Holy Cross College (Autonomous), Nagercoil - 629004

Kanyakumari District, Tamil Nadu.

Nationally Accredited with A^+ by NAAC IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli

DEPARTMENT OF MATHEMATICS

TEACHING PLAN (UG)

ODD SEMESTER 2024-2025

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 (PEOs)

PEOs	**Upon completion of B.Sc. Degree Programme, the graduates will be able to**	**Mission addressed**
PEO 1	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.	**M1 & M2**
PEO 2	inculcate practical knowledge for developing professional empowerment and entrepreneurship and societal services.	**M2, M3, M4 & M5**
PEO 3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	**M3, M4, M5 & M6**

PROGRAMME OUTCOMES (POs)

POs	Upon completion of B.Sc. Degree Programme, the graduates will be able to:	PEOs Addressed
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	**PEO 1**
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	**PEO2**
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	**PEO 2**
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	**PEO 1&PEO 3**
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	**PEO 2&PEO 3**
PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	**PEO 2& PEO 3**
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to develop knowledge and skills.	**PEO1 & PEO 3**

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO	Upon completion of B.Sc. Mathematics, the graduates will be able to:	Mapping with POs
PSO – 1	acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.	**PO1**
PSO – 2	understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.	**PO6**
PSO - 3	apply Mathematical theories and principles accurately, precisely and effectively including higher research and extensions	**PO3 &PO7**
PSO – 4	prepare the students who will demonstrate respectful engagement with other's ideas, behaviours, beliefs and apply diverse frames of references to decisions and actions.	**PO5 &PO6**
PSO – 5	create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start-ups and high potential organizations.	**PO2 &PO4**

Teaching Plan

Department : Mathematics

Class : I B.Sc

Title of the Course : Major Core I: Algebra and Trigonometry

Semester : I

Course Code : MU241CC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MU241CC1	4	-	-	4	4	60	25	75	100

Learning Objectives

1. To understand the basic ideas on the theory of equations, Matrices.
2. To get the knowledge to find expansions of trigonometry functions, solve theoretical and applied problems

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO – 1	know the definitions and properties of the Remainder Theorem, equations with real and rational coefficients, and the transformations of equations	PSO - 1	K1
CO – 2	find eigen values, eigen vectors, verify Cayley — Hamilton theorem and diagonalize a given matrix	PSO - 3	K1
CO – 3	expand the powers and multiples of trigonometric functions in terms of sine and cosine	PSO - 1	K2
CO – 4	classify and solve reciprocal equations	PSO – 2	K2

CO – 5	determine relationship between circular and hyperbolic functions and the summation of trigonometric series	PSO – 2	K3

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Theory of equations					
	1.	Theory of equations	2	K1 & K2	Brainstorming	MCQ
	2.	Remainder Theorem-Equation with real coefficients	3	K2	Lecture	Slip Test
	3.	Equation with rational coefficients	2	K3	Lecture Discussion	Questioning
	4.	Transformations of equations-Roots with sign changed	2	K1 & K3	Lecture	Questioning
	5.	Roots multiplied by a given number	3	K3	Problem Solving	Class test
II	Reciprocal Equations					
	1.	Reciprocal Equations-Standard form	3	K1	Lecture with Illustration	Questioning
	2.	Increasing or decreasing the roots of a given equation.	2	K2	Problem solving	Short summary
	3.	Removal of terms.	2	K3	Brain storming	Concept definitions
	4.	Approximate solutions of roots of polynomials by Horner's method	2	K3	Lecture with Problem solving	Recall steps
	5.	Horner's method related problems.	3			

III	Matrices					
	1.	Characteristic equation	2	K1 & K2	Brainstorming	Quiz
	2.	Eigen values, Eigen Vectors and Properties	3	K3	Lecture	Explain
	3.	Similar matrices	1	K3	Lecture Discussion	Slip Test
	4.	-Cayley — Hamilton Theorem (Statement only)	1	K3	Lecture	Questioning
	5.	Finding powers of square matrix	2	K3	Collaborative learning	Questioning
	6.	Inverse of a square matrix up to order 3 - related problems.	3	K5	Problem Solving	Concept explanations
IV	Hyperbolic functions					
	1.	Introduction	1	K1 & K2	Brainstorming	Quiz
	2.	Hyperbolic functions	3	K3	Lecture Discussion	Differentiate between various ideas
	3.	Relation between circular and hyperbolic functions	3	K3	Integrative method	Explain
	4.	Inverse hyperbolic functions	3	K1 & K2	Collaborative learning	Slip Test
	5.	Logarithm of complex quantities Related problems.	2			
V	Summation of Trigonometric Series					
	1.	Summation of Trigonometric Series	3	K1 & K2	Brainstorming	MCQ
	2.	Difference Method	4	K4	Lecture	Concept explanations

	3.	Angles in Arithmetic Progression Method	4	K1 & K2	Lecture Discussion	Questioning
	4.	C+iS method	4	K4	Lecture	Recall steps

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

Activities (Em/ En/SD): **Group Discussion**

Assignment: **Exercise Problems in Logarithm of complex quantities**

Sample questions

Part A

1. The equation whose roots are 10 times those of $x^3 + 3x - 5 = 0$ is ----------

   a) $x^3 + 3x - 50 = 0$ b) $x^3 + 30x - 50 = 0$

   c) $x^3 + 30x - 500 = 0$ d) $x^3 + 300x - 5000 = 0$

2. One real root of $x^3 - 6x - 13 = 0$ lies between ----------

   a) 0 and 1 b) 1 and 2 c) 3 and 4 d) -1 and 0

3. If the eigen value of a square matrix A are 1,2,3 then the eigen value of A^2 are…….

   a) 1, 4, 9 b) 2, 4, 6 c) -1,-4,-9 d) 3, 6, 9

4. The product of the eigen values of $\begin{pmatrix} -3 & 3 \\ -2 & 4 \end{pmatrix}$ is ……

   a) -6 b) 6 c)0 d) None

5. $cosh^2x - sinh^2x = \cdots$ ... ...

   a) 0 b) 1 c) 2 d) 3

6. Log 1=……

   a) $2n\pi$ b) $n\pi$ c) $2n\pi i$ d) $3n\pi$

Part B

7. Increase the roots of the equation $4x^5 - 2x^3 + 7x - 3 = 0$ by -2.

8. Diminish the roots of $2x^4 - x^3 - 2x^2 + 5x - 1 = 0$ by 3.

9. Find the characteristic equation of the matrix $A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$

10. Show that the matrix $A = \begin{pmatrix} 2 & -3 & 1 \\ 3 & 1 & 3 \\ -5 & 2 & -4 \end{pmatrix}$ satisfies the equation $A(A - I)(A + 2I) = \mathbf{0}$.

11. If $\cos(x + iy) = r(\cos\alpha + i\sin\alpha)$ prove that $y = \frac{1}{2}\log\left(\frac{\sin(x-\alpha)}{\sin(x+\alpha)}\right)$

12. Find Log(1-i)

Part C

13. Solve the equation $6x^5 - x^4 - 43x^3 + 43x^2 + x - 6 = 0$

14. Find the positive root of $x^3 - x - 3 = 0$ correct to two places of decimals by Horner's method.

15. Using Cayley-Hamilton theorem find the inverse of the matrix $\begin{pmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{pmatrix}$.

16. Find the eigen values and eigen vectors of the matrix $A = \begin{pmatrix} 4 & -20 & -10 \\ -2 & 10 & 4 \\ 6 & -30 & -13 \end{pmatrix}$.

17. i) If $\cosh u = \sec\theta$ show that $u = \log\tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$

ii) If $\tan(x+iy) = u+iv$ prove that $\frac{u}{v} = \frac{\sin 2x}{\sinh 2y}$

18. If $\log\sin(\theta + i\varphi) = L+iB$, prove that $2e^{2L} = \cosh 2\varphi - \cos 2\theta$

Head of the Department — Course Instructor

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

Department : Mathematics

Class : I B. Sc

Title of the Course : Major Core II: DIFFERENTIAL CALCULUS

Semester : I

Course Code : MU241CC2

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MU241CC2	4	-	-	4	4	60	25	75	100

Learning Objectives

1. Basic knowledge on the notions of curvature, envelope and polar co-ordinates, and solving related problems.
2. The basic skills of differentiation, successive differentiation, and their 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 basic concepts of Differential Calculus	PSO - 2	K1
CO - 2	understand the concepts of Differentiation, Partial Differentiation, Envelope & Curvature	PSO - 2	K2
CO - 3	determine Partial derivatives of a function of two variables and use Lagrange's method of undetermined multipliers.	PSO - 1	K2
CO - 4	distinguish between partial and ordinary differential equations.	PSO - 3	K3
CO - 5	find the radius of curvature using polar co-ordinates.	PSO - 2	K3

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Successive Differentiation**					
	1.	Introduction (Review of basic concepts)	2	K1 & K2	Brainstorming	MCQ
	2.	The n^{th} derivative - Standard results & Corollaries on successive differentiation	2	K3	Lecture	Concept explanations
	3.	Finding n^{th} derivative of some functions of x	2	K3	Problem-solving, Peer tutoring	Questioning
	4.	Trigonometrical transformation – Basic formulas	1	K1 & K2	Brainstorming	Questioning
	5.	Finding n^{th} derivative of Trigonometric functions	2	K3	Collaborative learning	Concept explanations
	6.	Formation of equations involving derivatives	1	K1 & K2	Blended classroom	Evaluation through short test
	7.	Leibnitz formula for the n^{th} derivative of a Product	2	K1 & K3	Lecture Discussion	Concept definitions

II	**Partial Differentiation**					
	1.	Basic concepts of Partial derivatives	3	K1	Brainstorming	True/False
	2.	Successive partial derivatives - Function of a function rule	3	K2	Flipped Classroom	Short Summary
	3.	Problems Based on Partial Differentiation	3	K3	Lecture Discussion	Concept definitions
	4.	Total differential coefficient	3	K3	Group Discussion	Recall steps
III	**Partial Differentiation (Continued)**					
	1.	Homogeneous functions – Euler's Theorem	3	K2	Lecture Discussion	Concept definitions
	2.	Problems on Homogeneous functions & Euler's Theorem	3	K3	Problem solving	Slip test
	3.	Partial derivatives of a function of two variables	2	K3	Lecture, Group discussion	Concept explanations
	4.	Problems on Partial derivatives of a function of two variables	2	K3	Problem solving	Formative assessment
	5.	Lagrange's method of undetermined multipliers	2	K2, K3	Lecture Discussion	Concept definitions

IV	**Envelope**					
	1.	Method of finding the envelope	2	K1 & K2	Brainstorming	Quiz
	2.	Another definition of envelope	3	K2	Flipped Classroom	Differentiate between various ideas
	3.	Envelope of family of curves which are quadratic in the parameter	3	K3	Problem solving	Explain
	4.	Problems on Envelope	4	K3	Collaborative learning	Slip Test
V	**Curvature**					
	1.	Definition of Curvature	1	K1 & K2	Lecture Discussion	MCQ
	2.	Circle, Radius and Centre of Curvature	2	K2 & K3	Blended classroom	Concept explanations
	3.	Problems on Curvature	3	K3	Problem solving	Questioning
	4.	Radius of Curvature in Polar Co-ordinates	3	K3	Collaborative learning	Recall steps
	5.	Problems on Radius of Curvature in Polar Co-ordinates	3	K3	Flipped Classroom	True/False

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

Activities (Em/ En/SD): **Derivative Gallery Walk, Real-World Applications**

Assignment: **Create a story problem.**

Sample questions

Part A

1. Find $\frac{dy}{dx}$ when $y = \tan^{-1}\frac{x}{a}$. (R)

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

2. Say true or false: If $u = (x-y)(y-z)(z-x)$, then $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.

3. Find the degree of the homogeneous function $f(x,y) = sin\left(\frac{x+y}{x-y}\right)$.

   a) 0 b) 1 c) 2 d) 3

4. How is the envelope of a family of curves defined?

   a) A curve which touches 50% of the family of curves

   b) A curve which is a straight line

   c) A curve which touches each member of the family of curves

   d) A curve which surrounds the family of curves

5. What is the radius of curvature of the curve $x^4 + y^4 = 2$ at the point $(1,1)$?

Part B

1. Find the n^{th} differential coefficient of $\cos x.cos2x.cos3x$.
2. Illustrate the theorem that $\frac{\partial^2 u}{\partial x.\partial y} = \frac{\partial^2 u}{\partial y.\partial x}$ when u is equal to $\log(\frac{x^2+y^2}{xy})$.
3. Verify Euler's Theorem when $u = x^3 + y^3 + z^3 + 3xyz$.
4. Find the envelope of the family of curve$(x-a)^2 + (y-a)^2 = 4a$.
5. Show that the radius of curvature at any point of the catenary $y = c\cosh\frac{x}{c}$ is equal to the length of the portion of the normal intercepted between the curve and the axis of x.

Part C

1. Find the n^{th}differential coefficient of $\cos^5\theta \sin^7\theta$.
2. If $u = \tan^{-1}\frac{x^3+y^3}{x-y}$, prove that $x\frac{(\partial u)}{\partial x} + y\frac{\partial u}{\partial y} = sin2u$.
3. A tent having the form of a cylinder surmounted by a cone is to contain a given volume. If the canvass required is minimum, show that the altitude of the cone is twice that of the cylinder.
4. Find the envelope of the circles which pass through the origin and whose centres lie on $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
5. Find the radius of curvature of the cardioid $r = a(1 - cos\theta)$.

Head of the Department
Dr. T. Sheeba Helen

Course Instructor
Dr. V. Sujin Flower

Teaching Plan

Department : Chemistry/ Physics

Class : I B.Sc

Title of the Course : Allied Mathematics I: Algebra And Differential Equations

Semester : I

Course Code : MU231EC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MU231EC1	5	1	-	5	6	90	25	75	100

Learning Objectives

1. To understand the simple concepts of the theory of equations
2. To find the roots of the equations by using techniques in various methods.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO-1	recall the methods of finding the solutions of algebraic equations, differential equations and various formulae of Laplace transform	PSO - 1	K1
CO-2	understand the theory of algebraic equations, eigen values, differential equations and Laplace transform	PSO – 2	K2
CO-3	simplify algebraic expressions using various methods, find eigen values, solve initial value problems for ODEs and find inverse Laplace Transform	PSO - 2	K3
CO-4	analyse various types of first-order ODEs, relate Laplace transform and inverse Laplace transform and formulate algebraic equations from real world problems.	PSO - 3	K4

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Theory of Equations**					
	1.	Theory of Equations – An Introduction	3	K1 &K2	Brainstorming	MCQ
	2.	Formation of Equations	2	K2	Lecture with illustrations	Slip Test
	3.	Problems on Formation of Equations	2	K3	Problem Solving	Questioning
	4.	Relation between roots and coefficients	4	K4	Lecture Discussion	Questioning
	5.	Reciprocal equations	2	K2	Collaborative learning	Concept explanations
	6.	Problems on Reciprocal equations	2	K3	Problem Solving	True/False
II	**Transformation of Equations**					
	1.	Transformation of Equation- An Introduction	2	K1 &K2	Brainstorming	True/False
	2.	Approximate solution to equations	4	K2	Problem Solving	Short summary
	3.	Newton's method	2	K2&K4	Lecture Discussion	Concept definitions
	4.	Problems on Newton's method	2	K3	Problem Solving	Quiz
	5.	Horner's method	2	K2&K4	Lecture with illustrations	Recall steps
	6	Problems on Newton's method	3	K3	Group Discussion	Test
III	**Matrices**					
	1.	Matrices- An introduction, Characteristic equation of a	3	K1 &K2	Brainstorming	Quiz

		matrix				
	2.	Eigen values and Eigen vectors	2	K2	Lecture Discussion	Slip Test
	3.	Problems on Eigen values and Eigen vectors	3	K3	Problem Solving	Open book Test
	4.	Cayley Hamilton theorem	2	K2	Blended Learning	Questioning
	5.	Application of Cayley Hamilton theorem	3	K3& K4	Problem Solving	Concept Recalling
	6.	Simple Problems.	2	K3	Collaborative learning	Questioning
IV	**Differential equation**					
	1.	Differential equation- An introduction, Differential equation of first order but of higher degree	3	K1 &K2	Brainstorming	Simple Questions
	2.	Equations solvable for p,x,y	3	K3	Integrative method	Explain the concept
	3.	Partial differential equation, Partial differential equation formations	4	K1 &K2	Collaborative learning	Slip Test
	4.	Partial differential equation solutions	2	K3	Problem Solving	Concept explanations
	5.	Standard form Pp+Qq=R.	3	K3& K4	Problem Solving	Test
V	**Laplace Transform**					
	1.	Laplace transformation–An introduction, Properties of Laplace transformation	4	K1 &K2	Lecture with illustration	MCQ, Concept explanations
	2.	Problems based on Laplace transformation, Inverse Laplace transform	5	K2&K3	Problem Solving	Questioning
	3.	Problems based on Inverse	3	K2&K3	Problem Solving	True/False

		Laplace transform				
	4.	Relation between Laplace transformation and Inverse Laplace transform	3	K4	Analytic Method	Evaluation through short test

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

Activities (Em/ En/SD): **Group Discussion**

Assignment: **Exercise Problems**

Part A:

1. Identify the real root of the equation $x^3-7x^2+14x-8=0$

   (a) -2 (b) ½ (c) -1/2 (d) 2

2. Complete: One root of $x^4 - 3x + 1 = 0$ lies between ----------

   a) 2 and 3 b) 2 and 2.5 c) 2.5 and 3 d) 1 and 2

Part B:

1. Form the equation with rational coefficients one of whose roots is $\sqrt{2}+\sqrt{3}$

2.Find correct to 2 places of decimals the root of the equation x^3-3x+1 which lies between 1 and 2 by Newton's method.

Part C:

1. Show that the roots of the equation $px^3 + qx^2 + rx + s = 0$ are in arithmetic progression iff $2q^3 + 27p^2s = 9pqr$
2. Find the positive root of $x^3 - x - 3 = 0$ correct to two places of decimals by Horner's method.

Head of the Department
Dr. T. Sheeba Helen

Course Instructor
Dr. M K Angel Jebitha,
Mrs. J C Mahizha

Teaching Plan

Department : Mathematics
Class : I UG
Title of the Course : SEC :Mathematics for Competitive Examinations I
Course Code: MU231SE1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MU231SE1	2	-	-	2	2	30	50	50	100

Objectives

1. To understand the problems asked in various competitive examinations and identify the method to solve them.
2. To develop numerical aptitude by practicing different types problems.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO - 1	Understand the problems and remember the methods to solve problems.	PSO - 2	K1 &K2
CO - 2	Grasp the simplest method to solve problems.	PSO - 2	K2
CO - 3	Apply suitable mathematical method and get solutions to simple real life problems.	PSO - 5	K3

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Simplification and Averages**					
	1.	Simplification	3	K1& K2	Problem Solving	Questioning
	2.	Averages	3	K2, K3	Flipped Class	Recall the Method
II	**Ratio and proportion**					
	1.	Comparison of two ratios and Compounded Ratio	2	K2	Interactive Method	Concept explanations
	2.	Mean, Third and Fourth Proportional	1	K2	Problem Solving	Slip Test
	3.	Real life problems	3	K2& K3	Lecture with Illustration	Solving Methods
III	**Percentages and Partnership**					
	1.	Percentage on numbers	1	K2	Lecture with Illustration	Quiz
	2.	Population	1	K2& K3	Brainstorming	Discussion
	3.	Depreciation	1	K2 & K3	Discussion Method	Questioning
	4.	Partnership	3	K3	Lecture with Illustration	Slip test
IV	**Profit and Loss**					
	1.	Gain and Loss	2	K1& K2	Experimental Method	Questioning
	2.	Selling Similar Items	2	K2	Lecture with Illustration	MCQ
	3.	Problems on trader professes to sell his goods	2	K3	Lecture with PPT	Recall steps
V	**Problems on numbers**					
	1.	Framing and solving equations involving unknown numbers	3	K1& K2	Blended Learning	Quiz
	2.	Problems involving ratios and fractions	3	K3	Lecture with Illustration	Slip test

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

Activities (Em): **Real life situation problem solving, Quiz, MCQ, Slip Test, Exercise Problem Solving**

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

Activities related to Cross Cutting Issues: -

Assignment: **Exercise Problems in Simplification and Averages, Ratio and proportion, Percentages and Partnership, Profit and Loss, Problems on numbers**

Sample questions

Part A

Unit I

1.Simplify$\frac{(6+6+6+6)+6}{4+4+4+4+4}$..

2. If$7: x = 17.5 : 22.5$,find the value of *x*.

3. If A, B, C started a business by investing Rs. 120000, Rs. 135000 and Rs. 150000 respectively, find A's share, out of an annual profit of Rs. 56700.

4.If C.P is Rs. 2516 and S.P is 2272, then find the loss percentage.

5. If the sum of a rational number and its reciprocal is $\frac{13}{6}$, then find the number.

Part B

1. The average of five consecutive numbers A , B , C , D and E is 48. What is the product of A and E?

2. If $(2x + 3y): (3x + 5y) = 18: 29$, what is the value of $x: y$.

3. Mrs. Roy spent Rs. 44620 on Deepawali shopping, Rs.32764 on buying laptop and remaining 32% of the total amount she had as cash with her. What was her total amount?

4. Mansi purchased a car for Rs.2,50,000 and sold it for Rs. 3,48,000. What is the percent profit she made on the car?

5. If the sum of two numbers is 42 and their product is 437, then find the absolute difference between the numbers.

Part C

1. A man spends 2/5 of his salary on house rent, 3/10 of his salary on food and 1/8 of his salary on conveyance. If he has ₹1400 left with him, find his expenditure on food and conveyance.
2. The average score of girls in class X examination in a school is 73 and that of boys is 71. The average score in class X of the school is 71.8. Find the percentage of the number of girls and boys in class X of the school.

3. Divide Rs. 6450 among A, B, C and D such that when A gets Rs. 9, B gets Rs. 8; when B gets Rs. 6, C gets Rs. 5 and when C gets Rs. 4, D gets Rs. 3.

4. The price of petrol is increased by 25%. How much percent must a car owner reduce his consumption of petrol so as not to increase his expenditure on petrol?

5. A dishonest dealer sells the goods at $6\frac{1}{4}\%$ loss on the cost price but uses $12\frac{1}{2}\%$ loss weight. What is his percentage profit or loss?

6.The ratio between a two digit number and the sum of the digits of that number is 4 : 1. If the digit in the unit's place is 3 more than the digit in ten's place, what is the number?

Head of the Department **Course Instructor**

Dr. T. Sheeba Helen **Dr. T. Sheeba Helen**

Teaching Plan

Department : Mathematics

Class : I B.Sc

Title of the Course : FOUNDATION COURSE - BRIDGE MATHEMATICS

Semester : I

Course Code : MU231FC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU231FC1	2	-	-		2	2	30	40	60	100

Learning Objectives:

1. To bridge the gap and facilitate transition from higher secondary to tertiary education.
2. To instill confidence among stakeholders and inculcate interest for Mathematics.

Course Outcomes

On the successful completion of the course, student will be able to**:**		
1.	prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems.	**K2 & K3**
2.	find the various sequences and series and solve the problems related to them. Explain the principle of counting.	**K1 & K3**
3.	find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations.	**K2 & K3**
4.	explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations.	**K2 & K3**
5.	find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function.	**K3**

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

Total contact hours: 30 (Including instruction hours, assignments and tests)

Unit		Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I		**Algebra**					MCQ
	1.	Binomial theorem		1	K1 & K2	Brainstorming	MCQ
	2.	Problems based on the Binomial theorem		2	K3	Lecture	Concept explanations
	3.	Problems based on the middle term		2	K3	Problem-solving, Peer tutoring	Questioning
	4.	Problems based on General term		1	K1 & K2	Brainstorming	Questioning
II		**Analysis**					
	1	Sequences and series (Progressions)		1	K1	Brainstorming	True/False
	2	Problems based on Sequences and series		2	K2	Flipped Classroom	Short Summary
	3.	Problems based on Partial Fundamental principle of counting		2	K3	Lecture Discussion	Concept definitions
	4.	Problems based on Factorial n		1	K3	Group Discussion	Recall steps
III		**Combinatorics**					
	1.	Permutations and combinations		1	K2	Lecture Discussion	Concept definitions

	2.	Derivation of formulae and their connections	1	K3	Problem solving	Slip test
	3.	Simple applications	1	K3	Lecture, Group discussion	Concept explanations
	4.	Combinations with repetitions	1	K3	Problem solving	Formative assessment
	5.	Arrangements within groups, formation of groups	2	K2, K3	Lecture Discussion	Concept definitions
IV		**Trigonometry**				
	1.	Introduction to trigonometric ratios	1	K1 & K2	Brainstorming	Quiz
	2.	Proof of sin(A+B), cos(A+B), tan(A+B) formulae	2	K2	Flipped Classroom	Differentiate between various ideas
	3.	Multiple and sub multiple angles, sin(2A), cos(2A), tan(2A) etc., Transformations sum into product and product into sum formulae	2	K3	Integrative method	Explain
	4.	Inverse trigonometric functions, Sine rule and cosine rule	1	K3	Collaborative learning	Slip Test
V		**Calculus**				
	1.	Limits, standard formulae and problems	1	K1 & K2	Seminar Presentation	MCQ
	2.	differentiation, first principle	1	K2 & K3	Seminar Presentation	Concept explanations

	3.	uv rule, u/v rule	1	K3	Seminar Presentation	Questioning
	4.	Methods of differentiation, application of derivatives	1	K3	Seminar Presentation	Recall steps
	5.	Integration - product rule and substitution method.	2	K3	Seminar Presentation	True/False

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

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

Assignment:**Create Mathematics formula song.**

Sample questions

Part A

1. $(x+y)^n$=……..

2.nCr =……..

3. Compute $\frac{7!}{5!}$.

4. Find the value of $\frac{31\pi}{3}$.

5. Find $\frac{dy}{dx}$ if $y = \frac{\log x}{e^x}$.

Part B

1. Find the expansion of $(2x + 3)^5$

2. Find the middle term in the expansion of $(x + y)^6$

3. In how many ways can 5 girls and 3 boys be seated in a row so that no two boys are together?

4. Find the value of $\tan^{-1}\left[\tan\frac{2\pi}{3}\right]$.

5. Find f′(x), if $f(x) = \cos^{-1}(4x^3 - 3x)$.

Part C

1. Evaluate $(98)^4$

2. Find the last two digits of the number $(7)^{400}$

3.Find the number of arrangements of the letters of the word INDEPENDENCE. In how many of these arrangements,

(i) do the words start with P

(ii) do all the vowels always occur together

(iii) do the vowels never occur together

(iv) do the words begin with I and end in P?

4. Find the value of $\tan^{-1}\left[\tan\frac{5\pi}{6}\right] + \cos^{-1}\left[\cos\frac{13\pi}{6}\right]$.

5. Differentiate $(2x+1)^5(x^3 - x + 1)^4$.

Head of the Department **Course Instructor**

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

Department : Mathematics

Class : II B. Sc Mathematics

Title of the Course : Core Course V: Vector Calculus And Its Applications

Semester : III

Course Code : MU233CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisite:

12^{th} Standard Mathematics

Learning Objectives:

1. To get the knowledge about differentiation of vectors and on differential operators.
2. To analyze the physical applications of derivatives of vectors.

Course Outcomes

Upon completion of this course, the students will be able to:		Cognitive Level
1.	remember the formulae of vector differentiation, integration and the basic principles of vectors, including their properties, operations, and geometric interpretations	**K1**
2.	understand the concepts of divergence and curl and their applications in physics and engineering	**K2**
3.	apply Green's, Gauss', and Stokes' theorems to solve problems involving line and surface integrals, demonstrating their understanding of vector calculus principles	**K3**
4.	gain proficiency in differentiating vectors and interpreting their gradients geometrically	**K4**
5.	learn how to integrate vectors to calculate work done by forces and solve related problems	**K5**

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

Unit	Section	Topics	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Elements of Vector Algebra**					
	1.	Scalars and Vectors, Equality of vectors	3	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping, Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Evaluation through slip test quiz test
	2.	Multiplication of Vector by a Scalar	3	K3(Ap)		
	3.	Addition and Subtraction of Vectors	3	K1(R)		
	4.	Collinear and Coplanar Vectors	3	K3(Ap)		
	5.	Linearly Independent and Independent Set of Vectors and Examples	3	K5(E)		
II	**Vector Differentiation**					
	1	Vector Algebra and Differentiation of vectors	3	K2(U)	Lecture Illustration	Home Assignment
	2	Gradient	3	K4(An)	Lecture, Group discussion	Evaluation through slip test
	3	Geometrical Interpretation	3	K3(Ap)	Lecture using videos, Problem solving	Formative Assessment
	4	Directional Directive	3	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion	Online Quiz, Test
	5	Equation of the tangent plane and Equation of the normal line	3	K3(Ap)	Lecture Illustration	Online Assignment

III	**Divergence and Curl**					
	1	Divergence and Curl	4	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping, Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Evaluation through short test, MCQ, True/False, Short essays, Concept explanations
	2	Solenoidal and irrotational	3	K3(Ap)		Simple definitions, MCQ, Recall steps, Concept definitions
	3	Laplacian operator	4	K4(An)		Suggest idea/concept with examples, Suggest formulae, Solve problems
	4	Harmonic vectors and related problems	4	K3(Ap)		Evaluation through short test, MCQ, True/False, Short essays, Concept explanations
IV	**Vector Integration**					
	1	Work done by a force	5	K2(U)	Lecture Illustration	Slip Test
	2	Evaluation of line integrals	5	K3(Ap)	Lecture, Group discussion, Problem solving	Home Assignment
	3	Evaluation of surface integrals	5	K3(Ap)	Lecture using videos, Problem solving	quiz
V	**Theorems of Green, Gauss and Stokes**					
	1	Verification and Evaluation of Green's,	3	K2(U)	Lecture Illustration,	Class Test

		theorem			Problem solving	
	2	Verification and Evaluation of Stoke's theorems	3	K3(Ap)	Lecture Illustration, Problem solving	Formative assessment
	3	Verification and Evaluation of Gauss divergence theorem	3	K3(Ap)	Lecture Illustration, Problem solving	Online Quiz

Course Focussing on Skill Development

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

Assignment : Gauss divergence theorem **(**online Assignment**)**

Sample questions

Part A

1. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ then $\nabla.\vec{r}$ = ...

   a) 0 b) 3 c) 1 d) r^2

2. 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

3. A vector $\vec{f}$ is said to be harmonic if ..... = 0.

4. Find the directional derivative of $\phi = xy + yz + zx$ at the point $(1,2,3)$ in the direction of $3\hat{\imath} + 4\hat{\jmath} + 5\hat{k}$.

   a) $\frac{46}{5}$ b) $\frac{46}{5\sqrt{2}}$ c) $\frac{46}{\sqrt{2}}$ d) $\frac{23}{5}$

5. The value of $div\ curl\ f$ is …….

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

Part B

1. 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?

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

3. 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

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

5. Find the work done by the force $\vec{f} = 3xy\hat{i} - 5zj + 10x\hat{k}$ along the curve C: $x = t^2 + 1$, $y = 2t^2$ and $z = t^3$ from t = 1 to t = 2.

Part C

1. Find the equation of the (i) tangent plane and (ii) normal line to the surface xyz = 4 at the point (1, 2, 2)
2. 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).
3. Prove that $div(r^n\vec{r}) = (n+3)r^n$, Deduce that $r^n\vec{r}$ is solenoidal iff $n = -3$.
4. Evaluate $\iint_S \vec{f}.\hat{n}\,ds$ where $\vec{f} = 4xz\hat{i} - y^2 j + yz\hat{k}$ and S is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0 and z = 1.
5. Evaluate $\iint_S \vec{f}.\hat{n}\,ds$ where $\vec{f} = z\hat{i} + xj - 3y^2z\hat{k}$ and S is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between z = 0 and z = 5.

Head of the Department — **Course Instructor**

Dr. T. Sheeba Helen — Dr. A. Jancy Vini

Teaching Plan

Department : Mathematics

Class : II B.Sc

Semester : III

Name of the Course : DIFFERENTIAL EQUATIONS AND APPLICATIONS

Course Code : MU233CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233CC2	5		-	-	5	5	75	25	75	100

Learning Objectives:

1. To gain deeper knowledge in differential equations, and partial differential equations.
2. To apply the concepts in higher mathematics and physical sciences.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	learn Exact differential equations and Bernoulli's equations	**K1**
2	learn methods of forming and solving partial differential equations	**K2, K4**
3	apply the concepts to solve problems in physical sciences and engineering	**K3**
4	solve linear differential equations with constant coefficients	**K5**
5	solve linear differential equations with variable coefficients	**K5**

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Differential equations					
	1.	Introduction on Differential equations of first order	1	K1	Brainstorming	MCQ

	2.	Problems based on Differential equation	3	K1	Problem Solving	Slip Test using Socrative
	3.	Definition of Equations of first order and first degree	2	K1	Analytic Method	Questioning
	4.	Solutions of Exact differential equations	3	K1	Lecture with Illustration	Concept explanations
	5.	Definition and examples based on Integrating factors	3	K1	Collaborative learning	Simple questions
	6.	Linear equations and Bernoulli's equations	3	K1	Blended classroom	Evaluation through poll
II	Linear equations of higher order					
	1.	Introduction on Linear equations of higher order	1	K5	Brainstorming	Evaluation through Nearpod
	2.	Introduction on Linear Equations with Constant Coefficients	2	K5	Blended classroom	Slip Test using Quizziz
	3.	Problems on Linear Equations with Constant Coefficients	3	K5	Flipped Classroom	Short summary of the concept
	4.	Methods of finding complementary functions	2	K5	Peer Teaching and Learning	MCQ
	5.	Methods of finding particular integrals	3	K5	Lecture and problem solving	Concept Explanation
	6.	Homogeneous linear equations	1	K5	Group Discussion	Recall steps
	7.	Problems on Homogeneous linear equations	3	K5	Integrative method	Questioning
	Linear equations of higher order					

III	1.	Introduction on Linear equations with variable coefficients	1	K5	Brainstorming	Quiz
	2.	Problems based on Linear equations with variable coefficients	3	K5	Problem Solving	Concept Explanation
	3.	Problems based on Simultaneous Linear differential equations	4	K5	Group Discussion	Slip Test
	4.	Total differential equations.	2	K5	Analytic Method	Questioning
	5.	Problems based on Total differential equations.	5	K5	Collaborative learning	Evaluation through poll
IV	Partial differential equations					
	1.	Introduction on Partial differential equations	2	K2 & K4	Lecture with Illustration	Quiz through Quizziz
	2.	Formulation of partial differential equations	4	K4	Flipped Classroom	Differentiate various tests
	3.	First order partial differential equations	3	K2 & K4	Analytic Method	Simple Questions
	4.	Methods of solving first order partial differential equations	3	K2 & K4	Integrative method	Concept Explain
	5.	Charpit's method	3	K2 & K4	Solving Problems in relay	Sip test through slido
V	Applications of differential equations					
	1.	Applications of differential equations	3	K3	Heuristics Method	MCQ

	2.	Orthogonal trajectories	2	K3	Contextual Based Learning	Concept explanations
	3.	Growth and decay	3	K3	Analytic Method	Questioning
	4.	Continuous compound interest	4	K3	Synthetic Method	Slip Test
	5.	The Brachistochrone problem.	3	K3	Seminar Presentation	Simple Questions

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

Activities (Em/ En/SD): **Applications of Differential Equations through Seminar Presentation, Solving real time problems on relay**

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

Activities related to Cross Cutting Issues: -

Assignment: **Solving Real life problems by applying Differential Equations**

Sample questions

PART-A

1.The degree of the ordinary differential equation $\sqrt{(y' + y)} = \sin x$ are _____

(a) 2 (b) 3 (c) 1 (d)4

2,.The complementary function of $(D^2 + 9)y = \cos x$ is _____

(a) $y = Ae^{3x} \cos 3x$ (b) $y = A\cos 3x + B\sin 3x$

(c) $y = (A + B) \sin 3x$ (d) $y = Acos^3x + Bsin^3x$

3.The differential equation $y'' + Py' + Qy = X$. if $1 + P + Q = 0$ then an integral of

complementary function are _____

4. Charpit's methods gives_____

(a) a general method of solving any differential equation.
(b) a general method of solving any partial differential equation.

(c) a general method of solving any partial differential equation of first order.
(d) a general method of solving any partial differential equation of second order.

5. Say True or Flase.

The orthogonal trajectories of the family of circles $x^2+y^2 = a^2$ is the family of straight lines not passing through the origin.

PART-B

1. Solve $(x^2 + y^2 + x)dx + xydy = 0$.

2. Evaluate the particular integral of the differential equation $(D^2 + 9)y = 4sin3x$.

3. Solve $y''+$ y $= cosec\ x$ by the method of variation of parameters.

4. Find the general solution of $p + 3q = 5z + \tan(y - 3x)$.

5. Find the orthogonal trajectories of the family of curves given by $r = asin\theta$.

PART-C

1. Solve $\frac{dy}{dx} = \frac{x-y+1}{x+y-3}$

2. Solve $(2x + 1)^2\ y''-2(2x + 1)y' - 12y = 6x$.

3. By the method of variation of parameter solve $y'' - 2y' + y = e^x logx$.

4. Solve $(p^2 + q^2)y = qz$.

5. A tank contains 100 litres of fresh water. Salt water which contains 2 grams of salt per litre flows into the tank at the rate of 2 litres per minute. The mixture runs out at the same rate.How long will it take for the quantity of salt in the tank to increase from 50 to 100 grams?

Head of the Department — Course Instructor

Dr. T. Sheeba Helen — Dr. S.Sujitha

Department : Mathematics
Class : II B.Sc

Semester : III
Name of the Course: Mathematical Statistics

Course Code: MU233EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233EC1	4	-	-	-	3	4	60	25	75	100

Learning Objectives:

1. To analyze relationships between variables, as well as understanding interpolation methods and their applications for estimating values within data sets.
2. To learn data consistency, independence, and association, gaining proficiency in interpreting and using index numbers.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	calculate and interpret correlation coefficients and regression lines, and their applications in analyzing relationships between variables.	**K1**
2	understand Theory of Attribute in statistics, including concepts like consistency of data, independence, and association	**K2**
3	acquire knowledge of index numbers and learn how to apply index numbers in economic analysis	**K3**
4	**l**earn about rank correlation and understand when and how to use them to assess monotonic relationships between variables.	**K4**
5	develop proficiency in interpolation methods and apply these techniques to estimate values within a set of data points with precision.	**K5**

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Correlation and Regression**					
	1.	Introduction, Definitions and examples of Correlation, Properties of correlation coefficient	3	K1 & K2	Brainstorming	MCQ
	2.	Problems based on Correlation	3	K3	Problem Solving	Slip Test
	3.	Definition of Rank Correlation and proving Spearman's formula	3	K1 & K4	Analytic Method	Questioning
	4.	Calculating Rank Correlation coefficient for the given data	3	K3	Lecture with Illustration	Concept explanations
II	**Correlation and Regression**					
	1.	Definition and results based on regression,	3	K1	Brainstorming	Simple question
	2.	Problems on regression	3	K3 & K4	Group Discussion	Recall steps
	3.	Equation of regression linesand angle between the regression lines.	3	K2 & K3	Peer Teaching and Learning	MCQ

	4.	Problems based on Correlation Coefficient for a Bivariate Frequency Distribution	3	K3 & K4	Lecture and problem solving	Concept Explanation
III	**Interpolation**					
	1.	Definition, Finite Differences , examples and results on Finite Differences	2	K1 & K2	Brainstorming	Quiz
	2.	Problems on Finite Differences	2	K3	Problem Solving	Concept Explanation
	3.	Newton Gregory formula for forward interpolation and Newton Gregory formula for backward interpolation	2	K4	Analytic Method	Questioning
	4.	Problems based on Newton's Formula	3	K3 & K4	Lecture and problem solving	Concept Explanation
	5.	Lagrange's Formula	1	K3	Collaborative learning	Slip Test
	6.	Problems based on Lagrange's Formula	2	K3	Poster Presentation	Simple Questions
IV	**Theory of Attributes**					
	1.	Attributes, definition, examples and results	3	K2 & K4	Lecture with Illustration	Quiz through Quizziz

	2.	Problems on attributes	3	K3 & K4	Flipped Classroom	Concept Explanation
	3.	Consistency of Data, definition and solving problems	3	K3 & K4	Analytic Method	Simple Questions
	4.	Independence and Association of Data and solving problems	3	K3 & K4	Solving Problems inrelay	Concept Explain
V	**Index Numbers**					
	1.	Index Numbers, definition and its type	1	K1 & K2	Heuristics Method	MCQ
	2.	Problems on Index Numbers	2	K4	Contextual Based Learning	Concept explanations
	3.	Methods of computing weighted index number with examples	3	K4 & K3	Analytic Method	Questioning
	4.	Problems on Consumer Price Index Numbers	3	K2 & K4	Synthetic Method	Slip Test
	5.	Conversion of Chain Base Index Number into Fixed Base Index and Conversely	3	K4	Seminar Presentation	Simple Questions

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

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

Assignment: Solving exercise problems on **Correlation and Regression, Interpolation, Theory of Attributes and Index Numbers**

SAMPLE QUESTIONS

Part A

1. Income and expenditure of a family is an example of variables with negative correlation.(Say True/ False)
2. If the curve is a straight line it is called a ---------- between the two variables.
   a) Line of regression b) curve of regression c) regression d) none
3. Interpolation is the process of finding the most appropriate estimate for missing data. (Say True/ False)
4. Class frequencies of the type (A) (AB) (ABC) … are known as --------
   a) positive class frequencies b) negative class frequencies c) contrary class frequencies d) none
5. Index numbers can be broadly classified into ---------- and----------.

Part B

1. If x, y and z are uncorrelated variables each having same standard deviation obtain the coefficient of correlation between x+y and y+z
2. Prove that the angle between the two regression lines is given by
   $$\theta = \tan^{-1}\left[\left(\frac{\gamma^2-1}{\gamma}\right)\left(\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}\right)\right]$$
3. State and prove the fundamental theorem for finite differences.
4. Find the limits of (BC) for the following available data
   N = 125, (A) = 48, (B) = 62, (C) = 45, (A β) = 7 and (A γ) = 18
5. From the following data construct the simple aggregative index number for 1992

Commodities	Price in 1991 Rs	Price in 1992 Rs
Rice	7	8
Wheat	3.5	3.75
Oil	40	45
Gas	78	85
Flour	4.5	5.25

Part C

1. Three judges assign the ranks to 8 entries in a beauty contest

Judge Mr. X	1	2	4	3	7	6	5	8
Judge Mr. Y	3	2	1	5	4	7	6	8
Judge Mr. Z	1	2	3	4	5	7	8	6

Which pair of judges has the nearest approach to common taste in beauty?

2. The following data relate to the marks of 10 students in the internal test and the university examination for the maximum of 50 in each

Internal marks	25	28	30	32	35	36	38	39	42	45
University marks	20	26	29	30	25	18	26	35	35	46

   (i) Obtain the two regression equations and determine
   (ii) The most likely internal mark for the university mark of 25
   (iii) The most likely university mark for the internal mark of 30

3. The following table gives the census population of a town for the years 1931-1971. Estimate the population (i) for the year 1965 (ii) for the year 1933 by using an appropriate interpolation formula.

Year	1931	1941	1951	1961	1971
Population in lakhs	36	66	81	93	101

4. Given the following positive class frequencies. Find the remaining class frequencies N = 20, (A) = 9, (B) = 12, (C) = 8, (AB) = 6, (BC) = 4, (CA) = 4, (ABC) = 3
5. Construct with the help of data given below, Fischers index number, and show that it satisfies both the factor reversal test and time reversal test.

Commodity	A	B	C	D
Base price in Rs.	5	6	4	3
Base year quantity in Quintals	50	40	120	30
Current year price in Rs	7	8	5	4
Current year quantity in Quintals	60	50	110	35

Head of the Department
Dr. T. Sheeba Helen

Course Instructor
Dr. T. Sheeba Helen

TEACHING PLAN

Department: Mathematics
Class: II B.Sc
Title of the Course: Skill Enhancement Course SEC-II: Spherical Trigonometry
Semester: III
Course Code: MU233SE1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233SE1	**2**	-	-	-	**2**	**2**	**30**	**25**	**75**	100

Learning Objectives:

1. To improve problem solving skills in Spherical Trigonometry and to apply the concepts in real world problems
2. To develop applications of the related concepts and processes in the real world problems

Course Outcomes

On the successful completion of the course, students will be able to:		
CO -1	explain the concepts great and small circles, axis and poles of great circles	**K2**
CO -2	define spherical angle and also the angle of intersection between two great circles	**K2**
CO -3	calculate the arc length between two points on a sphere using the cosine rule for sides	**K3**
CO -4	distinguish between plane trigonometry and spherical trigonometry	**K4**
CO -5	discuss and derive the spherical cosine, sine, supplemental cosine and cotangent rules	**K5**

K2 - Understand; **K3** – Apply; **K4 -** Analyze; **K5 -** Evaluate

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I						
	1.	Sphere- great circles and small circles - Axis and poles of a circle	3	K4 (An)	Interactive method	Recall simple definitions, basic concepts about Trigonometry
	2.	Distance between two points on a sphere - angle between two circles – Secondaries	3	K2(U)	Lecture with illustration	Oral Test
II						
	1.	Angular radius or spherical radius	3	K2(U)	Lecture with PPT	Home work
	2	Spherical figures - Spherical triangle - Polar triangle	3	K4 (An)	Lecture with illustration	Assignments
III						
	2.	Relation between the elements of a spherical triangle and its polar triangle	4	K5(E)	Interactive method	Brain Storming
	3.	Some properties of spherical triangle	2	K4 (An)	Lecture with illustration	MCQ
IV						
	1.	Relations between the sides and angles of a spherical triangle	3	K5(E)	Group Discussion	Concept explanations
	2.	Cosine formula -Sine formula- Supplementary cosine formula –Five parts formula	3	K3(Ap)	Blended learning	Slip test
V						
	1	Spherical coordinates - relation between the spherical and rectangular coordinates	3	K2(U)	Lecture with illustration	Simple questions
	2	General proof of the spherical formula	3	K3(Ap)	Inductive learning	Concept explanations

Self-study	Some properties of spherical triangle

Course Focusing on Employability/Entrepreneurship/Skill Development: Employability
Activities (Em/En/SD): Evaluation through Short test, Assignments
Assignment: Spherical figures - Spherical triangle - Polar triangle

Sample Questions

Part A

1. Any great circle passing through the poles of a circle is called -------
2. Define Spherical radius.
3. The angle between two great circles is called--------
4. True/False: Two great circles bisect each other.
5. What is the polar distance of a great circle?
   a) 180 degree b) 45 degree c) 90 degree d) 60 degree

Part B

6. Prove that the points of intersection of two great circles are the poles of the great circle joining their poles.
7. List out any five properties of spherical triangles.
8. State and prove the Supplemental Cosine formula.
9. Write a short note on Polar triangle.
10. Prove that the sum of the three side of a spherical triangle is less than 360 degree.

Part C

11. Prove that the length of an arc of a small circle is equal to the corresponding arc on the parallel great circle multiplied by the sine of its spherical radius.
12. State and prove the Sine formula.
13. Write the general proof of the Cosine formula
14. Prove that the sides and angles of the polar triangle of a given spherical triangle are supplementary to the angles and sides of the given triangle.
15. Summarize the relations between the spherical and rectangular coordinates.

Head of the Department
Dr. T. Sheeba Helen

Course Instructor
Dr. J. Befija Minnie

Teaching Plan

Department : Mathematics

Class : III B.Sc Mathematics

Title of the Course : Major Core VII- Linear Algebra

Semester : V

Course Code : MC2051

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2051	6	-	-	5	6	90	25	75	100

Objectives:

1. To introduce the algebraic system of Vector Spaces, inner product spaces.

2. To use the related study in various physical applications.

Course Outcomes

CO	upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO-1	recall and define Groups, Fields, and their properties	PSO - 1	K1(R)
CO-2	cite examples of vector spaces, subspaces, and linear transformations	PSO - 1	K2(U)
CO-3	determine the concepts of linear independence, linear dependence, basis, and the dimension of vector spaces	PSO - 1	K2(U)
CO-4	correlate rank and nullity, Linear transformation, and matrix of a Linear transformation	PSO - 2	K3(Ap)
CO-5	examine whether a given space is an inner product space and the orthonormality of sets	PSO - 3	K4(An)

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

Unit	Section	Topics	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Vector spaces**					
	1.	Vector spaces - Definition	4	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping, Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Evaluation through slip test quiz, test
	2.	Vector spaces - Examples	4	K3(Ap)		
	3.	Subspaces	5	K4(An)		
	4.	Linear transformation.	5	K3(Ap)		
II	**The span of a Set**					
	1	Span of a Set	3	K2(U)	Lecture Illustration	Home Assignment
	2	Linear Independence	4	K4(An)	Lecture, Group discussion	Evaluation through slip test
	3	Basis and Dimension	3	K3(Ap)	Lecture using videos, Problem solving	Formative Assessment
	4	Rank and Nullity	4	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion	Online Quiz, Test
	5	Matrixof a Linear Transformation	4	K3(Ap)	Lecture Illustration	Online Assignment
III	**Cayley-Hamilton Theorem**					
	1	Characteristic Equation	4	K2(U)	Lecture using Chalk and talk ,Introductory	Evaluation through short

					session, Group Discussion, Mind mapping, Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	test,MCQ, True/False, Short essays, Concept explanations
	2	Cayley-Hamilton Theorem	5	K4(An)		Simple definitions, MCQ, Recall steps, Concept definitions
	3	Eigenvalues and Eigen vectors	5	K3(Ap)		Suggest idea/concept with examples, Suggest formulae, Solve problems
	4	Properties of Eigenvalues.	4	K3(Ap)		Evaluation through short test,MCQ, True/False, Short essays, Concept explanations
IV	**Inner Product Spaces**					
	1	Inner Product Spaces - Definition	4	K2(U)	Lecture Illustration	Slip Test
	2	Inner Product Spaces - examples	4	K4(An)	Lecture, Group discussion	Home Assignment
	3	Orthogonality	5	K3(Ap)	Lecture using videos, Problem solving	quiz
	4	Orthogonal complement	5	K3(Ap)	Lecture using Chalk and talk ,Introductory session, Group Discussion	Formative Test, Online Quiz
V	**Bilinear forms**					

	1	Bilinear forms	3	K2(U)	Lecture Illustration	Class Test
	2	Quadratic forms	3	K2(U)	Lecture Illustration	Formative assessment
	3	Reduction of a quadratic form to the diagonal form	3	K4(An)	Lecture Illustration	Online Quiz
	4	Partially ordered set-Lattices	3	K3(Ap)	Lecture Illustration	Online Assignment
	5	Distributive Lattices-Modular Lattices-	3	K3(Ap)	LectureIllustration	Class test
	6	Boolean Algebra.	3	K4(An)	Lecture Illustration	Slip test

Course Focussing on Skill Development

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

Assignment :Inner Product Spaces **(**online Assignment**)**

Sample questions

Part A

1. Let $A = \{(a,0,0)|a \in R\}$, $B = \{(0,b,0)|b \in R\}$ Then
   (a) A is a subspace of R. (b) B is a subspace of R
   (c) A and B and subspaces of R^2. (d) A and B are subspaces of R^3.
2. Let $T: V \to W$ be a linear transformation then T is a monomorphism iff
   (a) Ker T = {0} b) Ker T = {1}
   (c) Ker T = {e} d) Ker T = {φ}
3. Zero is an eigen value of A iff A is a----------matrix.

   a) zero b) non-singular c) singular d) identity
4. Eigen vectors corresponding to distinct eigen values of a matrix are linearly ----------

   a) dependent b) independent c) non-singular d) singular
5. The norm of the vector $4x + 5y$ where $x = (1,-1,0)$ and $y = (1,2,3)$ is …….

   a) $3\sqrt{38}$ b)$2\sqrt{38}$ c) $\sqrt{38}$ d) $3+\sqrt{38}$.

Part B

1. Prove that the intersection of two subspaces of a vector space is a subspace.
2. Verify the vectors { (1, 2, 3), (4, 1, 5), (- 4, 6, 2)} are linearly independent or linearly dependent.
3. If V is the vector space of polynomials with inner product given by $\langle f, g\rangle = \int_0^1 f(t)g(t)dt$ with $f(t) = t + 2$ and $g(t) = t^2 - 2t - 3$. Then find (i) $\langle f, g\rangle$, (ii) $\|f\|$.
4. Define symmetric bilinear form. If f is a bilinear form defined on V and q be the associated quadratic form. Then prove that $f(u, v) = \frac{1}{4}\{q(u + v) - q(u - v)\}$.
5. Prove that in a distributive lattice the complement of any element a, if it exists, is unique

Part C

1. State and prove fundamental theorem of homomorphism.
2. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$
3. Prove that the norm defined in an inner product space V has the following properties.
   (i) $\|x\| \geq 0$ and $\|x\| = 0$ iff $x = 0$.
   (ii) $\|\alpha x\| = |\alpha| \, \|x\|$.
   (iii) $|\langle x, y\rangle| \leq \|x\| \, \|y\|$.
   (iv) $\|x + y\| \leq \|x\| + \|y\|$.(R)

4.Prove that the lattice of normal subgroup of any group is a modular lattice.(Ap)

5.If V is a vector space over a field F. Prove that L(V,V,F) is a vector space over G under addition and scalar multiplication defined by

$(f + g)(u, v) = f(u, v) + g(u, v)$ and $(\alpha f)(u, v) = \alpha f(u, v)$

Head of the Department **Course Instructor**

Dr.T.Sheeba Helen **Dr.l.Jesmalar**

Teaching Plan

Department: Mathematics

Class: III B.Sc Mathematics

Title of the Course: Real Analysis II

Semester: V

Course Code: MC2052

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2052	6		-	5	6	90	25	75	100

Objectives

- To introduce Metric Spaces and the concepts of completeness, continuity, connectedness and compactness
- To use these 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 concepts of completeness, continuity and discontinuity of metric spaces	PSO - 1	U
CO - 2	apply the metric space theorems to real life situations	PSO - 4	Ap
CO - 3	distinguish between continuous functions and uniform continuous functions	PSO - 5	An
CO - 4	use basic concepts in the development of real analysis results	PSO - 1	C
CO - 5	understand the concepts of metric space, connectedness and compactness of metric spaces	PSO - 3	U
CO - 6	develop the ability to reflect on problems that are quite significant in the field of analysis	PSO -2	Ap

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Metric Spaces**					
	1.	Metric Space Introduction	1	K2	Brainstorming	Questioning
	2.	Definition and Examples on Metric Space	2	K3	Problem Solving	Concept Explanations
	3.	Bounded sets	2	K2	Lecture with Illustration	Group Discussion
	4.	Open ball	2	K2	Group Discussion	Slip test
	5.	Open sets in a Metric Space	2	K4	Brainstorming	Evaluation through quizzes
	6.	Subspace and Interior of a set	2	K4	Inductive Learning	Simple Questions
	7.	Closed sets and Closure	2	K4	Heuristic Method	Quiz
	8.	Limit point and Dense sets	3	K4 & K6	Lecture with Illustration	Recall steps
II	**Complete Metric Spaces and Contraction Mapping**					
	9.	Complete Metric Space – Introduction	2	K2	Lecture with PPT	Concept explanations
	10.	Definition and examples of Complete Metric Space	2	K3	Problem Solving	Evaluation through poll

	11.	Theorems on Complete Metric Space	4	K4	Blended Learning	Slip test
	12.	Cantor's Intersection Theorem	2	K4	Lecture	Short summary
	13.	Baire's Category Theorem and problems	2	K4	Lecture with Illustration	Discussions
	14.	Contraction mapping-definition and examples and contraction mapping theorem	4	K6	Brainstorming	Simple Questions
III	**Continuity**					
	15.	Continuous Function – definition and Examples	4	K2	Discussion	Questioning
	16.	Problems on continuous function	3	K3	Problem Solving	Short summary of the concept
	17.	Equivalent conditions for continuity and Homeomorphism	5	K4	Interactive Method	MCQ
	18.	Uniform Continuity	2	K4	Brainstorming	Concept Explanation
	19.	Discontinuous Functions on R	5	K6	Heuristic Method	Recall steps
IV	**Connectedness**					
	20.	Connected Space– definition and Examples	4	K3	Problem Solving	Concept Recalling
	21.	Closure of connected space and union of connected space	4	K2	Flipped Classroom	Short summary

	22.	Connected subsets of R	2	K4	Heuristic Method	Recall steps
	23.	Connectedness and continuity	3	K4	Lecture with PPT	Questioning
	24.	Intermediate value Theorem	3	K6	Collaborative Learning	MCQ using Socrative
V	**Compactness**					
	25.	Compact space - definition and Examples	4	K2	Heuristics Method	MCQ through Nearpod
	26.	Compact subsets of R	1	K2	Contextual Based Learning	Concept explanations
	27.	Equivalent Characterisations for Compactness	2	K4	Analytic Method	Questioning
	28.	Totally bounded set	4	K6	Synthetic Method	Slip Test
	29.	Sequentially compact space	2	K4	Heuristics Method	MCQ
	30.	Compactness and continuity	3	K4	Discussion	MCQ

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

Activities (SD): **Applications of Real Analysis through Seminar Presentation, Solving real time problems on relay**

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

Activities related to Cross Cutting Issues: -

Assignment: **Applications of Metric Space using poster presentation**

Sample questions

Part A

1. Which of the following subsets are open in R?

(i) $\mathbb{Q}$ (ii) N (iii) Z (iv) $(1, 2)$

2. In R with usual metric any finite subset A is
   (i) First category (ii) Second Category
   (ii) Everywhere dense (iv) Nowhere dense
3. Give an example of a function which is continuous but not uniformly continuous
4. Which of the following are connected subsets of R?
   (i) (a, b) (ii) (a, b] (iii) [a, b) (iv) [a, b]
5. The open cover for R is …….

Part B

1. Let (M, d) be the discrete metric space. Then show that

$$B(a,r) = \begin{cases} M & if\ r < 1 \\ \{a\} & if\ r \geq 1 \end{cases}$$

2. Let M be a metric space and $A \subseteq M$. Then $x \in \bar{A}$ if and only if there exists a sequence (x_n) in A such that $(x_n) \to x$
3. Prove that the function $f: (0, 1) \to \mathbb{R}$ defined by $f(x) = 1/x$ is not uniformly continuous
4. Prove that any connected subset of R containing more than one point is uncountable
5. Prove that any continuous real valued function f defined on a compact metric space is bounded and attains its bounds

Part C

1. Let (M, d) be a metric space. Let $A, B \subseteq M$.
   (i) A is open iff A = Int A
   (ii) Int A = union of all open sets contained in A
   (iii) Int A is the largest open set contained in A
   (iv) $A \subseteq B \Rightarrow Int\ A \subseteq Int\ B$
   (v) $Int\ (A \cap B) = Int\ A \cap Int\ B$
   (vi) $Int\ (A \cup B) \supseteq IntA\ \cup Int\ B$
2. State and prove Cantor's Intersection Theorem
3. Prove that f is continuous if and only if inverse image of open set is open
4. Show that closure of a connected set is connected
5. Prove that in a metric space M the following are equivalent
   (i) M is compact
   (ii) Any infinite subset of M has a limit point
   (iii) M is sequentially compact
   (iv) M is totally bounded and complete

Head of the Department **Course Instructor**

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

Teaching Plan

Department: Mathematics Aided
Class: III B. Sc Mathematics
Title of the course: Computer Oriented Numerical Methods
Semester: V
Course Code: MC2053

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2053	6	-	-	4	90	90	25	75	100

Objectives:

1. To introduce the basic concept on elementary programming language and its structure
2. To apply computer programs for the solution of various numerical problems
3. To provide suitable and effective numerical methods, for computing approximate numerical values of certain raw data.
4. To lay foundation of programming techniques to solve mathematical problems.

Course Outcomes:

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	know the elementary programming language and its structure	PSO - 4	U
CO - 2	develop computer programs for the solution of various numerical problems	PSO - 5	C
CO - 3	apply numerical methods to obtain approximate solutions to mathematical problems	PSO - 3	Ap
CO - 4	employ different methods of constructing a polynomial using various methods	PSO - 2	E
CO - 5	determine the rate of convergence of different numerical formula and various numerical methods for the solution of algebraic and transcendental equations	PSO - 4	U
CO - 6	distinguish the advantages and disadvantages of various numerical methods	PSO - 4	An

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I						
	1.	Basic structure of C programs , Keywords and Identifiers, Constants and Variables	5	K1(R), K2(U)	Lecture using videos, PPT	Simple definitions, Recall basic concepts about computer education
	2.	Data Types, Operations and Expressions, Arithmetic Operators, Relational Operators.	5	K2(U)	Lecture using videos, PPT	Oral Test
	3.	Logical Operators, Assignment Operators, Increment and Decrement Operators.	5	K4(An)	Lecture using Chalk and talk, Peer tutoring	Suggest idea/concept, concept explanation with examples
	4.	Conditional Operators, Bitwise Operators, Special Operators.	5	K4(An)	Lecture using videos, PPT	Simple definitions and Questions
	5.	Managing Input and Output Operations	5	K3(Ap)	Lecture using videos, PPT, Group discussion	Differentiate between various ideas
	6.	Formatted Input, Formatted Output	5	K3(Ap)	Lecture using Chalk and talk, Peer tutoring	Evaluation through short test
II						
	1.	Decision making and Branching, Decision making with IF statement.	5	K2(U)	Hands on Training	Oral Test
	2	Simple IF statement, The IF…Else statements, Nesting of IF… Else statements.	5	K2(U), K3(Ap)	Lecture with videos	Slip test, Assignments
	3	The GOTTO statement, Decision making and Looping	5	K4(An)	Lecture using videos, PPT	Class test, Home work
	4	The WHILE statement, The DO statement	5	K2(U)	Lecture, Group discussion	Brain Storming
	5.	The FOR Statement	5	K2(U)	Lecture using videos, PPT	Formative Assessment
III						
	1.	Solution of algebraic and transcendental equations: Iteration	5	K2(U), K3(Ap)	Lecture using Chalk and talk, Problem	Brain Storming

		method.			solving, PPT	
	2.	Programs in C for Newton Raphson method	5	K3(Ap)	Hands on Training	Evaluation through output of the program
	3.	Interpolation, Newton's Interpolation formula, Programs in C for Newton's Forward Interpolation.	5	K3(Ap)	Lecture using Chalk and talk, Group Discussion, Problem solving, PPT, Hands on Training	Problem solving questions, Home work
	4.	Newton's Backward Interpolation, Lagrange' Interpolation formula	5	K3(Ap)	Problem Solving	Slip test, Assignments
IV						
	1.	Numerical differentiation, derivatives using Newton's forward difference formula	5	K2(U)	Lecture using Chalk and talk, Problem solving	Problem solving questions, Home work
	2.	Newton's backward difference formula	4	K2(U)	Group Discussion, Problem solving	Class Test, Home work
	3.	Numerical integration		K4(An)	Lecture using Chalk and talk, Problem solving	Problem Solving
	4.	Newton cote's, quadrature formula	5	K2(U), K3(Ap)	Problem Solving	Problem solving questions, Home work
	5.	Trapezoidal rule, *programs in C for Trapezoidal rule*	4	K3(Ap)	Hands on Training	Hands on Training
V						
	1	Simpson's (1/3)rd rule, programs in C for Simpson's	5	K2(U)	Problem Solving	Evaluation through solving exercise problem
	2	One - third rule- Simpson's (3/8)th rule	4	K3(Ap)	Lecture using Chalk and talk, Problem solving	Problem solving questions, Home work
	3	Numerical solution of differential equation.	5	K4(An)	Problem Solving	Formative Assessment
	4	Taylor's series method	4	K2(U), K3(Ap)	Lecture using Chalk and talk,	Slip test

					Problem solving	
	5	Picard's method	4	K2(U), K3(Ap)	Problem Solving	Class test, Problem solving questions, Home work

Course Focusing on Employability/Entrepreneurship/Skill Development : Employability

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

Assignment: Simple IF statement, The IF…Else statements, Nesting of IF… Else statements.

Seminar Topic: Newton Raphson method – Exercise Problems

Sample questions:

Part-A

1. Which one of the following is a string constant?
   (a) '3' (b) "hello" (c) 30 (d) None
2. Loop is allowed for which of the following statements?
   (a) while (b) for (c) do (d) all the above
3. The order of convergence of the Newton Raphson's method is
   a) 1 b) at least 2 c) at least 1 d) at most 2
4. What is the other name of Newton's forward interpolation formula ?
   a) Adam's – Bashforth formula b) Taylor's formula
   c) Gregori- Newton formula d) Lagrange's formula
5. The general solution of a differential equation of the n^{th} order has ……arbitrary constants.10. The error in Simpson's one-third rule is of order……..

Part – B

11. Define variable. Summarize the rules for variable declaration

12. Explain FOR statement with an example

13. Prove the order of convergence of the Newton Raphson's method is at least 2.
14. Evaluate $\int_0^5 \frac{dx}{4x+5}$ by Trapezoidal rule using 11 coordinates.
15. Evaluate $\int_0^{\frac{\pi}{2}} \sin x dx$ by Simpson's one-third rule dividing the range into six equal parts.

Part – C

Answer all the questions:

16. Explain ASSIGNMENT, INCREMENT and DECREMENT operators.

17. Differentiate between WHILE and DO…..WHILE with syntax and example

18. Use Lagrange's interpolation formula to fit a polynomial to the data

x	0	1	3	4
y	-12	0	6	12

Find the value of y when $x = 2$.

19. Find $y'(x)$ for the given data.

x	0	1	2	3	4
y(x)	1	1	15	40	85

Hence find $y'(x)$ at x=0.5.

20. Using Picard's method solve $\frac{dy}{dx} = 1 + xy$ with $y(0) = 2$. Find $y(0.1)$, $y(0.2)$ and $y(0.3)$.

Head of the Department
Dr. T. Sheeba Helen

Course Instructor
Dr. J. Befija Minnie

Teaching Plan

Department : Mathematics

Class : III B.Sc Mathematics

Title of the Course : Graph Theory

Semester : VI

Course Code : MC2055

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MC2061	5	-	-	4	5	75	25	75	100

Objectives

1. To introduce graphs and the concepts of connectedness, matchings, planarity and domination
2. To apply these concepts in research

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO – 1	understand the basic definitions to write the proofs of simple theorems	PSO - 1	K2
CO – 2	employ the definitions to write the proofs of simple theorems	PSO - 2	K3
CO – 3	relate real life situations with mathematical graphs	PSO - 3	K3
CO – 4	develop the ability to solve problems in graph theory	PSO - 4	K4
CO – 5	analyze real life problems using graph theory both quantitatively and qualitatively	PSO - 4	K4

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Basics**					
	1.	Graphs, Pictorial Representation	2	K2	Lecture with Demonstration	Draw Graphs with p, q vertices and Identification of types of Graphs
	2.	Subgraphs	2	K2	Inductive Learning	Slip Test
	3.	Isomorphism and Degrees	3	K3	Blended Learning	True or False
	4.	Walks and Connected Graphs	3	K4	Lecture with Demonstration	Slip Test
	5.	Cycles in Graphs	3	K4	Inductive Learning	Peer Discussion
	6.	Cut-vertices and Cut-edges	2	K5	Demonstration Method	Assignment on find the Cut-vertices and Cut-edge of a graph
II	**Eulerian and Hamiltonian Graphs**					
	7.	Eulerian Graphs	2	K4	PPT using Nearpod	Quiz - nearpod
	8.	Fleury's Algorithm	1	K3	Video using Zoom	Construction of Closed Eulerian Trail using Fleury's Algorithm
	9.	Hamiltonian Graphs	2	K4	PPT using Gamma	Identify the graph – Eulerian or Hamiltonian
	10.	Weighted Graphs, Chinese Post-man Problem, Travelling Sales-man Problem	1	K4	Lecture with PPT	Questioning
	11.	Bipartite Graphs	3	K4	Demonstration Method	Poster Presentation
	12.	Trees	3	K4	Video using Zoom	Quiz – Socrative

III	**Planar graphs**					
	13.	Planar Graphs	2	K2	Demonstration Method	Concept Explanation
	14.	Euler Formula	1	K3	Flipped Classroom	Slip Test
	15.	Platonic Solids	1	K3	Analytic Method	Recall Steps
	16.	Dual of a Plane Graphs	2	K2	PPT using Nearpod	Concept Explanation
	17.	Characterization of Planar Graphs	2	K2	Video using Zoom	MCQ
	18.	Vertex Colouring	3	K5	Demonstration Method	Relay Race
	19.	Edge Colouring	3	K5	Brainstorming	Assignment on find the Edge Colouring of a Graphs
	20.	An Algorithm for Vertex Colouring	1	K3	Participative Learning	True or False
IV	**Directed Graphs**					
	21.	Directed Graphs	2	K2	Brainstorming	PPT Presentation
	22.	Connectivity in Digraphs	2	K4	Discussion	Riddles
	23.	Strong Orientation of Graphs	2	K4	Interactive Method	Slip Test
	24.	Eulerian Digraphs	2	K5	Analytic Method	Quiz – Quizzes
	25.	Tournaments	2	K5	Heuristic Method	Questioning
V	**Theory of Domination in Graphs**					
	26.	Dominating Sets	2	K2	Blended Learning	Assignment on find the Domination of a Graph
	27.	Relationship between Independent Sets and Dominating Sets	2	K4	Heuristic Method	Concept Recall
	28.	Irredundant Sets	2	K2	Inductive Learning	MCQ

	29.	Upper Bounds and Lower Bounds for the Domination Number $\gamma(G)$	2	K5	Participative Learning	Relay Race

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability

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

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

Activities related to Cross Cutting Issues: -

Assignment: Cut-vertices and Cut-Edges, Vertex Colouring, Edge Colouring and Dominating Sets

Sample questions (minimum one question from each unit)

Part A

Unit I

1. What is the relationship between vertices and edges?
2. Consider the following graph

Which of the following is/are true?

(a) It is a 2-regular graph.
(b) It is a connected graph such that each vertex is a cut-vertex.
(c) It is isomorphic with the graph. 
(d) It is denoted by C_3.

Unit II

1. A trail is called a Eulerian Trail of a graph if it contains …….
2. True or False: Peterson graph is a Hamiltonian graph.

Unit III

1. The Euler formula holds for which types of graph?
2. Choose the wrong statement(s) given below.
   (a) A graph is called as k-colourable if it t-colourable for at least one integer $t, t \geq k$.
   (b) Every cycle is 2-colourable.
   (c) For any graph $G, \chi(G) \leq \Delta(G) + 1$.
   (d) The vertex chromatic number and edge chromatic number are same for the bipartite graph.

Unit IV

1. What is the difference between graph and directed graph?
2. True or False: A connected graph is strongly orientable if it has no cut-edges.

Unit V

1. What is the lower bound for $\gamma(G)$?
2. The minimum domination number for a complete graph is
   (a) 1 (b) 2 (c) 3 (d) Nil

Part B

Unit I

1. Show that if G is a (p, q) graph, then sum of the degrees of each vertex of G is equal to twice the number of edges.
2. An edge e of a graph G is not a cut-edge iff e belongs to a cycle in G.

Unit II

1. Show that every T contains at least two vertices of degree one.
2. Give examples of graph which satisfy the properties (i), (ii), (iii) and (iv) respectively.
   (i) Eulerian and Hamiltonian.
   (ii) Eulerian and Hon-Hamiltonian.
   (iii) Non-Eulerian and Hamiltonian.
   (iv) Non-Eulerian and Non-Hamiltonian.

Unit III

1. By using Euler formula, show that K_5 and $K_{3,3}$ are nonplanar.
2. Prove that for any graph $G, \chi(G) \leq \Delta(G) + 1$.

Unit IV

1. Explain Strongly Connected, Weakly Connected and Unilateral Connected Digraphs with examples.
2. Give an example of a (p, q) −digraph with

$q = (p-1)(p-2,)$ which is disconnected.

$q = p$, which is strongly connected.

$q = p - 1$, which is weakly connected.

$q = p - 1$, which is unilaterally connected.

Unit V

1. Show that for any graph $G, \gamma(G) \leq p + 1 - \sqrt{1 + 2q}$.
2. Prove that a dominating set D is a minimal dominating set if and only if it is dominating and irredundant.

Part C

Unit I

1. Prove the following: A connected (p, q) −graph contains a cycle if and only if $q \geq p$.
2. If $q > \frac{p^3}{4}$, then show that every (p, q) graph contains a triangle.

Unit II

1. Prove the characterization for an Eulerian graph: A nontrivial connected graph is Eulerian if and only if it has no vertex of odd degree.
2. Show that the following statements are equivalent for a (p, q) graph
   (a) G is a tree.
   (b) G is connected and $q = p + 1$.
   (c) G is acyclic and $q = p - 1$.

Unit III

1. Prove that there are exactly five regular polyhedral.
2. Show that for any given integer $k(\geq 1)$, there exists a triangle-free graph with chromatic number k.

Unit IV

1. Prove the characterization for the strongly connected digraph: A digraph D is strongly connected if and only if D contains a directed closed walk containing all its vertices.
2. Show that every tournament D contains a directed Hamiltonian path.

Unit V

1. Show that $\gamma(G) = p/2$ if and only if the components of G are the cycle C_4 or the corona $H0K_{1,}$ for any connected graph H, where G be a graph with even order p and without isolated vertices.

2. Show that for any graph G with $\gamma(G) \geq 2, q \leq \left\lfloor \frac{1}{2}\big(p - \gamma(G)\big)(p - \gamma(G) + 2) \right\rfloor$.

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