Yogeshwari Education Society's

Yogeshwari Mahavidyalaya, Ambajogai

Department of Mathematics

Program Name : B.Sc Mathematics

Program Outcomes : A Bachelor of Science in Mathematics program typically provides students with a strong foundation in mathematical concepts, theories, and techniques, as well as the ability to apply these to real-world problems. Some of the possible outcomes of a B.Sc. in Mathematics program may include:

- A thorough understanding of mathematical concepts such as algebra, geometry, analysis, and differential equations.
- The ability to analyze and solve complex mathematical problems, both theoretically and computationally.
- The ability to communicate mathematical concepts and results effectively, both orally and in writing.
- The skills to apply mathematical techniques to problems in a variety of fields, including science, engineering, economics, and computer science.
- The ability to think logically and critically, and to approach problems in a systematic and analytical manner.

Program Specific Outcomes :

- Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.
- Inculcate mathematical reasoning.
- Development of critical thinking and problem-solving skills through the study of rigorous mathematical arguments and the application of abstract concepts to real-world problems.
- Understand the mathematical foundations of fields related to mathematics, such as computer science, statistics, and engineering.

How do we communicate the POs, PSOs and COs to the students ?

At the beginning of the program, or at the start of the academic year, the Principal introduces the POs to the students through an Induction Program and explains what it means and how it aligns with the overall goals of the program. Throughout the program, the faculties regularly brings up the POs, PSOs and COs during class discussions, asking questions that prompt students to think about how the material they are learning relates to the outcome and how it can be applied to real-world problems.

Course Outcomes

Semester I		
Course Code	**Course Name**	**Course Outcomes**
MAT-101	**Differential Calculus**	● A thorough understanding of the fundamental concepts of differential calculus, including limits, derivatives, and differentiability. ● The ability to apply derivatives to solve problems in a variety of contexts, including optimization, related rates, and curve sketching. ● The ability to use differential calculus to model real-world phenomena and to understand the behavior of functions in various situations. ● A deeper understanding of the advanced concepts of differential calculus, including higher-order derivatives, implicit differentiation, and applications to vector calculus. ● The ability to compute higher-order derivatives and to use them to solve more complex problems, including those involving multivariable functions.
MAT-102	**Differential Equations**	● Will be able to explain the concept of differential equation ● Classifies the differential equations with respect to their order and linearity. ● Solves the homogeneous linear differential equations with constant coefficients.
Semester II		
MAT-201	**Integral Calculus**	● A thorough understanding of the fundamental concepts of integral calculus, including the indefinite integral, the definite integral, and the Fundamental Theorem of Calculus. ● The ability to compute indefinite and definite integrals using various techniques, including substitution, integration by parts, and integration of trigonometric functions. ● The ability to apply integrals to solve problems in a variety of contexts, including finding areas, volumes, and average values.

		● The ability to use integral calculus to model real-world phenomena and to understand the behavior of functions in various situations. ● A thorough understanding of the concepts of double and triple integrals, including how to evaluate them using various techniques and how to apply them to solve problems involving two or three dimensions. ● A deep understanding of vector integration, including how to work with vector fields, how to compute line integrals and surface integrals, and how to use Green's Theorem and Stokes' Theorem.
MAT-202	**Geometry**	● express the relationship between point and line in the plane. ● identifies given a point and slope of line. ● identifies the equation of line given two points ● describes that two nonzero vectors u and v are perpendicular to the condition. ● describes that two nonzero vectors u and v are parallel of condition. ● restates dot product on two nonzero vectors.
Semester III		
MAT-301	**Number Theory**	● explain the concepts of divisibility, prime number, congruence and number theorems. ● define the concept of divisibility. ● define the concept of prime numbers. ● explain the division algorithm. ● explain Euclid’s algorithm. ● explain the greatest common divisor. ● explain the concept of congruence. ● express the concept of congruence with its qualities. ● explain the concepts of linear congruence and quadratic linear congruence.
MAT-302	**Integral Transforms**	● A thorough understanding of the concepts of integral transforms, including the beta and gamma functions, the Laplace transform, and the Fourier transform.

		• The ability to compute and manipulate integral transforms using various techniques, including the properties of the transforms and their inverses. • The ability to apply integral transforms to solve problems in a variety of contexts, such as differential equations, signal processing, and physics.
MAT-303	**Mechanics-I**	• Understand the fundamental concepts and principles of mechanics, including kinematics, dynamics, and statics. • Understand the basic laws of motion and their applications, such as Newton's laws of motion and conservation of energy and momentum.
Semester IV		
MAT-401	**Numerical Methods**	• A thorough understanding of the fundamental concepts of numerical methods, including numerical solution of equations, approximation, and interpolation. • The ability to use various numerical methods to solve problems, including root finding, optimization, and linear and nonlinear systems of equations. • The ability to select and implement appropriate numerical methods for a given problem, and to evaluate the accuracy and efficiency of the methods.
MAT-402	**Partial Differential Equations**	• To study Nonlinear ODEs . • To solve Lagrange PDE • To find solution of Pp+Qq =R
MAT-403	**Mechanics-II**	• Understand the fundamental concepts and principles of mechanics, including kinematics, dynamics, and statics. • Understand the basic laws of motion and their applications, such as Newton's laws of motion and conservation of energy and momentum.
Semester V		
MAT-501	**Real Analysis-I**	• A deep understanding of the concepts of sequences and series, including how to prove convergence and

		divergence, and how to use these concepts to solve problems. ● A thorough understanding of real valued functions, including how to prove their properties and how to use them to model real-world phenomena. ● The ability to use the Jacobian matrix to compute partial derivatives and to understand the behavior of functions in higher dimensions. ● The ability to prove theorems and lemmas using logical reasoning and rigorous mathematical arguments. ● The skills to approach problems in a systematic and analytical manner and to think logically and critically.
MAT-502	**Abstract Algebra-I**	● To study Group, Normal subgroups, Homomorphism ● To study theorems and examples on related topics. ● To study Ring, Ideals,Integral Domain, Field etc.
MAT-504	**Ordinary Differential Equations-I**	● Understanding of the basic concepts of ODEs, including first-order and higher-order equations, linear and nonlinear equations, and initial and boundary value problems. ● Familiarity with the techniques for solving different types of ODEs, including separation of variables, integrating factors, and power series methods.
Semester VI		
MAT-501	**Real Analysis-II**	● Understanding the basic properties of metric spaces, including the concept of open and closed sets, and the use of metric spaces to define the concept of continuity. ● Knowledge of the concepts of connectedness, completeness, and compactness in metric spaces, and the relationship between these concepts. ● Proficiency in the manipulation of the Riemann integral, including the definition, properties, and applications. ● Understanding of the fundamental theorem of calculus and its relationship to the Riemann integral. ● Knowledge of Fourier series, including the definition, properties, and applications.

MAT-502	**Abstract Algebra-II**	• To Study vector spaces, subspaces, Homomorphisms. • To study Linearly independent and dependant vectors
MAT-504	**Ordinary Differential Equations-II**	• Familiarity with the methods and techniques for solving linear differential equations with variable coefficients and linear differential equations with regular singular points, such as the Frobenius method, and understanding of their applications in physics and engineering. • Understanding of the properties and solutions of homogeneous ODEs with analytic coefficients, and knowledge of the methods to solve them, such as separation of variables and characteristic equations. • Knowledge of special types of ODEs, such as the Legendre and Bessel equations, and the methods used to solve them.

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MAT-502	**Abstract Algebra-II**	● To Study vector spaces, subspaces, Homomorphisms. ● To study Linearly independent and dependant vectors
MAT-504	**Ordinary Differential Equations-II**	● Familiarity with the methods and techniques for solving linear differential equations with variable coefficients and linear differential equations with regular singular points, such as the Frobenius method, and understanding of their applications in physics and engineering. ● Understanding of the properties and solutions of homogeneous ODEs with analytic coefficients, and knowledge of the methods to solve them, such as separation of variables and characteristic equations. ● Knowledge of special types of ODEs, such as the Legendre and Bessel equations, and the methods used to solve them.

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Department of Mathematics

Program Name : M.Sc Mathematics

Program Outcomes : A postgraduate degree in Mathematics typically builds upon the foundation of a Bachelor's degree and provides more advanced training in mathematical concepts, theories, and techniques. Some of the possible outcomes of a postgraduate degree in Mathematics may include:

- A deeper understanding of advanced mathematical concepts and techniques, such as abstract algebra, topology, and advanced analysis.
- The ability to conduct independent research in mathematics and to contribute to the advancement of the field.
- The ability to apply advanced mathematical techniques to solve complex problems in a variety of fields, including science, engineering, economics, and computer science.
- The ability to communicate mathematical concepts and results effectively to both specialist and non-specialist audiences.
- Preparing students for a PhD program in mathematics or for a career in academia, industry or government.
- Proficiency in using mathematical software and technology to solve advanced problems and perform research.

Program Specific Outcomes :

- Ability to conduct independent research in a specific area of mathematics, and to read and understand mathematical literature.
- Knowledge of modern mathematical methodologies and techniques, including numerical methods and computational mathematics.
- Ability to use mathematical software and technology, such as Matlab, Maple, or Mathematica, to solve mathematical problems.
- Development of strong problem-solving and critical thinking skills through the study of complex mathematical concepts and the application of mathematical methods to real-world problems.
- Encourage for further research and independent thinking.

Course Outcomes

Semester I		
Course Code	**Course Name**	**Course Outcomes**
MAT-401	**Abstract Algebra**	Students will be able to: ● Understand the basic concepts and principles of abstract algebra, including groups, rings, fields, and modules. ● Understand the structure and properties of various algebraic systems, including the properties of homomorphisms, isomorphisms, subgroups, ideals, and quotient structures. ● Understand and use techniques for solving equations in algebraic structures, such as the theory of equations in groups, rings and fields.
MAT-402	**Real Analysis-I**	Students will be able to: ● Understand the basic concepts and principles of real analysis, including the theory of metric spaces, topology, and measure theory. ● Understand the structure and properties of the real number system, including the theory of sequences, series, and continuity. ● Understand and use techniques for differentiating and integrating functions, including the theory of the Riemann integral, Lebesgue integral and Riemann-Stieltjes integral. ● Understand and use techniques for the theory of functions of several variables, including the theory of partial derivatives, multiple integration and concept of partial derivatives.
MAT-403	**Topology-I**	Students will be able to: ● Understand the basic concepts and principles of point-set topology, including the theory of open and closed sets, continuity, compactness, connectedness, and separation axioms. ● Understand the structure and properties of topological spaces, including the concepts of homeomorphism, basis, subbasis, and product topologies. ● Understand the concepts of metric spaces and their

		relationship to topological spaces, including the theory of completeness, compactness and connectedness.
MAT-404	**Complex Analysis-I**	Students will be able to: ● Understand the basic concepts and principles of complex analysis, including the theory of complex functions, complex differentiation, and complex integration. ● Understand the topology of the complex plane and the concept of complex power series and its applications. ● Understand the theory of complex analytic functions, including complex differentiability, complex integration, and complex line integrals. ● Understand the theory of complex residues and its applications to complex integration, including Cauchy's Theorem, Cauchy's Integral Formula and Taylor and Laurent series expansions.
MAT-421	**Differential Equations-I**	Students will be able to: ● Understand the basic concepts and principles of ordinary and partial differential equations, including the theory of initial and boundary value problems. ● Understand and use techniques for solving and analyzing ordinary and partial differential equations, including separation of variables, characteristic equations, Laplace transforms, and series solutions. ● Understand and use techniques for solving first-order ordinary differential equations, including exact equations, Bernoulli equations, and linear equations. ● Understand and use techniques for solving second-order ordinary differential equations, including homogeneous and non-homogeneous equations, and systems of linear equations.
Semester II		
MAT-411	**Linear Algebra**	Students will be able to: ● Understand the concept of linear independence, span, and basis, and use them in the theory of dimension, change of basis, and subspaces. ● Understand the fundamental concepts and principles of linear algebra, including vector spaces, linear transformations, and eigenvalues/eigenvectors. ● Perform matrix operations, such as inversion,

		determinant, rank, and eigenvalue/eigenvector computation.
MAT-412	**Real Analysis-II**	Students will be able to: ● Understand and use techniques for differentiating and integrating functions, including the theory of the Riemann integral, Lebesgue integral and Riemann-Stieltjes integral. ● Understand the theory of abstract measure spaces, including the concept of measure, measurable functions and integration ● Understand the theory of Lebesgue integral and its relationship to Riemann integral, including the concept of convergence theorems and the theory of signed measures and Radon-Nikodym theorem. ● Understand the concept of uniform convergence and its applications.
MAT-413	**Topology-II**	● Built foundations for future study in analysis,in geometry, and in algebraic topology. ● Introduce the fundamental concepts in topological spaces. ● Acquire demonstrable knowledge of topological spaces, product spaces, and Continuous functions on topological spaces. ● Identify compact and connected sets in topological spaces. ● Use Separation and countability axioms, Urysohn lemma, Urysohn metrization theorem And the Tychonoff theorem.
MAT-414	**Complex Analysis-II**	Students will be able to: ● Understand the topology of the complex plane and the concept of complex power series and its applications, including Weierstrass Factorization Theorem. ● Understand the theory of Harmonic functions, univalent functions and Riemann zeta functions and its applications to complex analysis. ● Understand the concept of Analytic continuation and its applications.
MAT-431	**Differential**	Students will be able to:

	Equations-II	● Understand and use techniques for solving second-order ordinary differential equations, including homogeneous and non-homogeneous equations, and systems of linear equations. ● Understand and use techniques for solving partial differential equations, including separation of variables, the method of characteristics, and Fourier series. ● Understand the theory of linear differential equations with constant coefficients, including the theory of eigenvalues and eigenvectors, and the theory of linear systems of differential equations, including the theory of Sturm-Liouville problems. ● Understand the concepts of superposition principle and its applications. ● Understand the concepts of stability and asymptotic behavior of solutions, including the theory of Lyapunov stability, and the theory of limit cycles.
Semester III		
MAT-501	**Functional Analysis-I**	Students will be able to: ● Understand the basic concepts and principles of functional analysis, including metric spaces, normed spaces, inner product spaces, Hilbert spaces, and Banach spaces. ● Understand the theory of linear operators, including the theory of bounded linear operators, closed linear operators, self-adjoint operators, and compact operators.
MAT-502	**Partial Differential Equations**	Students will be able to: ● Analyze to classify the second order PDE ● Find the general solution of PDE using Jacobi's method, Charpit's method, etc ● Solve any type of PDE and boundary value problems
MAT-521	**MATLAB**	Students will be able to: ● Write and execute basic programs in MATLAB using the correct syntax and structure. ● Perform mathematical operations on arrays, matrices, and scalars using the built-in functions in MATLAB. ● Create and customize 2D and 3D graphs and charts using the plotting and visualization tools in MATLAB.

		● Import, manipulate, and analyze data using the built-in functions and toolboxes in MATLAB.. ● Apply their knowledge of MATLAB to solve real-world problems through hands-on exercises and projects.
MAT-523	**Numerical Analysis**	Students will be able to: ● Understand and apply numerical methods for solving mathematical problems, such as root-finding, optimization, linear and nonlinear equations, and differential equations. ● Choose appropriate numerical methods for different types of problems and analyze their performance and accuracy. ● Understand the limitations of numerical methods and develop an intuition for when numerical solutions are appropriate.
MAT-525	**Operation Research-I**	Students will be able to: ● Find optimal solution of LPP using graphical method and simplex method ● Find primal and duality in LPP and to solve dual simplex method ● Handle Industrial problems like - Transportation Problem and Assignment Problem using various given methods.
Semester IV		
MAT-511	**Linear Integral Equations**	Students will be able to: ● Understand the basic concepts and principles of linear integral equations, including Fredholm and Volterra integral equations. ● Understand the methods for solving linear integral equations, such as variation of parameters, eigenfunction expansions, and the method of successive approximations. ● Understand and use techniques for analyzing the properties of solutions to linear integral equations, such as existence and uniqueness, stability, and asymptotic behavior. ● Understand and use techniques for solving linear integral equations with special kernels, such as singular and degenerate kernels, and understand the concept of singular integral equations.

MAT-512	**Mechanics**	Students will be able to: ● Understand the fundamental concepts and principles of mechanics, including kinematics, dynamics, and statics. ● Understand the basic laws of motion and their applications, such as Newton's laws of motion and conservation of energy and momentum. ● Understand the principles of rigid body dynamics and the techniques used to analyze the motion of rigid bodies, such as Euler's equations and Lagrangian mechanics, with a special focus on Lagrange's equation, Hamilton's equations, and D'Alembert's principle.
MAT-531	**Difference Equations**	Students will be able to: ● Understand the basic concepts and properties of difference equations, including linear and nonlinear difference equations. ● Understand the methods for solving difference equations, such as the z-transform, generating functions, and the inverse z-transform. ● Understand and use techniques for analyzing the stability and asymptotic behavior of solutions to difference equations, such as the Liapunov method.
MAT-533	**Fuzzy Mathematics**	Students will be able to: ● Understand the basic concepts and principles of fuzzy set theory and its application to model uncertain, imprecise, and vague systems. ● Understand the different types of fuzzy sets and their operations, such as union, intersection, complement, and cartesian product. ● Understand and use the concept of fuzzy relations and fuzzy logic, and its application in decision making, control systems, and artificial intelligence.
MAT-535	**Operation Research-II**	Students will be able to: ● Understand and apply mathematical modeling techniques to model real-world problems in a variety of fields such as finance, logistics, transportation, manufacturing, and healthcare. ● Formulate and solve linear, nonlinear and integer programming problems, and understand the concept of optimality conditions, including Kuhn-Tucker

		conditions. • Understand and use techniques for solving optimization problems, such as linear programming, nonlinear programming, and dynamic programming, with a special focus on Wolf's modified simplex method.

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