

## Programme and course outcome

### Course outcome for M.Sc.

#### Department of Mathematics

**Programme outcome:** The syllabus of Mathematics is designed to:

- Equip students with logical reasoning, mathematical thinking and problem solving skills.
- Enable students to apply the mathematical method and ideas not only to problem in Mathematics but also to other related fields such as Chemistry, Physics, Computer Science, Economics, Commerce, Statistics etc.
- Develop proficiency in writing proofs that empower students to communicate mathematical ideas both orally and in writing
- Prepare students for jobs in various sectors such as teaching, banking, research etc.
- Equip students for advanced study in the field of Mathematics, Statistics, Data Science etc.
- Prepare students for various competitive exam such as civil services, SSC, bank P.O., etc.

Course	Outcome
<b>Algebra</b>	Upon successful completion of this course, the student will be able to: <ul style="list-style-type: none"><li>• Define Normal and Subnormal Series, Commutators and their properties.</li><li>• Define Central Series, Nilpotent groups, Solvable groups</li><li>• Define and illustrate Extension field, Algebraically closed fields</li><li>• Define and illustrate Roots of unity, Primitive Elements, Galois Theory.</li></ul>
<b>Ordinary Differential Equations-1</b>	Upon successful completion of this course, the student will be able to: <ul style="list-style-type: none"><li>• Determine E-approximate solution for the given initial value Problem, Converse of ODE into Integral Equation and conversely, Determine the solution of IVP using various Theorem(Arzela-Ascoli, Cauchy Peano, Picard Lindelof)</li><li>• Solving First-Order Equation using Power series method, Numerical Methods, Dependence of Solution on Initial Condition and Function</li><li>• Determine solution of ODE using various methods, Gronwall's Differential Inequality</li><li>• Zeroes of solutions, Oscillatory and Non-oscillatory equations, Riccati's equation and its solutions, Lagrange's Identity and Green's formula for 2<sup>nd</sup> order equation.</li></ul>

<b>Real Analysis</b>	<p>A student will be able to:</p> <ul style="list-style-type: none"> <li>• Determine the Riemann integrability and the Riemann stieltjesintegrability of a bounded function and Prove a selection of theorems concerning integration.</li> <li>• Recognize the difference between Pointwise and Uniform convergence of a sequence of functions.</li> <li>• Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability and integrability</li> <li>• Illustrate the convergence properties of Power Series</li> <li>• Define Lebesgue measure of sets and non-measurable sets.</li> </ul>
<b>Complex Analysis</b>	<p>At the end of this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Represent Complex numbers algebraically and geometrically</li> <li>• Define and analyze limit and continuity for complex functions as well as consequences of continuity</li> <li>• Apply the concept and consequences of analyticity and Cauchy –Riemann equation and result harmonic and entire functions including the fundamental theorem of algebra</li> <li>• Analyze sequence and series of analytic function and type of convergence</li> <li>• Evaluate complex contour integrals directly and by the fundamental theorem</li> <li>• Represent functions as theorems and find residues and evaluate complex integrals using the residue theorem</li> </ul>

<b>Mechanics</b>	<p>Upon successful completion of this course, the student will be familiar with :</p> <ul style="list-style-type: none"> <li>• The basic concepts of moment of inertia</li> <li>• Representation of the equation of the motion for mechanical system using Lagrangian, Hamiltonian formulations of classical mec</li> </ul>
<b>Programming Language</b>	<p>Upon successful completion of this course, the student will be familiar with :</p> <ul style="list-style-type: none"> <li>• The basis of computer and programming concepts of scientific language Fortran 90/95.</li> </ul>
<b>Topology</b>	<p>Upon successful completion of the course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Define topological space and continuous functions.</li> <li>• Define Neighbourhoods, Interior, exterior and Boundary point of a set.</li> <li>• Define and illustrate the concepts of connectedness and compactness.</li> <li>• Define separation axioms. T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> spaces.</li> <li>• Define and illustrate projection mapping, product topological spaces.</li> </ul>

<b>Partial Differential Equations-1</b>	<p>Upon completion of this course, the student will be able to :</p> <ul style="list-style-type: none"> <li>• Recognize the classification of P.D.Es.</li> <li>• Define and illustrate the wave equation, energy methods</li> <li>• Define and solve the problems related to heat equation</li> <li>• Solve the problems by separation of variables</li> <li>• Define and illustrate Fourier and Laplace Transform</li> </ul>
<b>Advanced Discrete Mathematics</b>	<p>Upon successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Define and illustrate Quantifiers, formal logics.</li> <li>• Define and illustrate Boolean Algebra, Switching Algebra</li> <li>• Define graph theory, planar graphs and their properties complete and complete bipartite graphs.</li> <li>• Define and illustrate Trees, spanningtrees, directed graphs</li> </ul>

<b>Fluid Mechanics</b>	<p>Upon successful completion of this course, the student will be able to :</p> <ul style="list-style-type: none"> <li>• Define Kinematics of fluid, pathlines, streak lines</li> <li>• Define Boundary conditions, Axially symmetric flows, Motion of a sphere</li> <li>• Define stream functions, Conformal mapping, Sinks, Sources and doublets</li> <li>• Define Two-Dimensional irrotational Motion produced by Motion of circular Co-axial and elliptical cylinders in an infinite mass of liquid.</li> </ul>
<b>Mechanics of Solids</b>	<p>Upon successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Define Tensor and illustrate theory of elasticity.</li> <li>• Understand about affine transformation. Strain quadric of Cauchy, Analysis of stress.</li> <li>• Define Elasticity and Stress quadric of Cauchy</li> <li>• Understand strain Energy function and its connections with Hook's law, SaintVenant's Principle.</li> </ul>
<b>Functional analysis</b>	<p>At the end of course, students will be able to understand the concept of :</p> <ul style="list-style-type: none"> <li>• Normed linear space, completeness of quotient spaces of normed linear spaces</li> <li>• Second conjugate spaces, reflexive spaces, uniform boundedness principle, equivalent spaces</li> <li>• Inner product space, Hilbert spaces etc.</li> </ul>
<b>Matlab</b>	<p>At the end of this course the student will be able to analyze</p> <ul style="list-style-type: none"> <li>• the working of the Matlab software.</li> <li>• Typing on matlab, Arrays, Creating M- files and Functions, Programming in matlab, Applications in numerical analysis, Symbolic Math.</li> </ul>

<b>Mechanics of Solids 2</b>	<p>At the end of course, students will be able to understand the concept of :</p> <ul style="list-style-type: none"> <li>• Two dimensional problems, generalized plane stress</li> <li>• The structure of various functions</li> <li>• Visco elasticity spring and dashport</li> <li>• Torsion of cylindrical bars</li> <li>• Waves of dilation and distortion</li> </ul>
<b>Integral equations</b>	<p>At the end of course ,students will be able to understand the concept of :</p> <ul style="list-style-type: none"> <li>• Definition of integral equations and their classification</li> <li>• Reduction of a system of algebraic equations, resolvent kernel and their properties</li> <li>• Symmetric kernel, solution of integral equation with symmetric kernel</li> <li>• Solution of singular integral equation</li> </ul>
<b>Advanced fluid mechanics</b>	<p>At the end of course, students will be able to understand the concept of :</p> <ul style="list-style-type: none"> <li>• Stress components in a real fluid, relation between rectangular component of stress</li> <li>• Wave motion in a gas, speed of sound, equation of motion of gas flow through a nozzle</li> </ul>
<b>Differential geometry</b>	<p>At the end of course, students will be able to understand the concept of :</p> <ul style="list-style-type: none"> <li>• Curves with torsions, tangent ,principal normal</li> <li>• Locus of centre of curvature, spherical curvature</li> <li>• Curvilinear coordinates</li> <li>• Principal direction, torsion of geodesics</li> </ul>
<b>Abstract Algebra</b>	<p>At the end of course, students will be able to understand the concept of :</p> <ul style="list-style-type: none"> <li>• Canonical forms-similarity of Linear Transformation, Reduction to triangular forms</li> <li>• The Primary decomposition theorem, Jordan Block, Jordan forms.</li> <li>• Some properties of rings and modules</li> <li>• Wedderburn-Artin theorem, Smith normal form over a Principal and rank, fundamental structure theorem for finitely generated abelian groups and its application to finitely generated abelian groups</li> </ul>
<b>Measure and Integration theory</b>	<p>To acquaint the students with the topics of:</p> <ul style="list-style-type: none"> <li>• Measurable function and its properties</li> <li>• Shortcomings of Riemann integral, Lebesgue integral, Lebesgue convergence theorem</li> <li>• Vitali's converging Lemma, Differentiation of Monotonic Function, fundamental theorem of calculus</li> <li>• LP Space, Convex function, Inequalities, Riesz representation theorem</li> </ul>

<b>O.D.E.</b>	<p>At the end of this course ,the students will be able to analyze :</p> <ul style="list-style-type: none"> <li>• Linear System, Fundamental Sets and Fundamental matrix of a Homogeneous System</li> <li>• System with Constant Coefficient, Periodic Solution, Lagrange’s identity Green’s Theorem</li> <li>• Non –Linear Differential Equation, Plane Autonomous System and their Critical points, Almost Linear System, Liapunov Function</li> <li>• Motivating Problems of Calculus of Variation, Shortest Distance, Euler Equation, Conditional Extremum Under Geometric Constraints &amp; Under Integral Constraints</li> </ul>
<b>Complex Analysis II</b>	<p>At the end of this course ,the students will be able to analyze :</p> <ul style="list-style-type: none"> <li>• The Concept of Analytic Continuation</li> <li>• Properties of Entire Function, Canonical Product, Jensen Formula, Borel’s Theorem , Hadamard’s Theorem</li> <li>• The Range of an analytic Function, Bloch’s Theorem, Picard’s Theorem</li> <li>• Conformal mapping, Green’s Function, Meromorphic Function, Univalent Function, Riemann’s Functional Equation, Poisson Jensen Formula</li> </ul>
<b>Method of Applied Mathematics</b>	<p>To familiarize the students with</p> <ul style="list-style-type: none"> <li>• Fourier Transformation &amp; its Properties</li> <li>• Curvilinear Co-ordinates, contravariant &amp; co-variant Components of a vector, Metric Co-efficient &amp; the Volume element</li> <li>• Sample Spaces, Random Variables, Mathematical Expectation &amp; Moments, Binomial, Poisson, Geometric</li> <li>• Normal &amp; Gamma distribution, multiple regression, F &amp; chi-square distributions, weak law of large numbers &amp; Central limit theorem</li> </ul>
<b>Latex</b>	<p>On completion of this course student will be to develop mathematical typing skills.</p>