DEPARTMENT OF MATHEMATICS S.F

Vision

To empower women globally competent with human values and ethics acquiring academic and entrepreneurship skills through holistic education.

Mission

1. To create opportunities which will ensure academic excellence in critical thinking, humanistic and scientific inquiry.
2. To develop application oriented courses with the necessary input of values.
3. To create a possible environment for innovation, team spirit and entrepreneurial leadership.
4. To form young women of competence, commitment and compassion.

Programme Educational Objectives (PEO)

PEO 1	The graduates will apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.
PEO 2	The graduates pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.
PEO 3	The graduates will demonstrate the ability to utilize effectively the variety of teaching techniques and class room strategies and develop confidence to appear for competitive examinations and occupy higher levels of academic and administrative fields.

Programme Outcomes (PO)

PO	**Upon completion of the B.Sc. Degree Programme, the graduates will be able to:**
PO - 1	equip students with hands on training through various courses to enhance entrepreneurship skills.
PO - 2	impart communicative skills and ethical values.
PO - 3	face challenging competitive examinations that offer rewarding careers in science and education.
PO - 4	apply the acquired scientific knowledge to face day to day needs and reflect upon green initiatives to build a sustainable environment.

Programme Specific Outcomes (PSO)

PSO	Upon completion of the B.Sc. Degree Programme, the graduates will be able to:	PO addressed
PSO - 1	acquire a strong foundation in various branches of mathematics to formulate real life problems into mathematical models	PO 4
PSO - 2	apply the mathematical knowledge and skills to develop problem solving skills cultivating logical thinking and face competitive examinations with confidence.	PO 3, 4
PSO - 3	develop entrepreneurial skills based on ethical values, become empowered and self-dependent in society.	PO 1,2
PSO - 4	enhance numerical ability and address problems in interdisciplinary areas which would help in project and field works.	PO 1
PSO - 5	pursue scientific research and develop new findings with global impact using latest technologies.	PO 4

III UG
Teaching Plan

Complex Analysis

Semester **: VI**

Name of the Course **: Complex Analysis**

Course code **: MC2061**

CourseCode	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MC2061	5	1	-	-	5	6	90	25	75	100

Objectives:

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

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	understand the geometric representation of mappings	PSO - 1	K2(U)
CO - 2	use differentiation rules to compute derivatives and express complex- differentiable functions as power series	PSO - 4	K5(E)
CO - 3	compute line integrals by using Cauchy's integral theorem and formula	PSO - 3	K5(E)
CO - 4	identify the isolated singularities of a function and determine whether they are removable, poles or essential	PSO - 1	K2(U)
CO - 5	evaluate definite integrals by using residues theorem	PSO - 5	K6(C)

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

Unit	Module	Topics	Lecture hours	Cognitive level	Learning Outcomes	Pedagogy	Assessment/ evaluation
I	**Differentiability**						
	1	Differentiability definitions and theorems	3	K1(R) K2(U)	To analyze the basic properties of differentiability	Lecture using videos	Recall basic definitions on differentiability
	2	Cauchy Riemann equations, theorems and examples, Alternate forms of C.R equations theorems and problems	7	K2(U)	To get necessary and sufficient condition for differentiability	Blending method	Concept definitions, Questioning Formative Assessment
	3	Analytic functions definition and problems	5	K4(An)	To discuss some properties of an analytic function	Lecture using PPT	Class test, Simple definitions ,examples, MCQ Test
	4	Harmonic functions, definitions, theorems and problems	7	K3(Ap)	To find an analytic functions	Lecture with Group Discussion	Recall steps, Questioning and Home Assignment
II	**Transformations**						
	1	Bilinear transformations,	7	K2(U)	To determine the image of given	Lecture with PPT	Concept definitions

		elementary transformation and cross ratio			region under bilinear transformation		, Questioning Formative Assessment
	2	Fixed Points of Bilinear Transformation	2	K4(An)	To obtain fixed pointsunder varies bilinear transformation	Problem solving	Class test, Simple definitions ,examples, MCQ Test
	3	Mapping by Elementary Functions- $w = z^2$, $w = z^n$, $w = e^z$, $w = \sin z$, $w = \cos z$, $w = \cosh z$	3	K3(Ap)	To explain the properties of elementary functions	Lecture with Gamma PPT	Recall steps, Questioning and Home Assignment
III	**Cauchy's Integral**						
	1	Definite integral, definitions, theorems and examples	4	K2(U)	To evaluate definiteintegral	Lecture with videos , Group Discussion and Problem solving.	Simple definitions ,examples, MCQ Test Assignment
	2	Cauchy's theorem, definition and theorems	5	K4(An)	To prove Cauchy's theorems	Lecture with Illustration, Group Discussion, Lecture using PPT and Peer teaching	Concept definitions , Questioning Formative Assessment Evaluation through short test

	3	Cauchy's integral formula – theorems and problems	5	K3(Ap)	To evaluate integrals	Lecture with Group Discussion	Recall steps, Open book test
IV	**Taylor's and Laurent's Series**						
	1	Taylor's series- Taylor's theorem and problems	5	K2(U), K4(An)	To expand the given function as Taylor's series	Lecture method, Group Discussion, Lecture using videos and Problem solving.	Concept definitions, Questioning Formative Assessment
	2	Laurent's Series – Laurent's theorem and problems	5	K2(U)	To expand the given function as Laurent'sseries	Group Discussion, Lecture using videos and Problem solving.	Class test, Simple definitions,examples, MCQ Test Formative Assessment
	3	Zeros of analytic functions – definition and problems	3	K4(An)	To determine the zerosof an analytic functions	Lecture using PPT and Peer teaching Lecture withGroup Discussion	Class test, Simple definitions,examples, MCQ Test Assignment
	4	Singularities – definitions and examples	1	K3(Ap)	To find the singularity ofa given function	Lecture withGroup Discussion and Peer teaching	Simple definitions,examples, Solving problems, MCQ, Slip Test
V	**Cauchy Residues**						

	1	Residues – definition, lemmas and problems	5	K2(U)	To find the residue of a given function	Lecture using PPT and Peer teaching	Concept definitions, Questioning Formative Assessment Evaluation through short test.
	2	Cauchy's residue theorem – theorems and examples	3	K4(An)	To apply Cauchy's residue theorem by evaluating the integrals	Lecture with Illustration, Group Discussion, Lecture using PPT and Peer teaching	Concept definitions, Questioning Formative Assessment
	3	Evaluation of definite integrals – method and problems	5	K3(Ap)	To evaluate the definiteintegrals by using the given method	Problem solving, Lecture with PPT, Lecture with Illustration	Class test, Simple definitions ,examples, MCQ Test

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities (Em/ En/SD): Solving the Problems, Group discussion, Seminar, Online Assignment

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

Activities related to Cross Cutting Issues: Nil

Assignment: Bilinear transformations, elementary transformation and cross ratio

Seminar Topic: Cauchy's integral formula, theorems and problems

Part A

1. What are the necessary conditions for a function $f(z)$ to be analytic in a given domain?
   a) Existence of partial derivatives
   b) Existence of Cauchy-Riemann equations
   c) Satisfying the Laplace equation
   d) All of the above
2. For an analytic function $f(z)$, which of the following statements is true?
   a) It is always a real-valued function
   b) Its derivative is not unique
   c) It satisfies the Cauchy-Riemann equations
   d) It has a singularity at every point
3. What is the cross ratio of four distinct complex numbers $z1$, $z2$, $z3$, $z4$?
   a) $(z2-z1)(z4-z3)/(z3-z1)(z4-z2)$
   b) $(z2-z1)/(z4-z3)$
   c) $(z1-z3)(z2-z4)/(z1-z4)(z2-z3)$
   d) $(z3-z1)/(z4-z2)$
4. Which theorem guarantees the existence of anti derivatives for holomorphic functions?
   a) Cauchy's Residue Theorem
   b) Fundamental Theorem of Algebra
   c) Maximum Modulus Theorem
   d) Cauchy's Integral Theorem
5. In a Laurent series expansion, if all the coefficients corresponding to negative powers of $(z-a)$ are zero, what type of singularity does the function have at $z=a$?
   a) Essential singularity b) Removable singularity c) Pole d) Branch point

Part B

6. Consider the function $f(z)=3z^2+2i$. Determine whether this function is analytic, and if so, find its derivative.
7. Given the bilinear transformation $w=\frac{2z+i}{3z-2i}$, find the expression for z in terms of w. Also, map the points $z_1=1$ and $z_2=-i$ under this transformation and express the results in terms of w.
8. Evaluate the following complex integral $\int_C \frac{e^z}{z-1}dz$ where C is the circle $|z|=2$ traversed counterclockwise.
9. Find the Taylor series expansion of the function $f(z)=\frac{1}{z^2-4}$ centered at $z=0$. Determine the radius of convergence and identify any singularities.
10. Use the Residue theorem to evaluate the following integral $\oint_C \frac{\cos(z)}{(z-1)(z-2)}$ where C is the positively oriented circle $|z|=3$.

Part C

11. State and prove Taylor's Theorem.
12. Prove that any bilinear transformation can be expressed as product of translation, rotation, magnification and inversion.
13. Prove that the cross ratio is preserved by a Bilinear transformation.
14. State and prove residue theorem.
15. Find the bilinear transformation which maps the points $z_1 = 2$, $z_2 = i$, $z_3 = -2$ onto $w_1 = 1$, $w_2 = i$, $w_3 = -1$ respectively.

Course Instructor

Dr. P.C. Priyanka Nair

Head of the Department

Dr. S. Kavitha

Mechanics

Department : Mathematics (SF)
Class : III B.Sc. Mathematics (SF)
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
MP231CC1	4	2	-	5	6	90	40	60	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	K6 (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 and tests)

Unit	Module	Topics	Teaching Hours	Cognitive level	Pedagogy	Assessment/ evaluation
I	**Forces Acting at a Point, Parallel Forces and Moments**					
	1	Introduction to types of Forces and equilibrium of forces	1	K2(U)	Introductory session	Simple definitions, Recall basic definitions
	2	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	3	K2(U) K3(Ap)	Interactive PPT using Gamma AI tool	Quiz using slido
	3	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) K6 (C)	Lecture using Chalk and talk	Evaluation through slip test

	4	Moment of a force, Geometrical representation, Varignon's theorem of moments	4	K3(Ap)	Flipped Classroom	Group Discussion
	5	Generalised theorem of moments, Problems based on Varignon's theorem of moments, Generalised theorem of moments	4	K3(Ap)	Lecture with interactive video	MCQ Using Nearpod
II	**Couples, Coplanar Forces**					
	1	Couples – Equilibrium oftwo 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) K3(Ap)	Interactive PPT using Gamma AI tool	Oral test
	2	Conditions for forces to reduce a single force or couple, Change of the base point & Equation tothe line of action of the resultant	3	K2(U) K3(Ap)	Lecture with Interactive video	Quizziz
	3	Problems based on reduction of number of coplanar forces	2	K3(Ap)	Demonstration	Slip test
	4	Problems based on forces to reduce a single force or couple	3	K3(Ap)	Blended Classroom	MCQ
	5	Problems based on Equation to the line of action of the resultant	3	K3(Ap)	Flipped Classroom	MCQ using Nearpod
III	**Friction**					

	1	Introduction, Statical, Dynamical, Limiting friction and Laws of friction, Coefficient of friction, Angle of friction, Cone of friction	4	K2(U) K4(An)	Lecture with interactive PPT	Quiz using Slido
	2	Equilibrium of a particle on a rough inclined plane, Equilibrium of a body on a rough inclined plane under a force parallel to the plane, Equilibrium of a body on a rough inclined planeunder any force	3	K2(U) K4(An)	Evaluative Learning	Formative Assessment Test I
	3	Problems based on Coefficient of friction, angle of friction	4	K2(U) K4(An)	Blended Classroom	Assignment
	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	K2(U) K4(An)	Flipped Classroom	Group Discussion
IV	**Projectiles**					
	1	Fundamental principles, Path of a projectile, Characteristics of the motion of a projectile	3	K3(Ap)	Lecture with interactive PPT using Gamma AI tool	Evaluation through short test
	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)	Demonstration	Practical Exercises

	3	Maximum horizontal range, Two possible directions of projection,Problems based on maximum horizontal range and Two possibledirections of projection	4	K2(U) K3(Ap)	Inquiry Based Teaching	Oral Test
	4	Velocity of the projectile,Velocity of the projectile falling freely from the directrix, Problems based on Velocity of theprojectile	4	K2(U) K3(Ap)	Lecture with interactive video	Quiz using Nearpad
V	**Motion under the action of central forces**					
	1	Motion under the action of central forces – Introduction – Velocity and Acceleration in Polar Coordinates	4	K3(Ap)	Lecture with interactive PPT using Gamma AI tool	Quiz using Slido
	2	Equation of Motion in Polar Coordinates – Noteon the equiangular spiral – Motion under a central force	4	K3(Ap)	Lecture using Chalk and talk	Slip test
	3	Differential Equation ofcentral orbits – Perpendicular from the pole on the tangent – Pedal equation of the central orbit – Pedal equation of some of the well-known curves	4	K3(Ap)	Blended Classroom	Assignment
	4	Velocities in a central orbit – Two – fold problems in central orbits	3	K3(Ap)	Evaluative Learning	Formative Assessment Test II
	5	Johnson's Algorithm for Sparse Graphs-Preserving shortest	2	K3(Ap)	Demonstration	Assignment

		paths by reweighting and related Lemma				

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

Activities(Em/En/SD) : 1. Evaluation through short test, Quiz competition

2. Model Making, Puzzles

Assignment: Preparation of quiz questions, Velocity of the projectile

Seminar Topic: Friction, Velocities in a centralorbit – Two – fold problems in central orbits.

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

Activities related to Cross Cutting Issues : Nil

Sample questions

Part-A

1.State Lami's Theorem

2.If the force tends to turn the body in a clockwise direction, its moment is said to be _____

3.The conditions of equilibrium depend only on

a) couples a) resultant a)forces e)none of these

4.Co-efficient of friction is _____.

a) FR b) F/R c) μF d) μR

5.Greatest height attained by a projectile is _____.

6. Force of friction depends on ----------

a) weight of the object b) speed c)Time d) None of these

Part B

1. ABC is a given triangle Forces P,Q,R acting along the lines OA,OB,OC are in equilibrium. Prove that $P:Q:R=\cos\frac{A}{2}:\cos\frac{B}{2}:\cos\frac{C}{2}$ if O is the in centre of the triangle.
2. Forces P,4P,2P,6P act along the sides AB,BC,CD,DA of a square of side a. Show that the equation to the line of action of the resultant is 2x-y +6a = 0 with AB and AD as axes of coordinates.
3. State the laws of friction
4. A particle is projected horizontally from a point at a certain height above the ground show that the path described by it is a parabola.
5. 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 $R=4\sqrt{hh^1}$.

Part – C

1.State and prove Lami's theorem

2. State and prove Varigons theorem of moments.

3.Forces F_1, F_2, F_3, F_4, F_5, F_6 act along the sides of a regular hexagon taken in order. Show that they will be in equilibrium if (i) $F_1+F_2+F_3+F_4+F_5+F_6=0$ and (ii) $F_1-F_4=F_3-F_6=F_5-F_2$.

4. 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^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 $tan\,\theta=\frac{1-\mu\mu^1}{2\mu}$

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

6. 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 $V^{6/}\big/2g(v^4+g^2a^2)$.

Course Instructor

Dr. S.Kavitha

Head of the Department

Dr. S.Kavitha

Number Theory

Semester : VI

Name of the Course : Number Theory

Course code : MC2063

CourseCode	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MC2063	4	1	-	-	4	5	75	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 Outcomes

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	U
CO - 2	construct mathematical proofs of theorems and find counter examples for false statements	PSO - 2	Ap
CO - 3	collect and use numerical data to form conjectures about the integers	PSO - 5	Ap
CO -4	understand the logic and methods behind the major proofs in Number Theory	PSO - 4	An

CO - 5	solve challenging problems related to Chinese remainder theorem effectively	PSO - 3	E
CO - 6	build up the basic theory of the integers from a list of axioms	PSO - 1	U

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

Unit	Module	Topics	Teaching hours	Cognitive Level	Pedagogy	Assessment/ evaluation
I	**Divisibility Theory in the Integers**					
	1	Preliminaries–Numbers ,integers, Divisors and Divisibility Theory in the Integers	3	K1(R)	Lecture with Illustration	Evaluation through appreciative inquiry
	2	The Division Algorithm theorem and its applications	3	K2(U)	Lecture using PPT	Evaluation through quizzes and discussions.
	3	The greatest common divisor and least common multiple	3	K3(Ap)	Lecture using videos	Evaluation Through SlipTest
	4	Euclid's lemma and Euclidean Algorithm	3	K4(An)	Problem Solving	Evaluation through Quiz andTest
II	**Diophantine Equation**					
	1	The Diophantine Equation $ax+by=c$	3	K2(U)	Lecture with chalk and talk	Evaluation Through discussions.
	2	Primes and their Distribution.	3	K2(U)	Problem Solving	Evaluation through Appreciative inquiry

	3	The fundamental theorem of arithmetic	3	K3(Ap)	Lecture using PPT	Evaluation through Formative Assessment Test
	4	The Sieve of Eratosthenes	3	K4(An)	Group Discussion	Evaluation through Formative Assessment Test
III	**Theory of Congruences**					
	1	Theory of Congruences	3	K2(U)	Lecture with Illustration	Evaluation through appreciative inquiry
	2	Basic properties of congruences	3	K3(Ap)	Flipped Class	Evaluation through quizzes and discussions
	3	Linear congruences and The Chinese remainder theorem.	3	K4(An)	Lecture using PPT	Evaluation through SlipTest
	4	Problems based on Chinese remainder theorem	3	K3(Ap)	Discussion with Illustration	Evaluation through Quiz andTest
IV	**Pseudo primes**					
	1	Fermat's Little theorem and Pseudo primes	2	K2(U)	Lecture with PPT Illustration	Evaluation through discussions
	2	Absolute Pseudo primes	3	K3(Ap)	Flipped Class	Evaluation through appreciative inquiry
	3	Wilsons theorem	3	K3(Ap)	Lecture with Illustration	Evaluation through Formative Assessment Test
	4	Quadratic Congruence	3	K5(E)	Group Discussion	Evaluation through SlipTest
V	**Number Theoretic Functions**					

	1	Number Theoretic Functions	3	K2(U)	Lecture with Illustration	Evaluation through discussions.
	2	The sum and number of divisors	3	K3(Ap)	Lecture and Group Discussion	Evaluation Through Assignment
	3	The Mobius Inversion formula.	3	K4(An)	Flipped Class	Evaluation through FormativeAssessment Test
	4	The greatest integer function	3	K5(E)	Lecture with Illustration	Evaluation through SlipTest

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

Activities (Em/ En/SD): Solving the Problems, Group discussion, Seminar, Assignment

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

Activities related to Cross Cutting Issues: Nil

Assignment : The sum and number of divisors, The Mobius Inversion formula.

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Seminar Topic: Basic properties of congruences, Problems based on Chinese remainder Theorem

Sample Questions

PART-A

1. Find gcd(12378,3024) using Euclidean algorithm.
2. The gcd (12,30) is

   a) 7 b)6 c)3 d)1

3. A solution of the Diophantine equation is **……**
4. An equation of the form $ax \equiv b(modn)$ is called as _____.

   a) Congruence b) Modular congruence c) Linear Congruence

5. $2^{31} \equiv$ ___(mod11)

   (a)11 (b)31 c)1 (d)2

PART-B

1. ABC is a given triangle Forces P,Q,R acting along the lines OA,OB,OC are in equilibrium. Prove that $P:Q:R=\cos\frac{A}{2}:\cos\frac{B}{2}:\cos\frac{C}{2}$ if O is the in centre of the triangle.

2. A body is projected with a velocity of 98 m/sec in a direction making an angle $\tan^{-1}3$ with the horizon; Show that it rises to a vertical height of 441 meters and that its time of flight is about 19 secs. Find also horizontal range through the point of projection. ($g=9.8$ m/sec^2).

3. If $v_1 \& v_2$ be the velocities of a projectile at the ends of a focal chord of its path and U is the velocity at the vertex prove that $v_1^{-2} + v_2^{-2} = U^{-2}$.

4. State and prove Fermat's theorem.

5. Show that the system of linear congruence $ax + br \equiv r(modn), cx + dy \equiv s(modn)$ has a unique solution modulo n whenever gcd (ad- bc, n) = 1.

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. Prove that equation of the path of the projectile is a parabola.

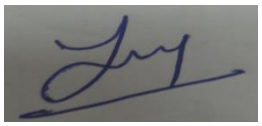
3. State and prove Chinese RemainderTheorem.

4. Prove that the number $\sqrt{2}$ is irrational.

5. State and prove Wilson's theorem. Is the converse true?

Dr. S. Kavitha

Head of the Department



Dr. J. Nesa Golden Flower

Course Instructor

Linear Programming

Department : Mathematics (SF)
Class : III B.Sc. Mathematics (SF)
Title of the Course : 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	75	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	K6 (C)

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

Unit	Module	Topics	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I						
	1	Formulation of LPP, Mathematical Formulation of LPP, Solution of LPP	3	K2 (U)	Introductory session, Lecture with illustration	Questioning, Recall steps, concept with examples
	2	Graphical method	4	K3 (Ap)	Flipped classroom	Group discussion
	3	Algorithm for Simplexmethod	1	K2 (U)	Lecture with illustration	Slip Test
	4	Simplex method problems	3	K3 (Ap)	PPT	Quiz using slido
	5	Algorithm for Big-M Method, Big-M Method problems	4	K2 (U)	Lecture Method	concept explanations

II						
	1	Two phase method - Phase I: Solving auxiliary LPP using Simplex method	4	K3 (Ap)	Computational thinking	Evaluation through short test
	2	Phase II: finding optimal basic feasible solution	3	K3 (Ap)	Flipped classroom	concept definitions, concept with examples
	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	K2 (U)	Blended learning	Quiz using Nearpod
	4	Dual Simplex Algorithm, Dual simplex problems	3	K2 (U)	Problem solving	Slip Test, Quiz using google forms
	5	Degeneracy and cycling in L.P.P.	2	K3 (Ap)	Lecture using videos	Brainstorming, Formative Assessment I
III						
	1	Mathematical formulation of Transportation Problems, Dual of a Transportation Problem	3	K1 (R)	Demonstrative	concept with examples, Questioning
	2	Solution of a Transportation Problem, North-West corner rule	3	K3 (Ap)	Lecture Method	Evaluation through short test
	3	Row minima method, Column minima method, Least Cost Method	3	K2 (U)	PPT	Group discussion
	4		3	K2 (U)	Lecture with illustration	Brain storming

		Vogel's Approximation Method				
	5	Degeneracy in Transportation Problems	3	K3 (Ap)	Problem solving	Slip Test
IV						
	1	Assignment Problems, Mathematical formulation, Solution to Assignment Problems	5	K3 (Ap)	Introductory session	concept with examples
	2	Hungarian Algorithm for solving AssignmentProblem	5	K3 (Ap)	Problem solving	concept explanations, Quiz using Slido
	3	Travelling Salesman Problem	5	K3 (Ap)	Computational thinking	Group discussion, Assignment
V						
	1	Introduction to Sequencing	3	K1 (R)	Lecture Method	concept with examples
	2	Processing n jobs in two machines	4	K3 (Ap)	Problem solving	Slip Test
	3	Processing n jobs in m machines	4	K3 (Ap)	Problem solving	Quiz using google forms, Seminar
	4	Processing two jobs in m machines	4	K3 (Ap)	Problem solving	Quiz using Mentimeter, Formative Assessment II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Entrepreneurship

Activities (Em/ En/SD): Identify a problem in the locality, formulate it as an LPP and solve it.

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

Activities related to Cross Cutting Issues: Nil

Assignment: Travelling Salesman Problem

Seminar Topic: Processing n jobs in m machines

Sample questions

Part A

1. A basic solution is said to be _____ if none of the basic variable is zero.

(a) optimal (b) degenerate (c) non-degenerate (d) feasible

2. In Two phase method, the solution is obtained in _____ phases.
3. State True or False:
   If the primal problem is of maximizing type then the dual problem is of minimizing type.
4. The assignment problem is said to be balanced if _____.
5. State True or False:
   No machine may process more than one job simultaneously for sequencing problems.

Part B

1. An egg contains 6 units of Vitamin A per gram and 7 units of Vitamin B per gram and costs 12 paise per gram. Milk contains 8 units of Vitamin A and 12 units of Vitamin B per gram and costs 20 paise per gram. The daily minimum requirements of Vitamin A and Vitamin B are 100 units and 120 units. Find the optimal product mix. Formulate a LP model for the above problem.
2. Write the algorithm of Two Phase Method.
3. Using Least Cost Method, find a basic feasible solution to the following transportation problem.

	W_1	W_2	W_3	a_i
F_1	8	10	12	900
F_2	12	13	12	1000
F_3	14	10	11	1200

b_j	1200	1000	900	3100

4. Solve the following Assignment problem

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

5. Write the algorithm to find the optimum sequence for n jobs in 2 machines.

Part C

1. Solve the following LPP by Big-M method:
Minimize $z = 60x_1 + 80x_2$ subject to
$20x_1 + 30x_2 \geq 900$
$40x_1 + 30x_2 \geq 1200$
$x_1, x_2 \geq 0.$

2. Explain Dual Simplex algorithm.
3. Solve the following transportation problem

	C	D	E	Availability
A	3	7	3	6
B	2	3	9	8
Requirement	4	7	3	14

4. A travelling salesman has to visit 5 cities. He wishes to start from a particular city, visit each city once and return to his starting point. Cost of travelling from one city to another it shown in the table below. Find the least cost route.

	A	B	C	D	E
A	∞	4	10	14	2
B	12	∞	6	10	4
C	16	14	∞	8	14
D	24	8	12	∞	10

E	2	6	4	14	∞

5. Write the algorithm to find the optimum sequence for n jobs in m machines.

Head of the Department: Dr.S.Kavitha **Course Instructor: Dr.C.Jenila**

Astronomy

Class **: III B.Sc Mathematics**

Title of the course **: Major: Astronomy**

Semester **: VI**

Name of the Course **: Astronomy**

Course code **: MC2065**

Course code	L	T	P	Credits	Inst.Hours	Total No. of Hours	Marks		
							CIA	External	Total
MC2065	4	2	-	6	6	90	25	75	100

Objectives:

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

Course Outcomes

CO	Upon completion of this course the students will be able to	PSO Addressed	Cognitive level
CO - 1	define the spherical trigonometry of the celestial sphere	PSO - 4	K3
CO - 2	discuss the Kepler's laws	PSO - 4	K3
CO - 3	calculate the motion of two particles relative to the common mass centre	PSO - 3	K3 & K5

CO -4	interpret latitude and longitude and apply this to find the latitude and longitude of a particular place	PSO - 2	K2
CO - 5	distinguish between Geometric Parallax and Horizontal Parallax	PSO - 4	K4

Total Contact Hours:90 (Includinglectures,assignmentsand tests)

Unit	Module	Topics	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	**Celestialsphere**					
	1	Spherical trigonometry(only the fourformulae)-Celestialsphere	3	K2(U)	LectureIllustration	Simple definitions, Recall basic concepts
	2	Four systems ofcoordinates	3	K4(An)	Problem solving	oral,test
	3	Diurnalmotion-SiderealTime	3	K3(Ap)	Lecturewith Illustration	Evaluation through slip test
	4	Hour angle and Azimuthatrising	4	K3(Ap)	Flipped Classroom	MCQ using Nearpod
	5	MorningandEveningstars	3	K4(An)	Problem solving	Assignment
	6	Circumpolarstars	2	K4(An)	Computational learning	Home Assignment
II						
	1	The Earth - Zones of the earth	3	K4(An)	Lecture with chalk and talk Illustration	HomeAssignment
	2	PerpetualDayandPerpetualnight	4	K2(U)	LectureIllustration	Evaluation through slip test
	3	Terrestrial attitude andlongitude	3	K3(Ap)	Experimental learning	MCQ using Nearpod

	4	Dip ofHorizon	4	K2(U)	Blended learning	FormativeAssessment Test I
	5	Twilight, Duration ofTwilight, Twilight throughout the night,Shortest Twilight.	4	K4(An)	Seminar	Quiz
III						
	1	Geocentric parallax – Parallax, Effects of Geocentric parallax	3	K3(Ap)	Lecture with Illustration	Simple definitions
	2	Changes in R.A andDeclination of a bodydue to GeocentricParallax	4	K2(U)	Lecture using videos	Solving problems
	3	Angular diameter Equatorialhorizontal parallax	4	K4(An)	Flipped classroom	MCQ using slido
	4	HeliocentricParallax, Effect of HeliocentricParallax	3	K3(Ap)	Blended learning	Formative Assessment Test I
	5	To find the effectofParallax on theLongitudeandLatitudeofaStar-Parsec	4	K2(U)	LectureIllustration	OnlineAssignment
IV	**Kepler's laws**					
	1	Kepler'slaws-EccentricityofEarth'sorbit	3	K4(An)	LectureIllustration	OralTest
	2	Verification ofKepler'sLaws(1)and(2)-Newton'sdeductions from Kepler'slaws	3	K3(Ap)	Computational learning	Short summary
	3	ToderiveKepler'sThird LawfromNewton'slaw ofGravitation, Tofind Themassofaplanet	4	K2(U)	Problem solving	Recall steps
	4	To fixthepositionofaplanetin itselliptic orbit, Geocentric andHeliocentric latitudesandlongitudes	4	K4(An)	LectureIllustration	FormativeTest, OnlineQuiz

	5	To prove that theHeliocentriclongitudeof the Earth andGeocentric longitudeof the Sun differ by180^o	4	K2(U)	LectureIllustration	SlipTest
V	**Two Body Problem**					
	1	Two Body Problem – Introduction, Newton's FundamentalequationofMotion	4	K2(U)	Introductory to Two body Problems	Recall basic definitions
	2	Motionofoneparticle relativetoanother	3	K3(Ap)	Experimental learning	Evaluation through online quiz
	3	The motion of the common center of mass	3	K4(An)	Blended learning	FormativeAssessment Test II
	4	The motion of two particles relative to the common mass center	4	K4(An)	Problem solving	Online Assignment
	5	The motion of a planetwith respect totheSun	4	K2(U)	Lecture using videos	Solving problems

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

Activities (Em/En/SD): Evaluation through short test, Seminar

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

Assignment:

1.To prove that the Helio centric longitude of the Earth and Geocentric longitude of the Sun differ by180^o

2. The motion of the common center of mass

Seminar Topic:

Motion of two particles relative to the common mass center.

Sample questions:

Part-A

1. The Zenith distance is the complement of the…….

2. The observer observes the line of horizon at the point……

3.State True or False: The direction in which the body is seen from the centre of earth is called heliocentric direction.

4. State Kepler's first law

5. Perigee and apogee are together called……..

Part – B

11. Write a short note on cardinal points

12. Write a short note on Dip of horizon

13. Derive tangent formula

14. Write a short note on Kepler's third law

15.Derive motion of one particle relative to another

Part – C

Answer all the questions:

16. Explain about morning and evening stars

17. Find the duration of twilight when it is shortest

18. Derive Cassin's formula for refraction

19.Explain interpretation of Newton's laws

20.Explain about Eclipses of sun

Head of the Department — Dr.S. KAVITHA

Course Instructor — Dr.Y.A.SHINY