***P. G. Department of Mathematics***

**FYUGP (Mathematics Major)**

**Syllabus Distribution**

***SEMESTER - I***

**MJ01:**

**Dr. Md. Moiz Ashraf**

Unit V: **Integral Calculus:** Reduction formulae, derivations and illustrations of reduction formulae of the type ∫ sinnx dx, ∫ cosnx dx, ∫ tannx dx, ∫ sinnxcosmx dx and ∫ cosmx.cosnx dx, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, Area of bounded curve, volume and area of surface of revolution.

**Dr. P. C. Banerjee:**

Unit I: **Differential calculus:** Differentiability of a real valued function, Geometrical interpretation of differentiability, Rules of differentiation, Chain rule of differentiation; Darboux’s theorem, Rolle’s theorem, Lagrange’s mean value theorem, Cauchy’s mean value theorem, Geometrical interpretation of mean value theorems, Successive differentiation, Leibnitz’s theorem.

Unit IV: **Curve Tracing:** Tracing of Cartesian, polar and parametric curves;

Envelope and evolutes.

**Dr. Shahid Ahmad Hashmi:**

Unit II: **Expansions of Functions:** Maclaurin’s and Taylor’s theorems for expansion of a function in an infinite series, Taylor’s theorem in finite form with Lagrange, Cauchy and Roche–Schlomilch forms of remainder, Maxima and minima.

Unit III: **Curvature and Asymptotes:** Curvature; Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection, Tangents at origin, Multiple points, Position and nature of double points.

***SEMESTER - II***

**MJ02:**

**Dr. Md. Moiz Ashraf**

Unit I: **Theory of numbers**: Well-ordering property (WOP) of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, Principles of Mathematical Induction, Fundamental Theorem of Arithmetic.

Unit IV: **Eigen values and Eigen vectors of matrices**: Characteristic polynomial of a matrix, Eigen values and Eigen vectors, A.M. and G.M. of Eigen values, Theorems on Eigen values and Eigen vectors, Minimal Polynomial, Cayley-Hamilton theorem.

**Dr. Shahid Ahmad Hashmi:**

Unit II: Matrices: Matrices and types of matrices, determinants, operations on matrices, submatrix, block Matrix, Invertible Matrices, Uniqueness of Inverse Matrix, Rank of a matrix, Normal form PAQ, Canonical or Echelon form, Rank-Nullity Theorem of a Matrix.

Unit III: System of linear equations: Matrix form of system of linear equations, augmented matrix, consistent and inconsistent system of linear equations, necessary and sufficient condition consistency of a system of linear equations, method of solving of homogeneous and non-homogeneous linear equations.

**MJ03:**

**Dr. P. C. Banerjee:**

Unit II: **Analytical geometry of three dimensions:** Direction cosines, Straight line, Plane, Sphere, Two Intersecting Spheres, Spheres Through a Given Circle Cone, Cylinder.

Unit III: **Conicoid:** Central conicoids, paraboloids, plane sections of conicoids, Generating lines. Reduction of second-degree equations to normal form; classification of quadrics.

**Dr. B. P Singh:**

Unit I: **Analytical geometry of two dimensions:** Transformation of rectangular axes, General equation of second degree and its reduction to normal form, Systems of conies, Polar equation of a conic.

**Prof. Yashmin Banu:**

Unit V: **Trigonometry:** Polar form of complex number, nth roots of unity, De-Moivre's Theorem, Applications of De-Moivre's Theorem in expansions trigonometric function, Hyperbolic function, Exponential Function and their properties.

***SEMESTER - III***

**MJ04:**

**Dr. Md. Moiz Ashraf**

Unit I: **Real Number System**

Axioms in ℝ, Absolute value of a real number; Bounds of a sets, Supremum and infimum of a nonempty subset of ℝ, The completeness property of ℝ, Archimedean property, Definition and types of intervals, Neighborhood of a point in ℝ, Open, closed and perfect sets in ℝ**Integral Calculus:** Reduction formulae, derivations and illustrations of reduction formulae of the type ∫ sinnx dx, ∫ cosnx dx, ∫ tannx dx, ∫ sinnxcosmx dx and ∫ cosmx.cosnx dx, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, Area of bounded curve, volume and area of surface of revolution.

Unit II: **Sequences of Real Numbers:**

Convergent sequence, Limit of a sequence, Bounded sequence, Limit theorems, Monotone sequences, Weierstrass’ theorem for−sequences, Monotone convergence theorem, Subsequences, Bolzano sequences, Limit superior and limit inferior of a sequence of real numbers, Cauchy sequence, Cauchy’s first theorem on limit, Cauchy’s convergence criterion. Completeness property of set of real number.

**Dr. P. C. Banerjee:**

Unit III: **Infinite Series**

Convergence and divergence of infinite series of positive real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Tests for convergence of positive term series; Basic comparison test, Limit comparison test, D’Alembert’s ratio test, Raabe’s test, Logarithmic test, Cauchy’s condensation Test, De Morgan & Bertrand’s test, Higher logarithmic test, Gauss’s test, Cauchy’s root test, Integral test;

Unit IV: **Alternating series**: Alternating series, Leibniz test, Absolute and conditional convergence. Properties of absolutely convergent series.

**MJ05:**

**Dr. Shahid Ahmad Hashmi:**

Unit I: **Product of three & four vectors:** Product of 3 & 4 vectors, Reciprocal system of vectors, Lami’s theorem, $λ-μ$ theorem, work done, Moment of force. Couple.

Unit II: **Vector Differentiation:** Vector function of scalar variable t, it’s derivative and geometrical meaning, Derivative of product of two and three vectors

Unit III: **Grad, Divergence & Curl:** Scalar point function and vector point function, grad, divergence and curl, their expansion formulae and properties.

Unit IV: **Green’s, Stoke’s & Gauss’s Divergence theorem:** Line integrals, Applications of line integrals: Mass and Work, Fundamental theorem for line integrals, Conservative vector fields, Green's theorem, Area as a line integral, Surface integrals, Stokes' theorem, The Gauss divergence theorem.

***SEMESTER - IV***

**MJ06:**

**Dr. Md. Moiz Ashraf**

Unit I: Limit and Continuity: Limit, Continuity, Discontinuities, uniform continuity, properties of functions continuous in closed intervals, Functions of bounded variation.

Unit II: Derivability, Relationship with continuity, Taylor’s theorem, Maclaurin’s theorem, remainder after n terms, Power series expansion of (1+x)n, sinx, cosx and log (1+x) using suitable remainder after n terms.

Unit III: Riemann Integration Definition, Darboux’s theorem I & II. Integrability condition, particular classes of bounded integerable function primitive, fundamental theorem, first and second Mean value theorem.

**Dr. P. C. Banerjee:**

Unit IV: Index family of sets, Generalised set operations & De-Morgan Laws, set Bijection mapping: Countable and Uncountable sets, Equivalence relation and related fundamental theorem on partition. Partial order & Total order relation

**MJ07:**

**Dr. Shahid Ahmad Hashmi:**

Unit I: First order higher degree ordinary differential equations, Equation solvable for y, solvable for x, Clairaut’s form, singular solution orthogonal trajectories.

Unit II: Linear Differential Equation of higher order with constant coefficients. Homogeneous linear differential equation (Cauchy- Euler’s Form)

Unit III: Second order linear differential equations: Normal forms (removal of first derivative) solution by changing independent variable and by variation of parameters.

Unit IV: Simultaneous equation dx/P = dy/Q = dz/R and Total differential equation Pdx+Qdy+Rdz=0 together with their geometrical significance.