Bachelor of Science
Department of Mathematics
PROGRAM OUTCOMES (2022-23)

POs	DESCRIPTIONS
PO1:	**Disciplinary Knowledge:** Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects.
PO2:	**Communication Skills:** Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modelling and solving of real-life problems.
PO3:	**Critical thinking and analytical reasoning:** The students undergoing this programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.
PO4:	**Problem Solving:** The Mathematical knowledge gained by the students through this programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development and also equip them with mathematical modelling ability, problem solving skills.
PO5:	**Research related skills:** The completing this programme develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO6:	**Information/digital Literacy:** The completion of this programme will enable the learner to use appropriate software's to solve system of algebraic equation and differential equations.
PO7:	**Self-directed learning:** The student completing this program will develop ability of working independently and to make an in-depth study of various notions of Mathematics.
PO8:	**Moral and ethical awareness/reasoning:** The student completing this program will develop an ability to identify unethical behaviour such as fabrication, falsification or misinterpretation of data and adopting

			objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in particular.
PO9:			**Lifelong learning:** This programme provides self-directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
PO10:			Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

Course outcomes

CLASS	PAPER	COURSE OUTCOMES	DESCREPTIONS
B. SC. I SEM	Algebra - I and Calculus – I		This course will enable the students to
		CO1	**Learn** to **solve** system of linear equations.
		CO2	**Solve** the system of homogeneous and non-homogeneous linear of m equations in n variables by using concept of rank of matrix, **finding** eigen values and eigen vectors.
		CO3	**Sketch** curves in Cartesian, polar and pedal equations.
		CO4	Students will be familiar with the techniques of integration and differentiation of function with real variables.
		CO5	**Identify** and **apply** the intermediate value theorems and L' Hospital rule.
	Theory based Practical's on Algebra - I and Calculus – I	CO1	Learn Free and Open Source Software (FOSS) tools for computer programming.
		CO2	**Solve** problem on algebra and calculus theory studied in MATDSCT 1.1 by using FOSS software.
		CO3	Acquire knowledge of applications of algebra and calculus through FOSS Practical/Lab Work to be performed in Computer Lab (FOSS).
	Mathematics I	CO1	Learn to **solve** system of linear equations.
		CO2	**Solve** the system of homogeneous and non-homogeneous m linear equations by using the

				concept of rank of matrix, finding Eigen values and Eigen vectors.
			CO3	Students will be familiar with the techniques of differentiation of function with real variables.
			CO4	**Identify** and **apply** the intermediate value theorems and L' Hospital rule.
			CO5	Learn to trace some standard curves.
B. SC. II SEM		Algebra - II and Calculus – II	CO1	Recognize the mathematical objects called Groups.
			CO2	Link the fundamental concepts of groups and symmetries of geometrical objects.
			CO3	Explain the significance of the notions of Cosets, normal subgroups and factor groups.
			CO4	Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
			CO5	Find the extreme values of functions of two variables.
		Theory based Practical's on Algebra - II and Calculus – II	CO1	Learn Free and Open Source Software (FOSS) tools for computer programming.
			CO2	Solve problem on algebra and calculus by using FOSS software's.
			CO3	Acquire knowledge of applications of algebra and calculus through FOSS Practical/Lab Work to be performed in Computer Lab.
		Mathematics - II	CO1	Recognize the mathematical objects called Groups.
			CO2	Link the fundamental concepts of groups and symmetries of geometrical objects.
			CO3	Explain the significance of the notions of Cosets, normal subgroups and factor groups.
			CO4	Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
			CO5	Find the extreme values of functions of two variables.
			CO6	To understand the concepts of multiple integrals and their applications.

B. SC. III SEM	Ordinary Differential Equations and Real Analysis – I	CO1	Solve first-order non-linear differential equations and linear differential equations.
		CO2	To model problems in nature using Ordinary Differential Equations.
		CO3	Formulate differential equations for various mathematical models
		CO4	Apply these techniques to solve and analyze various mathematical models.
		CO5	Understand the fundamental properties of the real numbers that lead to define sequence and series, the formal development of real analysis.
		CO6	Learn the concept of Convergence and Divergence of a sequence.
		CO7	Able to handle and understand limits and their use in sequences, series, differentiation, and integration.
		CO8	Apply the ratio, root, alternating series, and limit comparison tests for convergence and absolute convergence of an infinite series.
	Theory based Practical's on Ordinary Differential Equations and Real Analysis – I	CO1	Free and Open Source software (FOSS) tools or computer programming.
		CO2	Solving exact differential equations.
		CO3	Ploting orthogonal trajectories.
		CO4	Finding complementary function and particular integral of linear and homogeneous differential equations.
		CO5	Acquire knowledge of applications of real analysis and differential equations.
		CO6	Verification of convergence/divergence of different types of series.
	Ordinary Differential Equations	CO1	Understand the concept of the differential equation and their classification
		CO2	Know the meaning of the solution of a differential equation.
		CO3	To solve first-order ordinary differential equations.
		CO4	To Solve exact differential equations and Converts to separable and homogenous equations to exact differential equations by

				integrating factors.
			CO5	To Solve Bernoulli differential equations.
			CO6	To find the solution to higher-order linear differential equations.
B. SC. IV SEM	Partial Differential Equations and Integral Transforms		CO1	Solve the Partial Differential Equations of the first order and second order.
			CO2	Formulate, classify and transform partial differential equations into canonical form.
			CO3	Solve linear and non-linear partial differential equations using various methods; and apply these methods to solving some physical problems.
			CO4	Able to take more courses on wave equation, heat equation, and Laplace equation.
			CO5	Solve PDE by Laplace Transforms and Fourier Transforms.
	Theory based Practical's on Partial Differential Equations and Integral Transforms		CO1	Learn Free and Open Source software (FOSS) tools or computer programming.
			CO2	Solve problems on Partial Differential Equations and Integral Forms.
			CO3	To find Laplace transform of various functions.
			CO4	To find the Fourier Transform of periodic functions.
			CO5	To solve differential equations by using Integral transforms.
B. SC. V SEM	Real Analysis		CO1	Learn Riemann's definition of integrability and its Equivalence with Darboux definition of integrability along with the Necessary and sufficient condition for Riemann integrability.
			CO2	Learn that a bounded function on a closed and bounded interval is Riemann integrable if and only if the set of points of discontinuity is negligible.
			CO3	Definition of Improper Integrals. Improper integrals of first and second kind. Comparison tests. Abel's test and Dirichlet's test.
			CO4	Develop an idea of convergence and working knowledge of Beta and Gamma and their

			Duplication formula.
		CO5	Able to solve Differentiation under integral sign. Double and triple integrals, areas and volumes
	Numerical Analysis and Difference Equations	CO1	Apply numerical methods to obtain approximate solutions to mathematical problems.
		CO2	Solve the nonlinear equations, system of linear equations and interpolation problems using numerical methods.
		CO3	Examine the appropriate numerical differentiation and integration methods to solve problems.
		CO4	Apply the numerical methods to solve algebraic as well as differential equations
		CO5	Solve the initial value problems
	Practical's	CO1	Learn Free and Open Source software (FOSS) tools or computer programming.
		CO2	Solve problems on Riemann integrals.
		CO3	To find Beta & Gamma functions.
		CO4	Verification of given integral for its convergence.
		CO5	To solve double integral and triple integral.
	Practical	CO1	Learn Free and Open Source software (FOSS) tools or computer programming.
		CO2	Solve equation by Bisection method, Newton – Raphson method, Jacobi iteration method and Gauss - Seidel method.
		CO3	To find Interpolation using Newton – Gregory forward and backward interpolation formula, Lagrange's interpolation formula.
		CO4	Solution of initial value problem by modified Euler's method.
		CO5	To solve initial value problem by Runge – Kutta second and fourth order methods.
	Number Theory	CO1	Properties of Divisibility of numbers, division algorithm, prime, composite numbers and Congruences.
		CO2	Properties of Bracket function. Euler's

				function, Fermat, Euler and Wilson's theorems.
B. SC. VI SEM	Complex Analysis and Ring Theory		CO1	To demonstrate understanding of the basic concepts and fundamental definitions underlying complex analysis.
			CO2	Prove and explain concepts of series and integration of complex functions and clearly understand problem-solving.
			CO3	Prove and expand complex function ins series.
			CO4	Prove and solve problems on Residue Theorem, Jordan's lemma and Contour Integration.
			CO5	Develop a concept on Ring Theory of Abstract Algebra in details.
	Differential Equations		CO1	To solve simultaneous differential equations with two and three variables. Conditions of integrability and its solutions.
			CO2	To solve Series Solutions of Ordinary Differential Equations.
			CO3	To solve Legendre's equations in series, Legendre's functions- first and second kind, Rodrigue's formula.
			CO4	Derive and solve different types of partial differential equations which may arise in real life problems.
			CO5	To solve Non-linear partial differential equations.
	Practical		CO1	Learn Free and Open Source software (FOSS) tools or computer programming.
			CO2	Construction of analytic function.
			CO3	Verification of real and imaginary parts of analytic function being harmonic.
			CO4	Evaluation of contour integral.
			CO5	Computation of residues.
	Practicals		CO1	Learn Free and Open Source software (FOSS) tools or computer programming.
			CO2	Verification of Cauchy – Euler differential equations
			CO3	Verification of exactness of differential

			equations, linear partial differential equation, first orders non-linear partial differential equations.
		CO4	Verification of non-linear partial differential equations.
		CO5	Recurrence relation for Legendre's function and Bessel's unction.
	Graph Theory	CO1	Develop a concept on Graph Theory in details.
		CO2	Properties and characterization of sub graphs.

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