**COURSE & PROGRAMOUT COMES OF**

**Mathematics ( BA & BSc )**

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| **Semester** | **Subject Name and Code** | **Course Outcomes** |
| **SEM-1** | **ALGEBRA** | **CO-1:** Paper:Algebra Subject: Mathematics The course will enable the students to  **CO-2:** Recognize Symmetric, Skew-symmetric, Hermitian and skew Hermitian matrices  **CO-3:** Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.  **CO-**4: Perform Elementary Operations on matrices and find Rank of a matrices  **CO-5:** Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.  **CO-6:** Find eigen values and corresponding eigenvectors for a square matrix. |
| **CALCULUS** | **CO-1:** Sketch the curves in Cartesian and polar coordinates as well as learn techniques of sketching the conics  **CO-2:** Visualize three dimensional figures and calculate their volumes and surface areas.  **CO-3:** Understand limits, continuity and derivatives of functions of single variable.  **CO-4**: Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.  **CO-5**: Compute successive differentials.  **CO-6**: Understand asymptotes, reduction formula, rectification. |
| **SOLID GEOMETRY** | **CO1:**Learn concepts in two-dimensional geometry.  **CO2;** Identify and sketch conics namely, ellipse, parabola and hyperbola.  **CO3:** Learn about three-dimensional objects such as spheres, conicoids, straight lines and plane |
| **SEM-2** | **Differential Equations** | **CO-1:** Learn basics of differential equations and mathematical modeling.  **CO-2:** Formulate differential equations for various mathematical models.  **CO-3:** Solve first order non-linear differential equations and linear differential equations of higher order using various techniques.  **CO-4:**Apply these techniques to solve and analyze various mathematical models. |

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|  | **NUMBER THEORY AND TRIGNOMETR Y** | **CO-1:** Learn about some fascinating discoveries related to the properties of prime numbers.  **CO-2:** • Know about number theoretic functions and modular arithmetic.  **CO-3:** • Learn about equivalent classes and cardinality of a set.  **CO-4:** • Use modular arithmetic and basic properties of congruence. **CO-5:** Solve linear, quadratic and system of linear congruence equations.  **CO-6:** Employ De Moivre’s theorem in a number of applications to solve numerical problems |
| **VECTOR CALCULUS** | **CO-1:**Compute Scalar and vector product of three vectors and four vectors and Reciprocal vectors.  **CO-2:** Compute and apply gradient, divergence and curl of functions. **CO-3:**Transform curvilinear coordinates to Cartesian coordinates and vice versa.  **CO-4:**Apply Gauss, Green and Stocks Theorem. |
| **SEM-3** | **Advanced Calculus** | **CO-1:** Have a rigorous understanding of the concept of limit of a function.  **CO-2:** Learn about continuity and uniform continuity of functions defined on intervals.  **CO-3:** Understand geometrical properties of continuous functions on closed and bounded intervals.  **CO-4:** Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.  **CO-5:** Know about applications of mean value theorems and Taylor’s theorem.  **CO-6:** Learn basics of differential geometry |
| **PARTIAL DIFFERENTIA L EQUATIONS** | **CO-1:** Formulate, classify and transform first order PDEs into canonical form.  **CO-2:** Learn about method of characteristics and separation of variables to solve first orders PDE’s.  **CO-3:** Classify and solve second order linear PDEs.  **CO-4:** Learn about Cauchy problem for second order PDE and homogeneous and non homogeneous wave equations.  **CO-5:** Apply the method of separation of variables for solving many well-known second order PDEs |
| **STATICS** | **CO-1:** Understand Composition and resolution of forces, Parallel forces, Moments and Couples..  **CO-2:** • Derive Analytical conditions of equilibrium of coplanar forces. •  **CO-3:** Understand the concept of Friction and Centre of Gravity. •  **CO-4:** Understand the concept of Virtual work, Wrenches, Stable and unstable equilibrium |
|  | **Sequence and series** | **CO-1:** Understand the real numbers and their basic properties  **CO-2:** Be familiar with convergent and Cauchy sequences.  **CO-3:** Test the convergence and divergence of infinite series of real numbers.  **CO-4:** Test the behavior of sequences.  **CO-5:** Learn about power series expansion of some elementary functions |

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| **SEM-4** | **Special Functions and Integral Transforms** | **CO-1:** Derive Series solution of differential equations.  **CO-2:** • Explore Legendre and Hermite differentials equations and their solutions. •.  **CO-3:** Understand and use Laplace and Fourier transforms and their Properties. • Approximate transcendental functions in terms of power series as well as, differentiation and integration of power series  **CO-4:** Approximate transcendental functions in terms of power series as well as, differentiation and integration of power series |
| **Programming in C and Numerical Methods** | **CO-1:** Learn basics of Programming of C.  **CO-2:** Learn some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.  **CO-3:** Know about methods to solve system of linear equations, such as Gauss−Jacobi, Gauss−Seidel and SOR methods. |
| **Sem 5** | **GROUP AND RINGS** | **CO-1:** Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc. • **CO-2:** Link the fundamental concepts of groups and symmetrical figures. •  **CO-3:** Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups. •  **CO-4:** Explain the significance of the notion of cosets, normal subgroups and factor groups. …  **CO-5:** • Know about group homomorphism and group isomorphism. • **CO-6:** Learn about the fundamental concept of rings, integral domains and fields. •  **CO-7:** Know about ring homomorphism’s and isomorphism’s theorems of rings. • Appreciate the significance of unique factorization in rings and integral domains  … |
| **REAL ANALYSIS** | **CO-1:** Learn about some of the classes and properties of Riemann integral functions, and the applications of the Fundamental theorems of integration. •  .**CO-2:** Know about improper integrals including, beta and gamma functions.  **CO-3:** • Learn about Cauchy criterion for uniform convergence and Weierstrass M-test for uniform convergence. •  **CO-4:** Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces. •  **CO-5:** Learn about the two important topological properties, namely  connectedness and compactness of metric spaces |
| **LINEAR ALGEBRA** | **CO-1:** Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.  **CO-2:** • Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation, and the change of coordinate matrix..  **CO-3:** • Compute inner products and determine orthogonality on  vector spaces, including Gram−Schmidt orthogonalization to obtain |

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|  |  | orthonormal basis. •  **CO-4:** Find the adjoint, normal, unitary and orthogonal operator |
| **SEM 6** | **NUMERICA L ANALYIS** | **CO-1:**Understand Finite Differences operators and their relations. • **CO-2:** Use Gauss forward and Gauss’s backward interpolation formulae, Sterling, Bessel Formula. •  **CO-3:** Use Interpolation techniques to compute the values for a tabulated function at points not in the table. •  **CO-4:** Applications of numerical differentiation and integration to  convert differential equations into difference equations for numerical solutions |
| REAL AND COMPLEX ANALYSIS | **CO-1:** Use Jacobins, Beta and Gama functions, Double and Triple integrals, Drichlet’s integrals, change of order of integration in double integrals. •  **CO-2:** Understand Fourier expansion of piecewise monotonic functions, Properties of Fourier Coefficient, Stereographic projection of complex numbers. •  **CO-3:** Explore Analytic functions and their properties. • Use different type of transformations. |
| DYNAMICS | **CO-1:** Understand the concept of Velocity and acceleration along radial, transverse, tangential and normal directions as well as Relative velocity and acceleration. •  **CO-2:** Understand the terminology of Mass, Momentum and Force. • **CO-3:** State and apply Newton’s laws of motion. • Understand General motion of a rigid body. •  **CO-4:**Study Central Orbits, Kepler laws of motion |