied Statistics(Allied)
Course Code :MA2041

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MA2041	5		-	-	5	5	75	30	70	100

Objectives:1. To acquire the knowledge of correlation theory and testing hypothesis.
2.To solve research and application – oriented problems.

CO	Upon completion of this course the students Will be able to:	PSO addressed	CL
CO –1	Identify and demonstrate appropriate sampling processes	PSO –2	K3
CO –2	Recall the methods of classifying and analyzing data relative to single variable	PSO –4	K1
CO -3	Describe the χ^2 distribution in statistics	PSO –3	K2
CO -4	distinguish between the practical purposes of a large and a small sample	PSO –1	K4
CO -5	Understand that correlation coefficient is independent of the Change of origin and scale	PSO –5	K2

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I		**Correlation**				
	1.	Definitionsand examplesofcorrelati on, Properties of correlation coefficient	2	K1 & K2	Brainstorming	MCQ
	2.	Problems based on Correlation	2	K3	Problem Solving	Slip Test using Socrative
	3.	Definition of Rank correlation and proving Spearman's formula	2	K1 & K4	Analytic Method	Questioning
	4.	Calculating Rank correlation coefficient forthe given data	2	K3	Lecture with Illustration	Concept explanations
	5.	Definition and results basedon regression, Problems on regression	2	K1 & K3	Collaborative learning	Simple question
	6.	Equation of regression linesand angle between the regression lines.	2	K2 & K3	Blended classroom	Evaluation through poll
II		**Test of significance**				
	1.	Introduction on test of significance, Sampling andits types	1	K1	Brainstorming	Evaluatio nthrough Nearpod
	2.	Definition on Sampling distribution and examples,Standard error for some sampling distributions	2	K1 & K3	Blended classroom	Slip Test using Quizziz
	3.	Testing of hypothesis anderrors in testing of hypothesis, critical valuesfor different levels of significance	2	K3	Flipped Classroom	Short summary of the concept
	4.	Procedure for testing of astatistical hypothesis	1	K2 & K3	Peer Teaching and Learning	MCQ
	5.	Explanation and Problemsof test of significance for single proportions	2	K3 & K4	Lecture and problem solving	Concept Explanation
	6.	Probable limits, Test of significance for differenceof proportions	2	K3 & K4	Group Discussion	Recall steps

	7.	Problems on test of significance for differenceof proportions	2	K3	Integrative method	Questioning
III	**Test of significance for means**					
	1.	Test of significance for single mean if the standarddeviation is known	1	K1 & K2	Brainstorming	Quiz
	2.	Problems based on confidence limits for population mean and test ofsignificance of means.	2	K3	Problem Solving	Concept Explanation
	3.	Problems based on test of significance for differenceof sample means, Test of significance for single standard deviation	3	K3 & K4	Group Discussion	Slip Test
	4.	Test of significance for equality of standard deviations of a normal population.	2	K4	Analytic Method	Questioning
	5.	Problems based on test ofsignificance for standard deviation	2	K3	Collaborative learning	Evaluation through poll
	6.	Problems based on test of significance for correlationcoefficient	2	K3	Poster Presentation	Simple Questions
IV	**Test of significance for small samples**					
	1.	Distinguish large and smallsamples, Test of significance based on t-distribution	3	K2 & K4	Lecture with Illustration	Quiz through Quizziz
	2.	Test for the difference between the mean of a sample and that of a population, Test for the difference between the means of two samples,	3	K3 & K4	Flipped Classroom	Differentiate various tests
	3.	Confidence limits for population mean,Problemsbased on confidence limits for population mean	2	K3 & K4	Analytic Method	Simple Questions
	4.	Test of significance based on F-test, Problems on testof significance based on F-test.	2	K3 & K4	Integrative method	Concept Explain

	5.	Test of significance of an observed sample correlation, Problems on test of significance of an observed sample correlation.	2	K3 & K4	Solving Problems in relay	Sip test through slido
V	Test based on $\chi 2$-distribution					
	1.	Introduction on test based on $\chi 2$-distribution, $\chi 2$ −test for population variance	2	K1 & K2	Heuristic sMethod	MCQ
	2.	$\chi 2$ −test to test the goodnessof fit	2	K4	Contextua lBased Learning	Concept explanations
	3.	Result on $\chi 2$ −test to test the goodness of fit.	2	K4 & K3	Analyti c Method	Questioning
	4.	Fit a Poisson distribution for the given data and to testthe goodness of fit.	2	K2 & K4	Syntheti cMethod	Slip Test
	5.	Theorem based on the testfor independence of attributes, Yate's Correction.	4	K4	Seminar Presentation	Simple Question s

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

Activities (Em/ En/SD):**Applications of Statistics through Seminar Presentation, Solving realtime problems on relay**

Assignment:**Solving Real life problems by applying various tests on Statistics**
Sample questions

Part A

1. The qualitative characteristics of a population are called________.
2. Say True or False: Fister's index number is an ideal index number.
3. If n is small and σ is not known then 95% confidence limits for μ is_____.
4. The degrees of freedom for F – test is__________.
5. X^2 – test for goodness of fit for a set of n observations is _______.

Part B

1. Prove the (AB) = (ABC)+(ABγ)
2. A normal population has a mean of 6.48 and S.D. of 1.5. In a sample of 400 members mean is 6.75. Is the difference significant?
3. A sample of 900 men is found to have a mean height of 64cm. If this sample has been drawn from a normal population with S.D 20cm, find the 99% confidence limits for the mean height of the men in the population.
4. Find the least value of μ in a sample of 11 pairs from a bivariate normal population significant at 5% level.
5. A random sample of size 25 from a population gives the sample standard deviation 8.5. Test the hypothesis that the population S.D is 10.

Part C

1. In a class test in which 135 candidates were examined for proficiency in physics and chemistry, it was discovered that 75 students failed in physics, 90 failed in chemistry and 50 failed in both. Find the magnitude of association and state if there is any association between failing in physics and chemistry.
2. In a big city 325 men out of 600 men are found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers?
3. In a random sample of 50 pairs of values the correlation was found to be .89. Is this consistent with the assumption that the correlation in the population is .84.
4. Test the significance of the following rank correlation coefficient. i) μ = 139 n = 10 (ii) n = 20 μ=618 (iii) r = 42 n = 27
5. Find a Poisson distribution for the following data and test the goodness of fit.

X	0	1	2	3	4	5	6	Total
Y	273	70	30	7	7	2	1	390

Head of the Department **Course Instructor**

Dr. T. Sheeba Helen **Dr.S. Sujitha**

Teaching Plan

Department : Mathematics

Class : III B.Sc Mathematics

Title of the Course :Complex Analysis

Semester :VI

Course Code:MC2061

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2061	6	-	-	5	6	90	25	75	100

Objectives

- To introduce the basic concepts of differentiation and integration of Complex functions
- To apply the related concepts in higher studies

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO - 1	understand the geometric representation of mappings	PSO - 1	U
CO - 2	use differentiation rules to compute derivatives and express complex- differentiable functions as power series	PSO - 4	E
CO - 3	compute line integrals by using Cauchy's integral theorem and formula	PSO - 3	E
CO - 4	identify the isolated singularities of a function and determine whether they are removable, poles or essential	PSO - 1	U
CO - 5	evaluate definite integrals by using residues theorem	PSO - 5	C

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Analytic Functions**					
	1.	Differentiability	2	K5	Brainstorming	Questioning
	2.	The Cauchy-Riemann Equations	3	K5	Inductive Learning	Recall Steps
	3.	Complex form of Cauchy-Riemann Equations, Cauchy Riemann Equations in Polar Coordinates	5	K5	Blended Learning	True or False
	4.	Analytic Functions	2	K5	Lecture with Illustration	Slip Test
	5.	Harmonic Functions	5	K5	Inductive Learning	Peer Discussion with questions
II	**Bilinear Transformations**					
	6.	Elementary Transformations	2	K2	PPT using nearpod	Quiz - nearpod
	7.	Bilinear Transformations	2	K2	Video using Zoom	Short Answer – Google Form
	8.	Cross Ratio	2	K2	PPT using Gamma	Match the Following – Gamma
	9.	Fixed Points of Bilinear Transformations	3	K2	Lecture with PPT	Questioning
	10.	Mappings $w = z^2$	2	K2	PPT using nearpod	Quiz – nearpod
	11.	Mappings $w = e^z$	2	K2	Video using Zoom	Slip Test
	12.	Mappings w = Sinz, Cosz	2	K2	Demonstration Method	Poster Presentation
	13.	Mappings w = Coshz	2	K2	Video using Zoom	Quiz – Socrative
III	**Complex Integration**					
	14.	Definite Integral	5	K5	Heuristic Method	Solve Problem
	15.	Cauchy’s Theorem	4	K5	Flipped Classroom	Slip Test
	16.	Cauchy’s Integral Formula	5	K5	Problem Solving	Relay Race
IV	**Series Expansion**					
	17.	Taylor’s Theorem	4	K5	Brainstorming	PPT Presentation

	18.	Laurent's Series	4	K5	Discussion	Riddles
	19.	Zeros of an Analytic Function	2	K2	Interactive Method	MCQ
	20.	Singularities	3	K2	Analytic Method	Quiz – Quizzes
V	**Calculus of Residues**					
	21.	Residues	4	K6	Blended Learning	Riddles
	22.	Cauchy's Residue Theorem	5	K6	Heuristic Method	Relay Race
	23.	Evaluation of Definite Integrals	5	K6	Problem Solving	Solve Problems

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Skill Development
Activities (SD): Quiz, MCQ, Slip Test, Problem Solving, Relay Race, Poster Presentation, Riddles, PPT Presentation

Assignment: Evaluation of Definite Integrals using Cauchy's Residue Theorem, Conformal Mapping, Bilinear Transformation, Mappings w = z^2, Mappings w = e^z, Mappings w = Sinz, Cosz, Mappings w = Coshz

Sample questions (minimum one question from each unit)

Part A

Unit I

1. True or False: The function $f(z) = z^2$ is differentiable only at $z = 0$
2. Write the sufficient condition to prove the differentiability of the function $f(z)$
3. State the Cauchy Riemann equation in Polar Coordinates
4. Which implies which: Analytic function, Differentiability
5. The real part of an analytic function is ……….

Unit II

1. The transformation $w = bz$, where $b > 0$ and real is called as ………
2. Match the following

a. Circle not passing through the origin mapped into	1. A line passing through the origin
b. Circle passing through the origin is mapped into	2. A circle passing through the origin
c. Straight line not passing through the origin mapped into	3. A straight line not passing through the origin
d. Straight line passing through the origin is mapped into	4. A circle not passing through the origin

3. Give an example of bilinear transformation
4. Under which transformation the family of circles are transformed into family of circle
5. Four distinct points z_1, z_2, z_3, z_4 are collinear if and only if …….

   (i) (z_1, z_2, z_3, z_4) are real (ii) (z_1, z_2, z_3, z_4) are imaginary
   (iii) z_1, z_2, z_3, z_4 lies on a circle (iv) z_1, z_2, z_3, z_4 lies on a straight line

Unit III

1. Define length of the piecewise differentiable curve

2. The value of $\int_C \frac{dz}{z-a}$ is
3. True or False: $\int_C (z-a)^n\, dz = 0$ for every closed curve C, provided $n \geq 1$
4. State the difference between simply connected and multiple connected region
5. The value of the function at the centre is equal to the ....

Unit IV

1. Taylor series expansion of $f(z)$ about the point zero is called as
   (i) Maclaurin's series (ii) Laurent's series
   (iii) Cauchy's series (iv) None of these
2. The order of $z = 0$ for $f(z) = sin\, z$ is ......
3. What are the poles for the function $f(z) = tanz$
4. Give an example of a meromorphic function
5. A function f which is bounded and analytic in a region $0 < |z - z_0| < \delta$ is ......

Unit V

1. If $z = a$ is a simple pole for $f(z)$, then

   (i) Res { f(z); a} = $\frac{h(a)}{k\prime(a)}$ (ii) Res { f(z); a} = $\lim_{z\to a}(z-a)f(z)$
   (iii) Res { f(z); a} = $\frac{g^{(m-1)}(a)}{(m-1)!}$ (iv) None of these
2. The residue of$cot\, z$ at $z = 0$ is ....
3. True or False: If $f(z)$ is analytic inside and on C and not zero on C, then $\frac{1}{2\pi i}\int_C \frac{f\prime(z)}{f(z)}dz = N$
4. Fundamental theorem of algebra can deduct from which theorem?
5. State the application of Cauchy's Integral formula

Part B

Unit I

1. If $f(z)$ is differentiative at a point z, then it is continuous at that point. Show by an example that converse part need not be true
2. Prove that the function $f(z) = |z|^2$ is differentiable at $z = 0$
3. Derive the complex form of Cauchy Riemann Equation
4. Prove that the functions $f(z)$ and $\overline{f(z)}$ are simultaneously analytic
5. Prove that $u = 2x - x^3 + 3xy^2$ is harmonic and find its harmonic conjugate. Also find the corresponding analytic function.

Unit II

1. Under the transformation $w = iz + i$, show that the half plane $x > 0$ maps onto the half plane $v > 1$
2. Show that the transformation $w = \frac{5-4z}{4z-2}$ maps the unit circle $|z| = 1$ into a circle of radius unity and centre -1/2
3. Find the general bilinear transformation which maps the unit circle $|z| = 1$ onto $|w| = 1$ and the points $z = 1$ to $w = 1$ and $z = -1$ to $w = -1$
4. Find the image of the circle with centre origin and radius r under $w = z^2$
5. Under the mapping $w = e^z$, discuss the transforms of the lines

(i) $y = 0$ (ii) $y = \pi/2$ (iii) $y = \pi$

Unit III

1. Prove that $\left|\int_a^b f(t)dt\right| \le \int_a^b |f(t)|dt$
2. Prove that $\int_C \frac{dz}{(z-a)^n} = \begin{cases} 0 & if\ n \neq 1 \\ 2\pi i & if\ n = 1 \end{cases}$ where C is the circle with centre a and radius r and $n \in \mathbb{Z}$
3. State and prove Maximum Modulus Theorem
4. Evaluate $\int_C \frac{z}{z^2+4} dz$ where C is positively oriented circle $|z - i| = 2$
5. Evaluate $\frac{z}{(9-z^2)(z+i)} dz$ where C is the circle $|z| = 2$ taken in the positive sense

Unit IV

1. Expand $f(z) = sin\, z$ in a Taylor's series about $z = \pi/4$ and determine the region of convergence of this series
2. Find the Laurent's series for $\frac{z}{(z+1)(z+2)}$ about $z = -2$
3. Suppose that $f(z)$ is analytic in a region D and is not identically zero in D. Then the set of all zeros of $f(z)$ is isolated
4. Determine and classify the singular points of $f(z) = \frac{z}{e^z-1}$
5. An isolated singularity a of $f(z)$ is a pole if and only if $\lim_{z\to a} f(z) = \infty$

Unit V

1. If a is a simple pole for $f(z)$ and if $f(z)$ is of the form $\frac{h(z)}{k(z)}$ where $h(z)$ and $k(z)$ are analytic at a and $h(a) \neq 0$ and $k(a) = 0$, then

   $$\text{Res}\ \{ f\ (z); a\} = \frac{h(a)}{k\prime(a)}$$

2. Find the residue of $\frac{1}{(z^2+a^2)^2}$ at $z = ai$
3. State and prove the fundamental theorem of algebra
4. Evaluate $\int_C \ tanz\, dz$ where C is $|z| = 2$
5. Evaluate $\int_0^{2\pi} \frac{d\theta}{5+4\, sin\theta}$

Part C

Unit I

1. Let $f(z) = u(x,y) + iv(x,y)$ be differentiable at a point $z_0 = x_0 + iy_0$. Then $u(x,y)$ and $v(x,y)$ have first order partial derivatives $u_x(x_0,y_0)$, $u_y(x_0,y_0)$, $v_x(x_0,y_0)$ and $v_y(x_0,y_0)$ at (x_0,y_0) and these partial derivatives satisfy the Cauchy-Riemann equations given by

   $u_x(x_0,y_0) = v_y(x_0,y_0)$ and $u_y(x_0,y_0) = -v_x(x_0,y_0)$.

   Also $f'(z_0) = u_x(x_0,y_0) + iv_x(x_0,y_0)$

   $= v_y(x_0,y_0) - iu_y(x_0,y_0)$

2. Prove that $f(z) = \begin{cases} \frac{z\ Re\ z}{|z|} & if\ z \neq 0 \\ 0 & if\ z = 0 \end{cases}$ is continuous at $z = 0$ but not differentiable at $z = 0$
3. (i). An analytic function in a region D with its derivative zero at every point of the domain is a constant

   (ii). An analytic function in a region with constant modules is constant (iii). An analytic function $f(z) = u + iv$ with $arg\, f(z)$ constant is itself a constant function

4. Given that $v(x, y) = x^4 - 6x^2y^2 + y^4$. Then find $f(z) = u(x, y) + iv(x, y)$ such that $f(z)$ is analytic
5. Given the function $w = z^3$ where $w = u + iv$. Show that u and v satisfy the Cauchy-Riemann equations. Prove that the families of curves $u = c_1$ and $v = c_2$ (c_1 and c_2 are constants) are orthogonal to each other

Unit II

1. Find the image of the circle $|z - 3i| = 3$ under the map $w = 1/z$
2. Determine the bilinear transformation which maps $0, 1, \infty$ into $i, -1, -i$ respectively. Under this transformation, show that the interior of the unit circle of the plane maps onto the half plane upper to the v axis
3. Show that any bilinear transformation which maps the real axis onto unit circle $|w| = 1$ can be written in the form $w = w^{i\lambda}(\frac{z-\alpha}{z-\bar{\alpha}})$, where λ is real
4. Discuss the mapping $w = sin\, z$
5. Find the image of the following lines under the transformation $w = coshz$

   (i) $y = 0$ (ii) $y = \pi/2$ (iii) $y = \pi$ (iv) $x = 0$

Unit III

1. Show that $\int_C |z|^2 dz = -1 + i$ where C is the square with vertices O(0, 0), A(1, 0), B(1, 1) and C(0, 1)
2. Evaluate $\int_C |z|\bar{z}\, dz$ where C is the closed curve consisting of the upper semicircle $|z| = 1$ and the segment $-1 \le x \le 1$
3. State and prove Cauchy's Theorem
4. State and prove Cauchy's Integral formula
5. (i). Evaluate $\int_C \frac{e^z}{z^2+4} dz$ where C is positively oriented circle $|z - i| = 2$

   (ii). Let C denote the boundary of the square whose sides lie along the lines $x = \pm 2$ and $y = \pm 2$ where C is described in the positive sense.

   Evaluate (i) $\int_C \frac{z}{2z+1} dz$ nad (ii) $\int_C \frac{cos\, z}{z(z^2+8)} dz$

Unit IV

1. Expand $f(z) = \frac{z-1}{z+1}$ as a Taylor's Series

   (i) about the point $z = 0$ (ii) About the point $z = 1$

   Determine the region of convergence in each cases
2. State and Prove Taylor's Theorem
3. Expand $f(z) = \frac{z}{(z-1)(2-z)}$ in a Laurent's series valid for

   (i) $|z| < 1$ (ii) $1 < |z| < 2$ (iii) $|z| > 2$ (iv) $|z - 1| > 1$
4. For the function $f(z) = \frac{2z^3+1}{z(z+1)}$, find

   (i) a Taylor's series valid in a neighbourhood of $z = i$

   (ii) a Laurent's series valid within an annulus of which centre is the origin
5. Let $f(z)$ be a function having a as an isolated singular point. Prove that the following are equivalent

   (i) a is a pole of order r for $f(z)$

(ii) $f(z)$ can be written in the form $f(z) = \frac{1}{(z-a)^r}\theta(z)$, where $\theta(z)$ has a removable singularity at $z = a$ and $\lim_{z\to a} \theta(z) \neq 0$

(iii) a is a zero of order r for $1/f(z)$

Unit V

1. Find the residue of $\frac{e^z}{z^2(z^2+9)}$ at its poles
2. State and prove Argument theorem
3. Evaluate using (i) Cauchy's Integral formula (ii) Cauchy Residue theorem $\int_C \frac{z+1}{z^2+2z+4}dz$, where C is the circle $|z + i + i| = 2$
4. Prove that $\int_0^{2\pi} \frac{d\theta}{1+a\, sin\theta} = \frac{2\pi}{\sqrt{1-a^2}}, (-1 < a < 1)$
5. Use contour integration technique to find the value of $\int_0^{2\pi} \frac{d\theta}{2+cos\theta}$

Head of the Department

Dr. T. Sheeba Helen

Course Instructor

Dr. A. Anat Jaslin Jini

Department : **Mathematics**
Class : **III B. Sc**

Title of the Course : **Major Core XI- Mechanics**
Semester : **VI**
Course Code : **MC2062**

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2064	**6**	**-**	**-**	**5**	**6**	**90**	**25**	**75**	**100**

Objectives:

1. To visualize the application of Mathematics in Physical Sciences.
2. To develop the capacity to predict the effects of force and motion.

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO-1	Calculate the reactions necessary to ensure static equilibrium, ,	PSO-2	K2(U)
CO-2	apply the principles of static equilibrium to particles and rigid bodies	PSO-4	K3(Ap)
CO-3	understand the ways of distributing loads	PSO-5	K5(C)
CO-4	identify internal forces and moments of a rigid body	PSO-3	K3(Ap)
CO-5	apply the basic principles of projectiles into real-world problems,	PSO-2	K3(Ap)
CO-6	classify the laws of friction.	PSO-4	K4(An)

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

Unit	Module	Topics	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
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, Analytical expression for the resultant of two forces acting at a point, Triangle forces, Perperndicular Triangular forces, Converse of the Trigangle of Forces, The Polygon of Forces, Lami's Theorem, Problems based on Lami's Theorem	4	K2(U)	Demonstration, PPT	Concept explanations
	2	Resultant of two like parallel forces, two unlike and unequal parallel forces, Resultant of number of parallel forces, equilibrium of three coplanar parallel Forces	3	K3(Ap)	Flipped Classroom	Questioning

	3	Moment of a force, Geometrical representation, Varignon's theorem of Moments	4	K4(An)	Peer Teaching	MCQ
	4	Generalised theorem of moments, Problems based on Varignon's theorem of moments, Generalised theorem of Moments	4	K3(Ap)	Blended classroom, Lecture using videos	Slip Test
II	**Couples, Coplanar Forces**					
	1	Couples – Equilibrium of two couples – Representation of a couple by a vector– Resultant of coplanar couples – Resultant of couple and a force – Problems based on Couples, Introduction and reduction of any number of coplanar forces, Analytical proof	4	K2(U)	Lecture Illustration	Home Assignment

	2	Conditions for forces to reduce a single force or couple, Change of the base point & Equation to the line of action of The resultant	3	K2(U)	Group discussion	Evaluation through Quiz using slido
	3	Problems based on Reduction of number of coplanar forces	2	K3(Ap)	Lecture using videos, Problem solving	MCQ
	4	Problems based on forces to reduce a single force or couple	3	K3(Ap)	Collaborative learning	Quiz (Google forms)
	5	Problems based on Equation to the line of action of the resultant	3	K4(An)	Blended classroom	Evaluation through poll
III	**Friction**					
	1	Introduction, Statical, Dynamical, Limiting friction and Laws of friction, Coefficient off riction, Angle of friction, Cone of friction	4	K2(U)	Lecture with PPT Illustration	Assignment
	2	Equilibrium of a particle on a rough inclined plane, Equilibrium of a body on a rough inclined plane under a force	3	K3(Ap)	Peer Teaching	MCQ

		parallel to the plane, Equilibrium of a body on a rough inclined plane under any force				
	3	Problems based on Coefficient of friction, Angle of friction	4	K3(Ap)	Blended classroom	Self Assessment
	4	Problems based on Equilibrium of a particle on a rough inclined plane and equilibrium of a body on a rough inclined plane under a force Parallel to the plane	4	K4(An)	Group Discussion	Slip Test using Quizziz
IV	**Projectiles**					
	1	Fundamental principles, Path of a projectile, Characteristics of the Motion of a projectile	3	K2(U)	Lecture with PPT Illustration	Quiz
	2	Path of a projectile at a certain height above the ground, Problems based on Path of a projectile, Problems Based on Characteristics of the motion of a projectile	4	K3(Ap)	Flipped Classroom	Quiz through slido
	3	Maximum horizontal range, Two possible directions of projection,	4	K3(Ap)	Introductory session, Group Discussion	MCQ (Quizziz)

		Problems based on maximum horizontal range and Two possible Directions of projection				
	4	Velocity of the projectile, Velocity of the projectile falling freely from the directrix, Problems based on Velocity of the Projectile	4	K4(An)	Lecture with Illustration	Self Assessment
V	**Motion under the action of central forces**					
	1	Motion under the action of central forces–Introduction–Velocity and Acceleration in Polar Coordinates	4	K2(U)	Lecture with PPT Illustration	Test
	2	Equation of Motion in Polar Coordinates –Note on the equiangular spiral–motion under a Central force	4	K1(R)	Collaborative learning	Formative Assessment Test
	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	4	K2(U)	Problem Solving	Assignment

	4	Velocities in a central orbit – Two – fold problems in central Orbits	3	K4(An)	Lecture with PPT Illustration	Assignment &Quiz
	5	Johnson's Algorithm for Sparse Graphs-Preserving shortest paths by reweighting And relatedLemma	2	K3(Ap)	Group Discussion	Assignment

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

Activities(Em/ En/SD): Poster Presentation, Group Discussion

Assignment: Apply DFS to detect cycles in a directed graph.

Sample questions Part - A

1. Say true or false:The converse of the polygon of forces is true.

2.The conditions of equilibrium depend only on ----------.

a) couples b) resultant c) forces d) none of these

3. The best angle of traction up a rough inclined plane is ----------.

a) μ b) λ c) α d) θ

4. The horizontal range is a maximum when the particle is projected at an angle of ---------- to the horizontal.

a) 60^0 b) 45^0 c) 90^0 d) None

5. The polar equation to the equiangular spiral is ----------. (R)

a) $r = ae^{\theta\, cot\alpha}$ b) $r = ae^{\theta\, sin\alpha}$ c) $r = ae^{\, cot\alpha}$ d) $r = ae^{\theta\, cos\alpha}$

Part - B

1. Two forces act on a particle. If the sum and difference of the forces are at right angles to each other, show that the forces are of equal magnitude.

2. 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.

3. A uniform ladder is in equilibrium with one end resting on the ground and the other against a vertical wall; if the ground and wall be both rough, the coefficients of friction being

μ and μ^1respectively, 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 $tan\,\theta = \frac{1-\mu\mu^1}{2\mu}$.

4. 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.

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.

Part – C

1. A and B are two fixed points on a horizontal line at a distance C apart. Two fine light strings AC and BC of lengths b and a respectively support a mass at C. Show that the tensions of the strings are in the ratio $b(a^2 + c^2 - b^2) : a(b^2 + c^2 - a^2)$.

2. Forces P,Q,R,S act along the sides AB,BC,CD,DA of the cyclic quadrilateral ABCD, taken in order, where A and B are the extremities of a diameter. If they are in equilibrium, prove that $R^2 = P^2 + Q^2 + S^2 + \frac{2PQS}{R}$.

3. Two particles P and Q each of weight W on two equally rough inclined planes CA and CB of the same height, placed back to back are connected by a light string which passes over the smooth top edge C of the planes. Show that, if the particles are on the point of slipping, the difference of the inclinations of the planes is double the angle of friction.

4. Show that the path of a projectile is a parabola.

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.

Course Instructor | **Head of the Department**

Dr. V. Sujin Flower | **Dr. T. Sheeba Helen**

Department: Mathematics
Class: III B.Sc
Title of the Course: Number Theory
Semester: VI
Course Code: MC2063

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2063	**5**	**-**	**-**	**4**	**5**	**90**	**25**	**75**	**100**

Objectives: 1. To introduce the fundamental principles and concepts in Number Theory.
2. To apply these principles in other branches of Mathematics.

Course Outcome

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	express the concepts and results of divisibility of integers effectively	PSO - 1	K_2(U)
CO - 2	construct mathematical proofs of theorems and find counter examples for false statements	PSO - 2	K_4(Ap)
CO - 3	collect and use numerical data to form conjectures about the integers	PSO - 5	K_4(Ap)
CO - 4	understand the logic and methods behind the major proofs in Number Theory	PSO - 4	K_3(An)
CO - 5	solve challenging problems related to Chinese remainder theorem effectively	PSO - 3	K_5(E)
CO - 6	build up the basic theory of the integers from a list of axioms	PSO - 1	K_2(U)

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

Unit	Module	Topics	Lecture hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Divisibility Theory in the Integers**					
	1	Divisibility Theory in the Integers	3	K_2(U)	Introductory session, Group Discussion. PPT.	Evaluation through short test,Quizzes, True/False.
	2	The Division Algorithm	3	K_3(Ap)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Simple definitions, Recall steps.
	3	The greatest common divisor	3	K_3(Ap)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	solve problems, and explain.

	4	Relatively prime integers, linear combinations	3	K_4(An)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Problem-solving questions, Discussions.
	5	Euclid’s lemma	3	K_5(E)	Lecture using Chalk and talk, Problem-solving, PPT.	Concept explanations, Debating through Nearpod.
	6.	The Euclidean Algorithm	3	K_5(E)	Lecture using Chalk and talk, Problem-solving, PPT.	Concept explanations, Debating.
II	**The Diophantine Equation**					
	1	The Diophantine Equation $ax + by = c$	3	K_1(R)	Lecture using Chalk and talk, Problem-solving, PPT.	Check knowledge in specific situations.
	2	The solution of linear Diophantine Equation	4	K_2(U)	Problem-solving, Demonstration.	Evaluation through short tests.
	3	Primes and Their Distribution	4	K_3(Ap)	Problem-solving, Group Peer tutoring.	Formative Assessment.
	4	The fundamental theorem of arithmetic	4	K_4(An)	Lectures using videos, Problem-solving.	Presentations
	5	The Sieve of Eratosthenes	3	K_4(An)	Problem-solving, Demonstration.	Online Quiz, Assignment
III	**The Theory of Congruences**					
	1	The Theory of Congruences	3	K_2(U)	Lectures using videos.	Evaluation through short tests.
	2	Basic properties of congruence	4	K_2(U)	Introductory session, Group Discussion.	MCQ, True/False.
	3	Linear congruences and The Chinese remainder theorem	4	K_4(An)	PPT, Review.	Evaluation through short tests, Seminar.
	4	The Chinese	4		Lecture using	Concept

		remainder theorem		K_3(Ap)	Chalk and talk, Problem-solving, Group Discussion.	explanations.
	5	The problem related to The Chinese remainder theorem	3	K_3(Ap)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	MCQ, True/False.
IV	**Fermat's theorem**					
	1	Fermat's Little theorem and Pseudo primes	4	K_1(R)	Peer tutoring, Lectures using videos.	Evaluation through short tests.
	2	Fermat's theorem	3	K_2(U)	Lecture using Chalk and talk, Problem-solving.	Concept definitions through Nearpod.
	3	Absolute pseudo primes	3	K_3(Ap)	Problem-solving, Group Discussion.	MCQ, True/False.
	4	Wilson's theorem	4	K_4(An)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Concept definitions through Nearpod
	5	Quadratic Congruence	4	K_2(U)	Problem-solving, Group Discussion.	Slip Test
V	**Number Theoretic Functions**					
	1	Number Theoretic Functions	4	K_2(U)	Lecture using Chalk and talk, Problem-solving, Group Discussion.	Concept definitions
	2	The sum and number of divisors	3	K_1(R)	Peer tutoring, Lectures using videos.	Formative assessment
	3	The Mobius Inversion function	3	K_4(An)	Problem-solving, PPT.	Slip Test
	4	The Mobius Inversion formula	4	K_3(Ap)	Problem-solving, Group Discussion.	Assignment.
	5	The greatest integer	4	K_3(Ap)	Lecture thro google meet	Quiz through Socrative.

		function				

Course Focusing on Employability/ Entrepreneurship/ Skill Development: (Mention)
Activities (Em/ En/SD):
Assignment: Linear Diophantine Equations (Online)

Seminar Topic: Number Theoretic Functions.

Sample questions

Part A:

1. The division algorithm $a = qb + r$ satisfies when

$a)$ $0 \leq r \leq b$ b) $0 < r \leq b$ c) $0 \leq r < b$ d) None

2. The Diophantine Equation 6x+ 51y = 22 has

a) one solution b) two solutions c) no solution d) many solutions

3. Define congruent modulo n.
4. Define Pseudo prime.
5. Define number theoretic function.

Part B:

6.State and prove Euclid's lemma.

7.If p is prime and $p|ab$ then $p|a \ or \ p|b$.

8. Solve the linear congruence $18x \equiv 30(mod\ 42)$.

9. If n is an odd pseudoprime, then $M_n = 2^n - 1$ is a larger one.

10. If f is a multiplicative function, and F(n) = $\sum_{d/n} f(d)$ then show that F is multiplicative.

Part C:

11.Derive the Euclidean Algorithm.

12.The linear Diophantine equation $ax + by = c$ has a solution if and only if $d|c$ where d= gcd(a,b). If x_0 , y_0 is any particular solution of this equation, then all other solutions of the form $x^I = x_0 + \left(\frac{b}{d}\right) t$ and $y^I = y_0 - \left(\frac{a}{d}\right) t$

13.Solve the system of linear congruences $7x + 3y \equiv 10(mod\ 16)$, $2x + 5y \equiv 9(mod\ 16)$.

14.State and prove Wilson's Theorem.

15.Derive the Mobius inversion formula.

Head of the Department
Dr. T. Sheeba Helen

Course Instructor
Mrs. J C Mahizha

Department : Mathematics
Class : III B.Sc Mathematics
Title of the Course : Major Core XIII- Linear Programming
Semester : VI
Course Code : MC2064

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2064	5	-	-	4	5	90	25	75	100

Objectives:

1. To formulate real life problems into mathematical problems.

2. To solve life oriented and decision making problems by optimizing the objective function.

Course Outcomes

CO	upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO – 1	understand the methods of optimization and to solve the problems	PSO - 1	K2(U)
CO – 2	explain what is an LPP	PSO - 1	K2(U)
CO – 3	define how to formulate an LPP with linear constraints	PSO - 1	K1(R)
CO – 4	maximize the profit, minimize the cost, minimize the time in transportation problem , Travelling salesman problem, Assignment problem	PSO - 3	K3(Ap)
CO – 5	identify a problem in your locality, formulate it as an LPP and solve	PSO - 4	K5(C)

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

Unit	Section	Topics	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Formulation of L.P.P**					
	7.	Formulation of L.P.P - Mathematical Formulation of L.P.P - Solution of L.P.P	3	K2(U)	Brainstorming	Evaluation through Near pod
	8.	Graphical method	4	K3(Ap)	Flipped Classroom	Short summary of the concept
	9.	Simplex method	4	K4(An)	Peer Teaching and Learning	MCQ
	10.	Big-M Method - Algorithm for Big-M Method	4	K3(Ap)	Lecture and problem solving	Concept Explanation
II	**Two phase method**					
	1	Two phase method - Phase I: Solving auxiliary LPP using Simplex method	3	K2(U)	Lecture Illustration	Home Assignment

	2	Phase II: finding optimal basic feasible solution	3	K2(U)	Group discussion	Evaluation through slido
	3	Duality in L.P.P - Primal - Formation of dual L.P.P - Matrix form of primal and its dual - Fundamental theorem of duality	3	K3(Ap)	Lecture using videos, Problem solving	MCQ
	4	Dual simplex method - Dual Simplex Algorithm	4	K3(Ap)	Collaborative learning	Simple questions
	5	Degeneracy and cycling in L.P.P	2	K4(An)	Blended classroom	Evaluation through poll
III	**Transportation problems**					
	1	Transportation problems - Mathematical formulation of Transportation Problems - Dual of a Transportation Problem	4	K2(U)	Brainstorming	Evaluation through Nearpod
	2	Solution of a Transportation Problem - North-West corner rule - Row Minima method - Column Minima method	4	K3(Ap)	Blended classroom	Slip Test using Quizziz
	3	Least Cost method - Vogel Approximation Method	4	K3(Ap)	Flipped Classroom	Short summary of the concept
	4	Degeneracy in Transportation Problems	3	K4(An)	Peer Teaching and Learning	MCQ
IV	**Assignment Problems**					
	1	Assignment Problems - Mathematical formulation	4	K2(U)	Lecture with Illustration	Slip Test
	2	Solution to Assignment Problems	4	K3(Ap)	Group discussion	Home Assignment
	3	Hungarian Algorithm for solving Assignment Problems	4	K3(Ap)	Lecture using videos, Problem solving	Quiz through slido
	4	Travelling Salesman Problem	3	K4(An)	Lecture using Chalk and talk ,Introductory session, Group Discussion	Online Quiz through quizziz

V	**Sequencing of Jobs**					
	1	Sequencing of Jobs-Introduction	4	K2(U)	Collaborative learning	Evaluation through poll
	2	Processing n jobs in two machines	4	K2(U)	Problem Solving	Concept Explanation
	3	Processing n jobs in m machines	4	K4(An)	Group Discussion	Evaluation through quizziz
	4	Processing two jobs in m machines	3	K3(Ap)	Analytic Method	Questioning

Course Focusing on Employability
Activities (Em/ En/SD):Evaluation through Quiz competition
Assignment :Sequencing of Jobs**(**online Assignment**)**

Sample questions

Part A

1. A feasible solution that also optimizes the objective function is called an ………..solution
   (a) feasible (b) Basic
   (c) optimal (d) Basic feasible
2. The optimal solution of a linear programming problem involving ……… decision variables can be obtained by graphical method.
   (a) 2 b) 3 (c) 4 d) 5

3. State True or False
If the primal problem is of maximization type, then the dual problem is of maximization type.

4.The number of non-basic variables in the balanced transportation problem with m rows and n columns is _______.
a) $(m+n)-mn$ b) $m-(m+n-1)$
c) $mn-(m+n-1)$d) $mn+(m+n-1)$

5. The solving procedure of an assignment problem is known as ________
a) MODI method b) Simplex method
c) Hungarian method d) None

Part B

1. Solve by graphical method the LPP Maximize $z = 4x_1+3x_2$ subject to $2x_1-3x_2 \leq 6$, $6x_1+5x_2 \geq 30$, $x_1,x_2 \geq 0$
2. Given the cost matrix for travelling the cities A, B, C, D by a travelling salesman

	A	B	C	D
A	∞	46	16	40
B	41	∞	50	40
C	82	32	∞	60
D	40	40	36	∞

3. Explain the North West Corner Rule.
4. Explain unbalanced Assignment Problem.

5. Demonstrate Hungarian Method of Solving Assignment Problem.

Part C

1. Solve the LPP using Two phase method Maximize z = $5x_1+8x_2$ subject to $3x_1+2x_2 \geq 3$, $x_1+4x_2 \geq 4$, $x_1+x_2 \leq 5$, $x_1,x_2 \geq 0$
2. Solve by simplex method the LPP Maximize z = $4x_1+3x_2$ subject to $2x_1-3x_2 \leq 6$, $6x_1+5x_2 \geq 30$, $x_1,x_2 \geq 0$.
3. Solve the following L.P.P using Dual Simplex Method.

   Maximize $z = -x_1 - x_2$

   subject to $2x_1 + x_2 \geq 2$

   $$-x_1 - x_2 \geq 1$$

   $$x_1, x_2 \geq 0$$
4. For the set of data given below find the minimum total elapsed time and idle times on the two machines M_1 and M_2.

Jobs ⇒		A	B	C	D	E
Machines ⇒	$\mathbf{M_1}$	5	4	8	7	6
	$\mathbf{M_2}$	3	9	2	4	10

5. Solve the following Assignment problem for minimum cost.

	J1	J2	J3	J4
P1	20	13	7	5
P2	25	18	13	10
P3	31	23	18	15
P4	45	40	23	21

Head of the Department
Dr.T.Sheeba Helen

Course Instructor
Dr. A. JancyVini

Department : Mathematics
Class : III B.Sc
Semester : VI
Name of the Course : Astronomy
Course code : MC2065

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2064	6	-	-	4	6	90	25	75	100

Objectives: **1.** To introduce space science and to familiarize the important features of the planets, the sun, the moon, and the stellar universe.
2. To predict lunar and solar eclipses and study seasonal changes.

Course Outcome

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO –1	define the spherical trigonometry of the celestial sphere	PSO-1	U
CO –2	Discuss Kepler's laws	PSO-1	U
CO –3	Calculate the motion of two particles relative to the common mass Centre	PSO-2	Ap
CO –4	interpret latitude and longitude and apply this to find the latitude and longitude of a particular place	PSO-4	E
CO –5	Distinguish between Geometric Parallax and Horizontal Parallax	PSO-4	An

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

Unit	Module	Topics	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Celestial sphere					
	1.	Spherical trigonometry (only the four formulae) - Celestial sphere	3	K2(U)	Lecture Illustration	Evaluation through slip test
	2.	Four systems of coordinates	3	K3(Ap)	Lecture Illustration	Quiz through Quizziz
	3.	Diurnal motion, Sidereal Time	3	K4(An)	Lecture Illustration	Evaluation through Nearpod
	4.	Hour angle and Azimuth at rising	2	K2(U)	Lecture Illustration	Class test

	5.	Morning and Evening stars	2	K3(Ap)	Lecture Illustration	Assignment
	6.	Circumpolar stars	2	K4(An)	Lecture Illustration	Evaluation through poll
II	The Earth					
	1.	The Earth-Zones of the earth	3	K2(U)	Lecture Illustration	Home Assignment
	2.	Perpetual Day and Perpetual night	2	K2(U)	Lecture Illustration	Evaluation through slip test
	3.	Terrestrial latitude and longitude	3	K3(Ap)	Lecture Illustration	Formative Assessment
	4.	Dip of Horizon	3	K2(U)	Lecture Illustration	Quiz through Slido
	5.	Twilight, Duration of Twilight, Twilight throughout the night, Shortest Twilight.	4	K2(U)	Lecture Illustration	Home Assignment
III	Geocentric Parallax					
	1.	Geocentric parallax-Parallax - Effects of Geocentric parallax	3	K2(U)	Lecture Illustration	Slip Test
	2.	Changes in R.A and Declination of a body due to Geocentric Parallax	3	K3(Ap)	Lecture Illustration	Online quiz
	3.	Angular diameter, Equatorial horizontal Parallax	3	K3(Ap)	Lecture Illustration	Online Assignment
	4.	Heliocentric Parallax, Effect of Heliocentric Parallax	3	K4(An)	Lecture Illustration	Slip Test
	5.	To find the effect of Parallax on the Longitude and Latitude of a Star, Parsec	3	K2(U)	Lecture Illustration	Online Assignment
IV	Kepler’s laws					
	1.	Kepler’s laws , Eccentricity of Earth’s orbit	3	K2(U)	Lecture Illustration	Slip Test

	2.	Verification of Kepler's Laws(1)and (2), Newton's Deductions from Kepler's laws	3	K3(Ap)	Lecture Illustration	Home Assignment
	3.	To derive Kepler's Third Law from Newton's law of Gravitation, To find The mass of a planet	3	K3(Ap)	Lecture Illustration	Quiz through Quizziz
	4.	To fix the position of a planet in its elliptic orbit, Geocentric and Heliocentric latitudes and longitudes	3	K4(An)	Lecture Illustration	Formative Test,Online Quiz
	5.	To prove that the Helio centric longitude of the Earth and Geocentric longitude of the Sun differ by 180°	3	K4(An)	Lecture Illustration	SlipTest
V	Two Body Problem					
	1.	Two Body Problem – Introduction, Newton's Fundamental equation of Motion	3	K2(U)	Lecture Illustration	Class Test
	2.	Motion ofoneparticle relativetoanother	3	K2(U)	Lecture Illustration	Formative assessment
	3.	The motionofthe commoncenterof mass	3	K4(An)	Lecture Illustration	Online Quiz
	4.	The motion of two particles relative to the common mass center	3	K3(Ap)	Lecture Illustration	Online Assignment
	5.	The motion of a planet with respect to the Sun	3	K4(An)	Lecture thro Google meet	Class test

Course Focusing on: Employability
Activities (Em/ En/SD):Quiz, Poster presentation, PPT presentations using Gamma
Assignment: The motion of the common centre of mass**(**online Assignment**)**

Sample Questions

Part – A

1. A star of declination δ is a circumpolar star at a place of latitude φ if ----------

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------------
3. State true or false: Geocentric parallax affects only near bodies
4. The angle between the standard direction and apparent direction is -------------
5. The third law of Kepler is also known as-------------

Part – B

6. Find the maximum azimuth of a star.
7. Define Dip of horizon and derive an expression for Dip.
8. Derive changes in R.A and declination of a body due to geocentric parallax.
9. Write and explain Kepler's laws of planetary motion.
10. Derive the motion of two particles relative to the common mass centre.

Part – C

11. Find the time taken by a star to rise when it is x'' vertically below the horizon.
12. Trace the variations in the durations of day and night during the year for a place on the equator and at the north pole.
13. Show that the geocentric parallax of the sun is $\frac{\sin z' \sin P}{1 - \sin z' \sin P}$, where P is its horizontal parallax and z' its geocentric zenith distance.
14. Derive Newton's Deductions from Kepler's laws.
15. Derive the motion of a planet with respect to the sun.

Head of the Department
Dr. T. Sheeba Helen

Course Instructor
Dr.J. Befija Minnie