Department of Mathematics

Programme Specific Outcome

PSO 1 B.Sc graduates apply their broad knowledge of science across a range of fields, with in-depth knowledge in at least one area of study, while demonstrating an understanding of the local and global contexts in which science is practiced.

PSO 2 Articulate the methods of science and explain why current scientific knowledge is both contestable and testable by further inquiry. Apply appropriate methods of research, investigation and design, to solve problems in science.

PSO 3 Mathematics UG student at Dr. Ambedkar College, Deekshabhoomi, Nagpur will be able to apply critical thinking skills to solve problems that can be modeled mathematically, to critically interpret numerical and graphical data, to read and construct mathematical arguments and proofs, to use computer technology appropriately to solve problems and to promote understanding, to apply mathematical knowledge to a career related to mathematical sciences or in post - UG studies.

Course Outcomes

Course/Semester/ Paper	Name of Paper	Course outcome
B.Sc. Sem I Paper I	**M-1: Elementary Mathematics**	**CO1:** Apply De Moivre's Theorem to find powers and roots of complex numbers, and solve polynomial equations involving complex roots. **CO2:** Analyze and manipulate matrices using various techniques, including determining the rank of a matrix, transforming matrices to row canonical form, solving systems of equations, and applying the Cayley-Hamilton theorem to derive properties of a matrix. **CO3:** Students will gain a comprehensive understanding of

		various theorems and techniques for analyzing and solving equations, including relations between roots and coefficients, Descartes' rule of signs, Horner's process, transformation of equations, reciprocal equations, and solutions for cubic and biquadratic equations. **CO4:** Students will be able to understand and apply the division algorithm, greatest common divisor, Euclidean algorithm, Diophantine equations, the fundamental theorem of arithmetic, properties of congruence, linear congruence, and the Chinese remainder theorem.
B.Sc. Sem I Paper II	**M2: Differential and Integral Calculus**	**CO1:** Students will be able to find out expansion of various functions. **CO2:** Students can find limit and continuity of functions of two variables. **CO3:** Students will able to solve problems of maxima and minima of functions of two variables. **CO4:** Students learn how to find nth derivative of functions by using reduction formulae.
B.Sc. Sem II Paper I	**M3: Geometry, Differential & Difference Equations**	**CO1:** Students get idea about sphere and they can find the equation of sphere. **CO2:** Students get idea about various

		Differential equations and they solve the problems. **CO3:** Students learn second order linear equation they are able to solve the problems. **CO4:** They learn definition of difference equation and are able to find the solutions of difference equations.
B.Sc. Sem II **Paper II**	**M-4: Vector Analysis**	**CO1:** Students will be able to effectively apply vector differentiation techniques, understand concepts of differential geometry, and confidently work with gradient, divergence, and curl operations. **CO2:** Students will possess the skills to successfully perform double integration, evaluate double integrals, apply double integrals in various applications, work with area in polar coordinates, perform triple integration, understand the gamma function, its transformation and relation with the beta function, and evaluate and manipulate the beta function including its symmetric property and transformation. **CO3:** Students will have the ability to effectively integrate vectors over curves, calculate line integrals, perform surface integrals, and evaluate volume integrals.

		CO4: Students will be able to apply Green's theorem in the plane and its applications, understand and utilize the Gauss divergence theorem, and apply Stokes' theorem to solve various problems in vector calculus.
B.Sc. Sem III Paper I	**M5: Partial differential equation and Calculus of variations**	**CO1:** Students learn PDE and come to know how to solve the PDE. **CO2:** Students are able to find linear PDE by various method. **CO3:** Students know the various method of solving linear PDE with constant coefficients. **CO4:** Students get idea of definition of functional and able to find functional.
B.Sc. Sem III Paper II	**M-6: Modern Algebra**	**CO1:** Students will have a solid understanding of the definition and examples of groups, the concept of subgroups, and a counting principle related to group theory. **CO2:** Students will have a comprehensive understanding of normal subgroups and quotient groups, homomorphisms, and permutation groups. **CO3:** Students will have a thorough understanding of the definition and examples of rings, various special classes of rings, homomorphisms, ideals, and quotient rings. **CO4:** Students will have a deep

		understanding of the field of quotients of an integral domain, Euclidean rings, a specific Euclidean ring, and polynomial rings.
B.Sc. Sem IV Paper I	**M7:Real Analysis**	**CO1:** Students are able to find the open sets interior point and limit point of a set, they are able to solve the examples. **CO2:** Students are able to find the convergent and divergent sequence **CO3:** Students learn the infinite series and able to solve the various problems. **CO4:** Students will be familiar with remain integral and properties of integral function.
B.Sc. Sem IV Paper II	**M-8: Mathematical Methods**	**CO1:** Students will possess a comprehensive understanding of the introduction to series solutions, power series review, the series solution of first-order equations, second-order linear equations, ordinary and singular points, regular and irregular singular points, as well as Legendre's and Bessel's equations. **CO2:** Students will have a solid grasp of Legendre's and Bessel's functions, including their properties, generating functions, recurrence relations, and the concept of orthogonality of functions. **CO3:** Students will have a comprehensive understanding of the

		Laplace transform and its application, including the transformation of elementary functions, properties of Laplace transforms, inverse Laplace transforms, transforms of derivatives and integrals, Laplace transform of t·f(t), Laplace transform of f(t)/t, the convolution theorem, and the solution of ordinary differential equations with constant coefficients as well as simultaneous ordinary differential equations. **CO4:** Students will have a comprehensive understanding of Fourier coefficients, convergence issues, even and odd functions, half-range cosine and sine series, and the extension of Fourier series to arbitrary intervals.
B.Sc. Sem V Paper I	**M-9: Complex Analysis**	**CO1:** Students will have a comprehensive understanding of functions of complex variables, including their definition, limits, continuity, differentiability, analyticity, the necessary and sufficient conditions for a function to be analytic, the Cauchy-Riemann equations in polar form, orthogonal curves, harmonic functions, and methods for finding conjugate functions using the Milne-Thomson

		method. **CO2:** students will have a comprehensive understanding of transformations, including conformal transformations, linear transformations, magnification, rotation, inversion, reflection, their combinations, bilinear transformations, and the Schwarz-Christoffel transformation. **CO3:** Students will have a comprehensive understanding of complex integration, including the Cauchy integral theorem, Cauchy integral formula, Morera's theorem, Cauchy's inequality, and Liouville's theorem. **CO4:** Students will possess a comprehensive understanding of the convergence of series with complex terms, Taylor's theorem, Laurent's theorem, singular points, residues, residue theorem, evaluation of real definite integrals using contour integration, and evaluation of improper indefinite integrals.
B.Sc. Sem V Paper II	**M10:Metric Space , Boolean Algebra & Graph Theory**	**CO1:** Students get idea of metric space, interior point, open sets and closed sets. **CO2:** Students solve the problems of metric space and compact sets.

		CO3: Students learn the properties of lattices. **CO4:** Students know basic concept of graph theory and solve the problems. And learn how to find metric representation of graphs.
B.Sc. Sem V **Paper II**	**M-11: Mechanics** **(Optional)**	**CO1:** Students will have a comprehensive understanding of forces acting at a point, parallel forces, moments, couples, coplanar forces, reduction theorems, equilibrium under three forces, general conditions of equilibrium, and the concept of the center of gravity. **CO2:** Students will have developed a thorough understanding of work and energy principles, virtual work applications, the behavior of flexible strings, and the characteristics of the common catenary. **CO3:** Students will have acquired a comprehensive understanding of motion in a plane, including velocity and acceleration components, angular velocity and acceleration, the relationship between angular and linear velocities, tangential and normal components of velocity and acceleration, Newton's Laws of motion, and projectile motion. **CO4:** Students will have developed a

		comprehensive understanding of Lagrange's dynamics, constraints, generalized coordinates, the principle of virtual work and D'Alembert's principle, Lagrange's equations, the reduction of the two-body central force problem to the equivalent one-body problem, motion in a plane under central force, differential equations of an orbit, the inverse square law of force, and the Virial theorem.
B.Sc. Sem VI Paper I	**M-12: Linear Algebra**	**CO1:** Students are able to find that given set is a vector space or not. **CO2:** They learn definition of linear transformation and solve the problems. **CO3:** They come to know the application the theory of ordinary DE. **CO4:** Students get the idea of linear operation of matrices.
B.Sc. Sem VI Paper II	**M13: Numerical Methods (Optional)**	**CO1:** Students will have developed a strong understanding of various numerical methods for solving equations, including the bisection method, the method of false position, iteration methods, the Newton-Raphson method, Ramanujan's method, the secant method, Muller's method, and techniques for solving systems of non-linear equations. **CO2:** Students will have a solid understanding of finite differences, differences of a polynomial, Newton's formulae for interpolation, central difference interpolation formulae, interpolation with unevenly spaced points, divided differences and their properties, as well as inverse

		interpolation. **CO3:** Students will have acquired a comprehensive understanding of numerical differentiation, determining maximum and minimum values of a tabulated function, numerical integration techniques, and the application of the Euler-Maclaurin formula. **CO4:** Students will have developed a solid understanding of various numerical methods, including solution by Taylor's series, Picard's method of successive approximation, Euler's method, Runge-Kutta method, predictor-corrector method, cubic spline method, and techniques for solving simultaneous and higher-order equations.
B.Sc. Sem VI Paper II	**M-14: Special Theory of Relativity (Optional)**	**CO1:** Students will have developed a solid comprehension of Newtonian mechanics, covering topics such as inertial frames, the speed of light and Galilean relativity, the relative nature of space and time, the postulates of the special theory of relativity, the geometric interpretation of Lorentz transformation equations, and the group properties associated with Lorentz transformations. **CO2:** Students will have gained a comprehensive understanding of relativistic kinematics, including the composition of parallel velocities, the relativistic addition law for velocities, transformation equations for velocity and acceleration components, the transformation of Lorentz contraction factor, length contraction, and time dilation. **CO3:** Students will have developed a comprehensive understanding of the geometrical representation of space-time in the context of relativity, including the four-dimensional

		Minkowskian space-time, space-like and time-like intervals, proper time, the concept of the light cone or null cone, and the use of four-vectors and tensors in Minkowskian space-time. **CO4:** Students will have developed a comprehensive understanding of relativistic mechanics and electromagnetism, covering topics such as the variation of mass with velocity, the equivalence of mass and energy, transformation equations for mass, momentum, and energy, relativistic force and its components, relativistic Lagrangian and Hamiltonian, Maxwell's equations in vacuum, propagation of electric and magnetic field strengths, the four-potential, and transformation equations for electromagnetic four-potential vector, electric and magnetic field strengths.