SCHOOL OF SCIENCE
Name of the Programme: MSc. Mathematics
Programme Outcomes/ Programme Specific Outcomes

P01- Intellectual Rigour and Research

To be able to make well-reasoned arguments those are supported by logic and evidence. Intellectually rigorous individuals are able to convince others about their ideas because they are rooted in research and backed by solid evidence.

P02- Digital Capability

To be able to adopt and develop new practices with digital technology in order to be able to better analyse and develop a critical perspective on content and underlying systems, services and networks.

P03- Professional and Effective Communication skills

To develop an Effective communication to be clear and complete in what we are trying to express. Being an effective communicator in our professional and personal lives involves learning the skills to exchange information with clarity, empathy, and understanding.

P04- Creative and Critical Thinker

To develop Critical thinking and ability clearly and logically consider information that is presented to us. Creative thinking is about generating new, novel, or useful ideas. The great innovators combine critical thinking and creative thinking.

P05- Inter-disciplinary and Social Interaction

With repeated exposure to interdisciplinary thought, learners develop more advanced epistemological beliefs, enhanced critical thinking ability and metacognitive skills, and an understanding of the relations among perspectives derived from different disciplines.

P06- Holistic life-long formation with ethical practices and environmental concerns

Students are empowered to improve their educational outcomes and gain the life skills necessary to take on a successful professional career.

P07- Optimistic Catalyst of Transformation and Effective citizenship

Transformations catalysts (TCs) are promising organizing innovations specifically designed to address complexly wicked societal problems and opportunities and bring about purposeful system transformation.

PSO1: Prepare and motivate students for research studies in mathematics and related fields. Provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.

PSO2: Ability to learn the fundamentals of computational thinking and programming using mathematical tools.
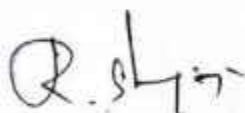
Name of the Course: Maxima practicals based on paper M105T

Name of the Course Faculty: R Shanmugapriya

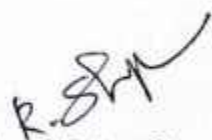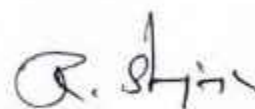| CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	After studying this course, you will be able to understand the concepts of Relations computationally.	PO2,7, PSO1,2	Ap,An
CO 2	You can Plot graphs using maxima and understand the basic concepts.,	PO3,6, PSO1,2	. Ap, An
CO 3	Able to solve problems of graph theory using Algorithms computationally.	PO4,5, PSO1,2	Ap, An, E
CO 4	Can understand the computational idea of Recurrence relations.	PO6,2, PSO1,2	Ap, An, E
CO 5	Can understand system for the manipulation of symbolic and numerical expressions	PO1,6, PSO1,2	U, Ap, An

Subject Matter Expert

HoD

Name of the Course: Algebra I

Name of the Course Faculty: Dr. R Shenbagavalli

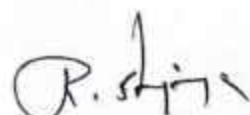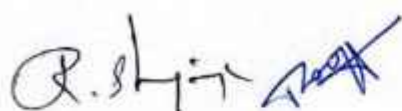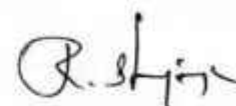| CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	After studying this course, you will be able to recall and be able to use the axioms that define a Group and a Ring, will able to know the basic properties of Groups and rings arising from these axioms. Also, able to define Ideals, Euclidean Rings, UFD, polynomial rings.	PO3,7, PSO1,2	R, U
CO2	Learn different types of Isomorphism Theorems.	PO4,6, PSO1,2	U, An
CO3	Understanding the structure of a group using Sylow's theorems.	PO1,4, PSO1,2	U, An, Ap
CO4	Able to understand Irreducible polynomials using Eisenstein Criteria.	PO2,3, PSO1,2	U, An
CO5	Relation between Rings and division algorithm	PO5,2, PSO1,2	R, U, Ap,E

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HoD

Name of the Course: Topology I

Name of the Course Faculty: R Shanmugapriya

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Able to understand basic set theory.	PO4,5, PSO1,2	U, R
CO2	Concept of Metric spaces ,Open balls and closed balls are dealt in detail.	PO2,4, PSO1,2	R, Ap, An
CO3	Topological spaces ,Open and Closed Sets.Relative topology.	PO4,6, PSO1,2	R, Ap, An
CO4	Connectedness, compactness, separation axioms of Topological spaces will be understood.	PO2,3, PSO1,2	R, Ap
CO5	Discuss connected spaces, the components of a space	PO1,6, PSO1,2	R, E

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Name of the Course: Real Analysis

Name of the Course Faculty: R Shanmugapriya & Roopa J

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	Understanding The concepts of Riemann Integral and Riemann -Stieltjes Integrals.	PO4,5, PSO1,2	R, U
CO 2	Convergence of sequence and series of functions,using different tests.	PO2,7, PSO1,2	U, Ap, An
CO 3	Understanding multi dimensional Real space and generalized theorems .	PO3,5, PSO1,2	U,An
CO 4	Concepts of Linear transformation ,Directional derivatives ,and understanding Inverse and implicit Function theorems.	PO1,2, PSO1,2	U, Ap, E
CO 5	Describe the concept of Riemann-Stieltjes integral and its properties.	PO3,4, PSO1,2	U, Ap, E

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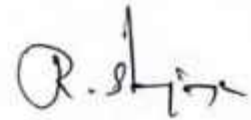PG Centre
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Name of the Course: Mathematical Analysis.

Name of the Course Faculty: Dr. R Shenbagavalli

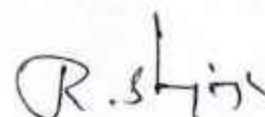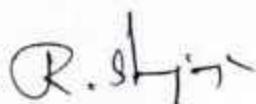| CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	Recap of basic concepts of limits Continuity and differentiability	PO2,7, PSO1,2	U, Ap
CO 2	Learn Mean Value theorems and Derivatives of Higher Order, Taylor's Theorem.	PO3,4, PSO1,2	R, U, An
CO 3	Understand the Convergence of Sequences and Series, Cauchy Criteria	PO2,5, PSO1,2	U, Ap, An
CO 4	Computation with Series, Double series.	PO5,6, PSO1,2	U, Ap
CO 5	Able to learn Rearrangements. Double series, infinite products	PO3,1, PSO1,2	R, An

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Name of the Course: Ordinary Differential Equations

Name of the Course Faulty: Roopa J

CO	**Course Outcomes** *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	Basic concepts of Linear Differential Equations and their relation with Linear algebra.	PO1,7, PSO1,2	R, U
CO 2	Existence and uniqueness of solutions, Sturm-Liouville Problems.	PO2,3, PSO1,2	U, An
CO 3	Will learn how to Solve Linear Differential Equations using Power Series Methods.	PO4,5, PSO1,2	Ap, E
CO 4	Learn Advanced concepts like Critical points, Stability of Linear differential Equations	PO3,6, PSO1,2	Ap, E
CO 5	Limit cycle and periodic solutions-Bifurcation of plane autonomous systems	PO2,4, PSO1,2	U, Ap, E

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HoD

Name of the Course: Discrete Mathematics

Name of the Course Faulty: R Shanmugapriya

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	Understanding the basic logics, direct proofs and indirect proofs.	PO2,7, PSO1,2	R, U
CO 2	Learn Counting techniques and basic algorithms.	PO4,3, PSO1,2	R, U, Ap,E
CO 3	Learn techniques of Recurrence relations and how to form generating functions.	PO1,3, PSO1,2	Ap, An, E
CO 4	Basic concepts of graph theory definitions and examples.	PO5,6, PSO1,2	Ap, An
CO 5	Learn Advanced algorithms of Graph theory.	PO4,5, PSO1,2	U, E, C

R. Sh

Subject Matter Expert

R Sh

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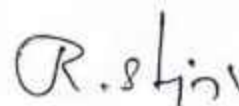St. Francis de Sales College
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Name of the Course: Sci lab Practicals Based on Numerical analysis II

Name of the Course Faculty: Dr. R Shenbagavalli

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	After studying this course, you will be able to find the root of the function using Fixed-point iterative method and Newton-Raphson method.	PO1,3, PSO1,2	R, U
CO2	You can find the solution of system of equations using Gauss-elimination method with pivoting.	PO2,6, PSO1,2	U. Ap, An
CO3	Crout's LU Decomposition method, and Doolittle LU Decomposition method.	PO4,7, PSO1,2	Ap, An, E
CO4	You can do numerical integration using Gauss-Legendre method and Gauss- Chebyshev method.	PO5,4, PSO1,2	Ap, An, E
CO5	You can do Numerical Double integrals using Scilab	PO1,5, PSO1,2	U, C

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PO-PSO- CO MAPPING

Cognitive Levels (Blooms taxonomy)

R- Remember; U- Understand; Ap- Apply; An – Analyse; E- Evaluate; C– Create

II SEMESTER

Name of the Course: Algebra II

Name of the Course Faculty: Dr. R Shenbagavalli

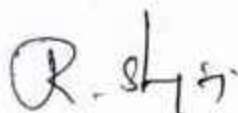| CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	After studying this course, you will be able to recall and be able to use the axioms that define a ring and know the basic properties of rings arising from these axioms. know how to add and multiply polynomials over arbitrary fields. You can also use this to define polynomial rings.	PO1,PSO1	R, U, Ap
CO2	Solving polynomial equations using formulas for roots	PO1, PSO2	U, An, E
CO3	How to test if a polynomial is irreducible Finite Field (Galois Fields)	PO2, PSO1,PSO2	U, An, E
CO4	Understanding which equations can be solved using radials using the conce.	PO7, PSO1,PSO2	U, An, E
CO5	Ability to understand/obtain the roots of a polynomial equation if the same has (or can be reduced to) degree less than five.	PO2, PSO1,PSO2	R, U, Ap

R.Sh

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R.Sh

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Name of the Course: Topology II

Name of the Course Faculty: R Shanmugapriya

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Acquire knowledge about various types of topological spaces and their properties	PO1, PSO1	U, R
CO2	Discuss connected spaces, the components of a space	PO2, ,PSO2	R, Ap, An, E
CO3	Apply the properties and derive the proofs of theorems.	PO5, PSO1,PSO2	R, Ap, An, E
CO4	Construct a variety of examples and counter examples in topology	PO3, PSO1,PSO2	R, Ap, E
CO5	Understand the properties of the compact spaces and analyse the different types of compactness.	PO6, PSO1,PSO2	U, An

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Name of the Course: Complex Analysis

Name of the Course Faculty: R Shanmugapriya

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Understand Cauchy's Integral Formula on open sets on the plane and know about poles , residues and singularities.	PO6, PSO1,PSO2	R, U
CO2	Remembering the concept of Analytic function and as a mapping on the plane and understand Mobius Transformation	PO7, PSO1	U, Ap, An
CO3	Apply the Cauchy's integral formula in residue theorems and in evaluation of definite integrals.	PO1,2, PSO1,PSO2	U, Ap
CO4	Analyse and represent the sum function of a power series as an Analytic Function	PO1,3,4,PSO 2	U, Ap, E
CO5	Study and understand periodic function, Weierstrass ☐ function and its applications	PO5,2, PSO1,2	U,An

R.shʒ

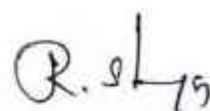**Subject Matter Expert**

R.shʒ

HoD

Name of the Course: Elementary Number Theory

Name of the Course Faculty: Roopa J

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Able to understand definitions of divisibility and related algorithms:	PO1,2, PSO1	U, Ap
CO2	Basic congruence results •	PO4,6, PSO2	R, U, E
CO3	Diophantine approximation and transcendental numbers Skills gained: • • Arithmetical functions •	PO3,5, PSO1	U, Ap, An
CO4	Solutions of Diophantine equations	PO1,7, PSO2	U, Ap, E
CO5	Distribution of primes Competency developed: • Useful tools in cryptography and related applied subjects	PO2,4, PSO1	U, Ap, An, E

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Name of the Course: Partial Differential Equations

Name of the Course Faulty: Roopa J

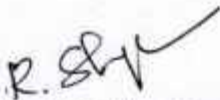| CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	The student masters the basic principles and methods for the analysis of partial differential equations.	PO2,4, PSO1,2	R, U, Ap
CO2	first-order equations, Cauchy's problems, characteristics, linear second-order equations, classification, boundary value problems for elliptic equations,	PO1,3, PSO1,2	U, E
CO3	boundary and initial value problems for hyperbolic and parabolic equations, fundamental solutions, maximum principles,	PO5,7, PSO1,2	Ap, An
CO4	maximum principles, weak solutions and functional analytic methods. 2. Skills.	PO1,2, PSO1,2	Ap, An
CO5	Skills. The student is able to apply the techniques to study specific examples, understand the proofs and apply central proof techniques of related problems.	PO1,6, PSO1	Ap, An, E

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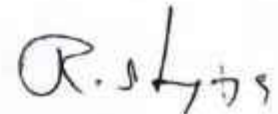PG Centre
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Name of the Course: Numerical Analysis I

Name of the Course Faulty: Dr. R Shenbagavalli

CO	**Course Outcomes** *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	After studying this course, you will be able to derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, solution of linear and nonlinear equations, and the solution of differential equations.	PO1,3, PSO1,2	R, U
CO2	You can analyse and evaluate the accuracy of common numerical methods also.	PO2,5, PSO1,2	R, U, Ap
CO3	Familiar with finite precision computation	PO1,6, PSO1,2	Ap, An, E
CO4	Familiar with calculation and interpretation of errors in numerical methods,	PO3,5, PSO1,2	Ap, An, E
CO5	Familiar with numerical solutions of nonlinear equations in a single variable	PO4,7, PSO1,2	U, E, C

R.&V

Subject Matter Expert

R.s475

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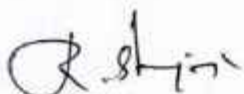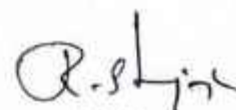St. Francis de Sales College
Bengaluru - 560100

Name of the Course: Linear Algebra
Name of the Course Faculty: R Shanmugapriya

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Understand the basic concepts of Linear Algebra.	PO1,3, PSO1,2	R, U
CO2	Understand the relation between Linear transformation and Matrices.	PO2,4, PSO1,2	U,Ap, E
CO3	Learn the Canonical forms of Linear transformation and their applications.	PO4,5, PSO1,2	U, E, Ap
CO4	Cconstruct the matrix of a bilinear form and to find index, rank and signature of a bilinear form.	PO6,7, PSO1,2	Ap, An, E
CO5	Understand different classes of linear operators on inner product spaces and study them structures.	PO2,7, PSO1,2	U, Ap, E

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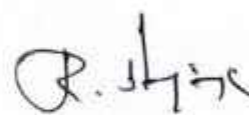St. Francis de Sales College
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Name of the Course: Numerical Analysis - II
Name of the Course Faculty: Roopa J

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Understand the different techniques of solving Ordinary Differential Equations Numerically.	PO3,7, PSO1,2	R, U,Ap
CO2	Understand the different techniques of solving Partially Differential Equations Numerically.	PO1,3, PSO1,2	R,U,Ap
CO3	Able to solve Elliptic equations, Parabolic equations	PO2,6, PSO1,2	U, An, E
CO4	Able to solve two-dimensional application problems	PO2,7, PSO1,2	U, An, C
CO5	Learn about Hyperbolic equations	PO3,5, PSO1,2	R, E

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Name of the Course: Scilab Practicals based on M305T
Name of the Course Faculty: Roopa J

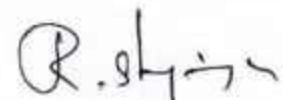| CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Learn How to solve Ordinary differential Equations Computationally using different methods.	PO2,5, PSO1,2	Ap,E
CO2	Learn How to solve Partial differential Equations Computationally using different methods.	PO1,7, PSO1,2	Ap,E
CO3	Able to solve Runge-Kutta 2 and 4 order methods, Runge-Kutta-Fehlberg order method, Runge-Kutta for system of equations	PO3,6, PSO1,2	An, C
CO4	Able to get results for Laplace equation, Poisson equation, Schmidt Method	PO6,7, PSO1,2	Ap, E
CO5	Learn how to solve ADI method, Explicit method for wave equation, Lees ADI method for wave equation	PO1,4, PSO1,2	Ap, C

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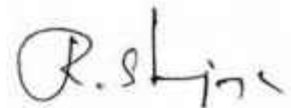PG Centre
St. Francis de Sales College
Bengaluru - 580

Name of the Course: Fluid Mechanics
Name of the Course Faculty: Roopa J

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Learn basic concepts of Fluid Mechanics such as Gradient, Divergence, Curl, Tensors	PO6,7, PSO1,2	R, U
CO2	Understand Fundamental basic physical laws: Conservation of mass, energy, Momentum.	PO1,3, PSO1,2	R, U, AN
CO3	Understand the Navier Stokes Equation and its consequences.	PO2,4, PSO1,2	An, U, Ap
CO4	Learn about Two dimensional flows of inviscid fluids.	PO3,5, PSO1,2	U, E
CO5	Able to learn Blasius theorem and applications.	PO5,6, PSO1,2	U, An, C

Subject Matter Expert

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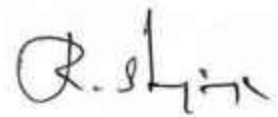St. Francis de Sales College
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Name of the Course: Functional Analysis

Name of the Course Faculty: R. Shenbagavalli

CO	Course Outcome *The learner will be able to*	PSOs Addressed	Cognitive Level
CO1	Learn Basic Concepts of Functional analysis and linear algebra.	PO2,7, PSO1,2	R, U
CO2	Learn Hahn Banach theorem and related concepts	PO1,3, PSO1,2	U, Ap, E
CO3	Understand the concepts of Inner product space and Orthogonality with Gram Schmidt Algorithm	PO2,5, PSO1,2	Ap, E
CO4	Understand the concepts of Hilbert Spaces in detail.	PO3,6, PSO1,2	U, R
CO5	Able to understand Projections on a Hilbert space	PO4,3, PSO1,2	U, An, E

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Name of the Course: Differential Geometry
Name of the Course Faculty: Dr. R Shenbagavalli

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	Learn basic concepts of Geometry and Differential Calculus.	PO1,4, PSO1,2	R, U
CO2	Understand the concepts of Frame Fields.	PO2,7, PSO1,2	U, Ap, An
CO3	Understand the concept Calculus on a Surface	PO3,6, PSO1,2	U, Ap, E
CO4	Learn about shape operators.	PO4,5, PSO1,2	U, Ap, E
CO5	Learn about Types of curvatures	PO2,4, PSO1,2	R, E, C

Subject Matter Expert

HoD

Name of the Course: Measure and Integration
Name of the Course Faculty: R Shanmugapriya

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	After studying this course, you will be able to gain an understanding of the concepts of Measurability of continuous functions	PO1,7, PSO1,2	R, U
CO 2	After studying this course, you will be able to gain an understanding of the concepts of measurability of a continuous image of measurable function,	PO3,5, PSO1,2	U, Ap, An
CO 3	Able to identify convergence theorems and Lebesgue integral, bounded convergence theorem,	PO2,6, PSO1,2	U, Ap, E
CO 4	Cconvergence theorems and Lebesgue integral, bounded convergence theorem, Fatou's lemma,	PO1,2, PSO1,2	U, Ap, E
CO 5	Understand the concept of Lebesgue measure, measurable sets and approximation of a measurable function by simple measurable function.	PO2,4, PSO1,2	U, Ap, An

R. Shyn

Subject Matter Expert

R. Shyn

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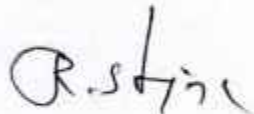St. Francis de Sales College
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Name of the Course: Mathematical Methods
Name of the Course Faculty: R Shanmugapriya

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	Understand and Apply various transforms and Integral equations to solve problems in all respects	PO1,3, PSO1,2	R, U,Ap
CO 2	Recognize and solve the special cases of Volterra Integral equations by the method of resolvent kernel, method of successive approximations and by using transforms	PO2,4, PSO1,2	R, U, Ap
CO 3	Understand the relations between the Hankel, Fourier transform and their applications in evaluating the equations.	PO5,6, PSO1,2	U, An, Ap
CO 4	Understand the formulation of variational problems, the variation of functional and its properties.	PO2,7, PSO1,2	U, An
CO 5	Demonstrate and apply the methods in all application problems in day-today life.	PO1,4, PSO1,2	R, An, E

Subject Matter Expert

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Department of Mathematics
PG Centre
St. Francis de Sales College
Bengaluru - 560100

Name of the Course: Entire and Mesomorphic Functions
Name of the Course Faculty: Dr. R Shenbagavalli

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	After studying this course, you will be able to gain an understanding of Meromorphic Functions	PO1,2, PSO1,2	R, U,Ap
CO2	Nevanlina's Characteristic Function,Cartan's Identity and Convexity Theorems,	PO4,3, PSO1,2	U, Ap, E
CO3	Able to understand Order of a Meromorphic Function and its Derivative.	PO3,6, PSO1,2	Ap, E, C
CO4	Able to understand Nevanlina's fundamental theorems and its applications	PO1,5, PSO1,2	U, An, E
CO5	Able to understand deficient values and a relation between various exceptional values	PO2,3, PSO1,2	U, Ap, An

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Name of the Course: Magnetohydrodynamics
Name of the Course Faculty: Roopa J & Dr. R Shenbagavalli

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	After studying this course, you will be able to gain an understanding of Electrodynamics Ampere's law and solenoidal property,	PO2,7, PSO1,2	R, U
CO 2	Able to understand Electrostatics and electromagnetic units derivation of Gauss law- Faraday's law,	PO1,3, PSO1,2	U, E
CO 3	Able to understand Alfven's theorem - Frozen in phenomenon circulation theorem-Bernoulli's equations - Analogue of Helmholtz vorticity equation .	PO2,4, PSO1,2	U, E, C
CO 4	Illustrative examples, Kelvin's circulation theorem-Bernoulli's equations - Analogue of Helmholtz vorticity equation	PO5,6, PSO1,2	Ap, An, E
CO 5	Applications and derivation of Flow problems	PO1,5, PSO1,2	An, E, C

R.Shiv Roopa
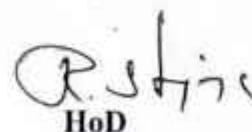
Subject Matter Expert

R.s.L

Name of the Course: Graph Theory
Name of the Course Faculty: Roopa J

CO	**Course Outcomes** *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO 1	After studying this course, you will be able to define the basic concepts of graphs, directed graphs, and weighted graphs, define a graph, identifying edges and vertices, find the degree of a vertex	PO2,4, PSO1,2	R, U
CO 2	Able to understand planar graphs and Euler polyhedron formula	PO4,7, PSO1,2	U, E
CO 3	Able to understand Vertex and Edge connectivity of graphs	PO6,2, PSO1,2	U, E, C
CO 4	Able to define the concept of Matching and marriage problem	PO1,5, PSO1,2	Ap, An, E
CO 5	Able to define the concepts of Digraph and applications of Tournaments	PO2,6, PSO1,2	Ap, An, C

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Name of the Course: Latex and Latex Beamer
Name of the Course Faculty: Roopa J

CO	Course Outcomes *The learner will be able to*	PO-PSOs Addressed	Cognitive Level
CO1	After studying this course, you will be able to include Mathematical symbols Δ, π, φ, ∞, μ, α, η, θ, λ, ξ, χ, τ, σ, β, Ω, Ψ, Υ, ϑ ect., write and display Mathematical Equations,	PO1,2, PSO1,2	R, U
CO2	Able to understand t how to create a table in different forms, import figures and graphs into latex document.	PO2,4, PSO1,2	U, E
CO3	Able to Write and Display Mathematical Equations	PO1,7, PSO1,2	U, C
CO4	Able to Draw different figures using latex commands	PO3,5, PSO1,2	U, An, C
CO5	After learning this program, they able to Create frames containing mathematical expressions, e frames in different formats, Bibliography in frames	PO3,6, PSO1,2	R, Ap, E

Subject Matter Expert

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