

SYLLABUS

B. Sc. Mathematics

BMG: 101

ABSTRACT ALGEBRA

Max Marks: 50

Unit-I

Sets and Logic (No question should be asked on this part). The well-ordering principle. The division algorithm. The fundamental theorem of arithmetic, Congruence modulo. Equivalence relations and Equivalence classes.

Unit-II

Groups: Definition, Examples and Properties, Permutation and Permutation group, Subgroups and their properties.

Unit-III

Cosets and Coset decomposition, Lagrange's theorem and its corollaries, Fermat's theorem, Cyclic group.

Unit-IV

Normal subgroup, Centre of a group, Quotient group, Homomorphism and Isomorphism, Fundamental theorem of homomorphism, Cayley's theorem.

Unit-V

Ring, Examples and simple properties, Different types of rings, Subring and Ideals, Divisibility in an integral domain, Polynomial ring, Field and simple properties.

Books Recommended:

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| 1. Thomas A. Whitelaw | Introduction to Abstract (Blakie & Son Ltd.) |
| 2. R.S. Mishra and N.N. Bhattacharya | Fundamental structure in Modern Algebra |
| 3. Bhattacharya, Jain & Nagpal | Abstract Algebra (Cambridge Uni. Press) |

BMG: 102

CALCULUS

Max Marks: 50

Unit-I

Successive differentiation: Expansion of functions, Maclaurin's and Taylor's theorems.

Unit-II

Maxima and minima up to two independent variables, Indeterminate form, Jacobian of three functions, Partial differentiation.

Unit-III

Asymptotes, Curvature, Envelop, Double point and curve tracing (Polar and Cartesian).

2. S.L.L.Loney
3. Schaum's series

Trigonometry part III
Coordinate Geometry

BMG: 201

Max Marks: 50

Elementary Analysis, Differential Equations and Vector Calculus

Unit-I

Real –Valued functions, Equivalence, Countability, Real numbers, Least upper bound, Sequence of real numbers, Series of real numbers.

Infinite series: Introduction, Alternating series with Leibnitz test, P-series test for positive terms, Comparison test for positive terms, D'Alembert's ratio test, Cauchy's root test, Raabe's test, Logarithmic test,

Open sets, closed sets on \mathbb{R} , Derivatives, Rolle's Theorem, The law of the mean.

Unit-II

Ordinary differential equation of the first order and first degree, Clairaut's form of differential equations, Orthogonal trajectories, Linear differential equations with constant coefficient, Homogeneous linear differential equations.

Unit-III

Linear differential equation of second order with constant coefficients.

Unit-IV

Scalar and Vector product of three vectors, Product of four vectors, Reciprocal vectors, Vector differentiation, Directional derivatives, Gradient, Divergence and Curl.

Unit-V

Vector integration, Theorems of Gauss, Green, Stokes and problems based on these.

BOOKS SUGGESTED

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| 1. R.R.Goldberg | Methods of Real Analysis |
| 2. Gorakh Prasad | Integral Calculus |
| 3. Shanti Narayan | A text –Book of Vector Calculus
(S. Chand & Co. New Delhi) |
| 4.G.F.Simmons | Differential Equations |
| 5. Murray R. Spiegel | Vector Analysis, Schaum Pub. Company New York |
| 6 S.L.Ross | Ordinary Differential Equations |
| 7 H.L.Royden | Real Analysis |

BMG: 202

Linear Algebra

Max Marks: 50

Unit-I

Vector Space: Field, Vector space, Subspaces, Base and dimension, Coordinates, Summary of rows equivalence, Computations concerning subspaces.

Unit-II

Linear Transformations: Linear transformations and their algebra. Isomorphism, Representation of transformations by matrices.
Linear functionals, Double dual, Transpose of linear transformations.

Unit-III

Polynomials: Algebra of polynomials, Polynomial ideals, Determinant functions and simple properties.

Unit-IV

Canonical Form: Characteristic values and Characteristic vectors, Annihilating polynomials, Examples of invariant subspaces.
Diagonalization, Orthogonal diagonalization, Applications to differential equations.

Unit-V

Quadratic forms: Quadratic forms in two and n variables, Cross-product terms of the quadratic form. Positive definite Quadratic form, Diagonalization of quadratic forms, Application to conic sections.

Books Recommended:

1. H.Anton Elementary Linear Algebra , John Wiley & Sons.
2. Charles W.Curtis(C.W.Curtis) Elementary Linear Algebra

BMG: 203

Mechanics

Max Marks: 50

Unit-I

Virtual Works: Equilibrium of strings and chains (common catenary and catenary of uniform strength), Stable and Unstable equilibrium, Moments and couples, Varignon's theorem of moments

Unit-II

Equilibrium of forces in three dimensions, central axis, Wrench and Screw, Pitch of the wrench.

Unit-III

Kinematics, Motion in a straight line and a plane, Radial and transverse velocities and accelerations.

Unit-IV

Angular velocity and acceleration, Tangential and normal velocities and acceleration, Rectilinear motion with constant acceleration.

Unit-V

Simple harmonic motion, Hook's law, Repulsion from a fixed point varying as the distance from the point, Constrained motion on a smooth plane (Vertical circle and cycloid) , Projection.

Unit-I

Curves With Torsion: Tangent, Principal normal-Curvature, Binormal -Torsion, Serret-Frenet formulae, Locus of centre of curvature and examples. Spherical curvature, Locus of centre of spherical curvature, Theorem: Curve determined by its intrinsic equation, Helices, Spherical indicatrix of tangent, Involutives, Evolutes. Bertrand curves.

Unit-II

Envelopes, Developable Surfaces: Surfaces, Tangent plane –Normal, One –Parameter Family of Surfaces: Envelope, Characteristics, Edge of regression, Developable surfaces, Developables associated with a curve: Osculating development, Polar development, Rectifying development. Two –parameter Family of Surface: Envelope, Characteristics points, and its examples.

Unit-III

Curvilinear Coordinates on a Surface Fundamental Magnitudes: Curvilinear Coordinates, First order magnitude, Directions on a surface, The normal, Second order Magnitude, Derivatives of n , Curvature of normal section, Meunier's theorem and examples.

Unit-IV

Curves on a Surface: Lines of Curvature: Principal direction and curvatures, First and second curvature, Euler's theorem, Dupin's indicatrix, The Surface $z = f(x,y)$, Surface of revolution and examples. Conjugate directions, Conjugate systems.

Asymptotic lines, Curvature and torsion, Isometric Parameters, Null Lines or Minimal curves and examples.

Unit-V

The Equations of Gauss and of Codazzi: Gauss's formula for r_{11}, r_{12}, r_{22} , Gauss's characteristic equations, Mainardi–Codazzi relations, Alternative expressions, Bonnets theorem, Derivation of an angle ω and examples.

Geodesic: Geodesic property, Equations of geodesics, Surface of revolution, Torsion of a geodesic, Curves in relation to Geodesics : Bonnet's theorem, Joachimsthal's theorems, Vector curvature, Geodesic curvature and its other formulae, Examples.

Books Recommended:

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| 1.C.E.Weatherburn | Differential Geometry |
| 2.Bansi Lal | Differential Geometry, Atma Ram & Sons, Delhi |
| 3.Andrew Presely | Elementary Differential Geometry, Springer |

BMG: 303

Linear Programming and Probability

Max Marks: 50

Unit-I

Convex sets and their properties, Introduction to linear programming problems, Mathematical formulation, graphical method, Simplex method.

Unit-II

Concept of duality in linear programming, Framing of dual problems, Dual simplex method, Sensitivity analysis.

Unit-III

Revised simplex method, Transportation problem and assignment problem.

