

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR
FIRST YEAR B. Sc. MATHEMATICS 2016-17

PAPER-I
ALGEBRA

Duration: 3 Hours

Max. Marks: 75

UNIT-I

Symmetric, Skew Symmetric, Hermitian and skew Hermitian matrices. Linear independence of row and column matrices. Row rank, column rank and rank of a matrix. Equivalence of column and row ranks.

Eigen values, Eigen vectors and characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding inverse of a matrix. Theorems and examples of consistency of a system of linear equations.

UNIT- II

Relation between the roots and coefficients of general polynomial equation in one variable. Transformation of equations. Descartes's Rule of signs, solution of Cubic equations (Cardan method). Biquadratic equations. Horner's Method, Ferrari's Method.

UNIT-III

Groups and their defining theorems. Various examples, order of an element and related theorems, Permutation Groups, even and odd permutations, cyclic groups, subgroups, union, intersection of two and finite subgroups and various examples, product of two subgroups.

UNIT –IV

Left and right cosets and their properties, Lagrange's theorem, index of a subgroup. Normal subgroups their examples and elementary basic theorems, Quotient group. Simple group, centre of group, Normalizer of an element and that of a subgroup, Conjugacy relation, class equation for finite groups.

UNIT-V

Group homomorphism and isomorphism with elementary basic properties, Cayley's theorem for finite groups, fundamental theorem of homomorphism in groups. The three isomorphism theorems of groups. Automorphisms and inner automorphisms.

References:

1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.

2. R. S. Agrawal : A Textbook on Modern Algebra.
3. K. B. Datta : Matrix and Linear Algebra Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
4. H. S. Hall and S.R. Knight : Higher Algebra, H.M. Publications, 1994.
5. Bansal, Bhargava, Agrawal : Amurt Beej Ganita.
6. Chandrika Prasad : Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd, Allahabad.
7. Gokhroo, Saini : Elements of Abstract Algebra
8. Sharma, Purohit : Elements of Abstract Algebra

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FIRST YEAR B. Sc. MATHEMATICS 2016-17

PAPER-II
CALCULUS

Duration: 3 Hours

Max. Marks: 75

UNIT-I

Polar coordinates and derivatives of arc, polar subtangent and subnormal, pedal-equation, Roll's Theorem, Mean Value Theorems, Taylor's Theorem, their proofs, verifications and applications.

UNIT -II

Asymptotes, curvature, Test of concavity and convexity. Points of inflexion. Multiple points. Tracing of curves in Cartesian and polar coordinates.

UNIT – III

Beta Gamma functions and their properties. Quadrature, Rectification.

UNIT - IV

Degree and order of a differential equation. Equations of first order and first degree, Equations in which the variables are separable, Homogeneous equations. Linear equations and equations reducible to the linear form. Exact differential equations.

UNIT - V

First order and higher degree equations solvable for x, y, p . Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Linear differential equations with

constant coefficients. Homogeneous linear ordinary differential equations and the equations reducible in homogeneous form.

References:

1. Gorakh Prasad : A Text book on differential calculus (Pothe shala)
2. Gorakh Prasad : A Text book on Integral calculus and Differential Equations (Pothe shala).
3. E. A. Codington : An introduction to ordinary Differential Equations Prentice Hall of India, 1961.
4. P.K. Jain and S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co., New Delhi-11, 2000.
5. Bansal, Bhargava : Avakalan Ganita-II
6. Bansal, Bhargava : Samakalan Ganita-II
7. Gokhroo, Saini : Uchch Avakalan Ganita.
8. Gokhroo, Saini : Uchch Samakalan Ganita.
9. Bansal, Bhargava & Agrawal : Avkal Samikaran I .
10. Gokhroo, Saini, Kumbhat : Avkal Samikaran.

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FIRST YEAR B. Sc. MATHEMATICS 2016-17

PAPER –III

GEOMETRY

Duration: 3 Hours

Max. Marks: 75

UNIT -I

General equation of second degree, nature of conic, eccentricity and foci of conic, Tracing of different conics. Ellipse : Tangent, normal, Chord of contact of the tangents, pole and polar, eccentric angle, auxiliary circle, director circle, equation of chord in term of middle point, pair of tangents, conjugate lines, diameter and conjugate diameters and their properties.

UNIT - II

Hyperbola: Parametric coordinates, tangent, normal, chord of contact of tangents, pole and polar etc. asymptotes, conjugate hyperbola, conjugate diameters, rectangular hyperbola,

equation of hyperbola referred to its asymptotes. Polar Equations: Polar equation of conic, polar equations of tangent, perpendicular lines and normal, director circle of the conic.

UNIT-III

Plane and straight line: Equation to represent two planes and angle between them, projection on a plane area of a triangle and volume of tetrahedron. Equations of line intersecting two lines, skew lines, shortest distance between two lines, intersection of three planes and three lines.

UNIT- IV

Sphere: General Equation, Tangent Plane, Pole and Polar, Intersection of two spheres, Radical plane, Radical line, Radical centre, Co-axial spheres, Limiting points.

Cone: Enveloping cone, Tangent plane, Reciprocal cone, Three mutually Perpendicular generators, Right circular cone.

Cylinder: Right circular cylinder, Enveloping cylinder

UNIT-V

General equation of second degree in three dimensions. Intersection of a line and a conicoid. Tangent lines and Tangent plane. Condition of tangency, plane section with a given centre. Diametral plane. Principal planes, principal directions and plane sections.

References:

1. Gorakh Prasad and H.C. Gupta : A Text book of coordinate Geometry (Pothishala)
2. S.L.Loney : The Elements of coordinate Geometry; Mack-Millan and Company, London.
3. R.J.T. Bell : Elementary Treatise on coordinate Geometry of Three Dimensions.
4. P.K. Jain and Khalil Ahmed : A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd., 1999.
5. N.Saran and R.S.Gupta : Analytical Geometry of Three Dimentions.(Pothhishala)
6. Bansal, Bhargava : Dwivim Nirdeshank Jyamiti
7. Gokhroo, Saini : Dwivim Nirdeshank Jyamiti
8. Gokhroo, Saini : Trivim Nirdeshank Jyamiti
9. Bansal, Bhargava : Trivim Nirdeshank Jyamiti.
10. Golas, Tandon, Bhargava : Analytical solid Geometry.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR
SECOND YEAR B. Sc. MATHEMATICS 2016-17

PAPER – I
ADVANCED CALCULUS

Duration: 3 Hours

Max. Marks: 75

UNIT - I

Continuity: Cauchy definition of continuity of a function of one variable, Notion of limit and continuity of function of two variable (Not Theorems), discontinuous functions and their kinds, Properties of continuous functions at a point and in closed intervals. Derivability: Differentiable functions and their properties including Darboux theorem, Examples of continuous and differentiable functions.

UNIT - II

Partial differentiations, envelopes and evolutes, Maxima and Minima of two variables and more than two variables including Lagrange's method of undetermined multipliers.

UNIT -III

Evaluation of double and triple integrals, Dirichlet's theorem and Liouville's extension, change of order of integration and volume and surface of solid of revolution.

UNIT - IV

Jacobians, change of independent variables. Vector Calculus: Direction of derivatives, gradient of scalar functions, irrotational Vectors, definition of gradient, divergence of a vector, curl of a vector, curl of the product of a scalar and vector, divergence of a vector product.

UNIT - V

Vector Integration: Gauss's theorem, divergence of the product of a scalar and a vector, Stoke's theorem, surface integral of the curl of a vector, Green's theorem (Excluding the proofs of the theorems)

References:

1. Gorakh Prasad : Differential calculus, Pothishala Pvt. Ltd., Allahabad.
2. Gorakh Prasad : Integral calculus, Pothishala Pvt. Ltd., Allahabad.
3. Malik, S.C. : Mathematical Analysis, Wiley Eastern Ltd., New Delhi
4. Shanti Narayan : A Course of Mathematical Analysis, S. Chand and Company, New Delhi.
5. Jain, P.K. and : An Introduction to Real Analysis by, S. Chand and Company, New Delhi.
6. Kaushik, S.K. : Principles of Mathematical Analysis.
7. Walter Rudin : A first course in Real Analysis.
8. Sharma Purohit : Elements of Real Analysis.
9. Bhargava, Goyal : Real Analysis.
10. Sharma, Gokhroo : Real Analysis.
11. Spain, B. : Vector Analysis.
12. Bhargava, Banwari Lal : Sadish Kalan.
13. Gokhroo, Saini : Sadish Kalan.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR
SECOND YEAR B. Sc. MATHEMATICS 2016-17

PAPER – II
DIFFERENTIAL EQUATIONS

Duration: 3 Hours

Max. Marks: 75

UNIT - I

Exact differential equations and equations of special forms. Simultaneous differential equations. Total differential equations.

UNIT – II

Linear differential equations of second order and their solutions by:

- (i) The method of finding an integral of the C.F. by Inspection,
- (ii) Changing of independent variables,

- (iii) Removal of the first derivative,
- (iv) Operational factors,
- (v) Undetermined coefficients and
- (vi) Variation of parameters.

UNIT - III

Linear partial differential equations of first order: Lagrange's method, Integral surfaces passing through a given curve, orthogonal surfaces, Geometric description of $Pp+Qq=R$. Non-Linear partial differential equations of order one. Special methods of their solutions applicable to certain standard forms.

UNIT -IV

Charpit's method of solving non linear partial differential equations of first order, Monge's method of integration of equations $Rr + Ss + Tt = V$. Higher order homogeneous linear part of differential equation of the first order.

UNIT - V

Numerical solutions of ordinary differential equations: Introduction about initial value problem, boundary value problem, Euler's method, short comings. Euler's modified method. Picard's method of successive approximation and Picard's method for simultaneous equations.

References:

1. Ray and Sharma : Differential equation.
2. Bansal, Dharmi : Differential equation (Vol. II).
3. Raisinghania, M.D. : Advanced differential equations.
4. Murray A. Daniel : Differential equation.
5. Forsyth, A.R. : A Treatise on Differential equation.
6. Ian N. Sneddon : Elements of Partial differential equations.,
Mc Graw–Hill Book Company.
7. Gokhroo, Saini, Kumbhat : Avkal Samikaran.
8. Gokhroo, Saini, Ojha : Partial differential equations.
9. Codington, E.A. : An introduction to ordinary differential equation by,
Prenticehall of India.

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SECOND YEAR B. Sc. MATHEMATICS 2016-17

PAPER – III
MECHANICS

Duration: 3 Hours

Max. Marks: 75

UNIT – I

Equilibrium of bodies under three or more forces, Friction, common category.

UNIT –II

Virtual work, Projectile on inclined plane and Impact.

UNIT – III

Velocity and Accelerations (Tangential, normal, radial, transversal), Rectilinear motion, Hooke's law and motion of horizontal and vertical strings.

UNIT –IV

Constrained motion (circular and cycloidal), motion under resisting medium (resistance varies as velocity and square of velocity).

UNIT –V

Fluid pressure and thrust on immersed plane surfaces. Center of pressure.

References:

1. S. L. Loney : Statics, Macmillan and Company, London.
2. R.S. Verma : A Text book of Statics (Pothishala)
3. Ray & Sharma : A Text book of Hydrostatics
4. N.Sharma : A Text book of Dynamics.
5. M Ray : A Text book of Dynamics.
6. Bhargava & Agrawal : Gati Vigyan
7. Gokhroo, Saini : Uchch Gati Vigyan
8. Gokhroo & Others : Hydrostatics(Hindi Ed.)
9. Gokhroo & Others : Statics (Hindi Ed.)
10. Bhargava & Others : Hydrostatics (Hindi Ed.)
11. Bhargava & Others : Statics (Hindi Ed.)

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR
THIRD YEAR B.Sc. MATHEMATICS 2017-18

PAPER – I
REAL ANALYSIS

Duration: 3 Hours

Max. Marks: 75

UNIT - I

Real number system:

- (i) Field, ordered field, upper and lower bounds of a set in an ordered field. Supremum and infimum of a set and their properties. Completeness, Archimedean and denseness properties of an ordered field, the set Q of rational numbers as a non-complete dense Archimedean ordered field and the set R of real numbers as a complete dense Archimedean ordered field,
- (ii) Open interval, closed interval, neighbourhood of a number. Real line R -Interior points and limit points of a set in R , open sets and closed sets in R and their properties, Nested Interval property. Bolzano-Weierstrass theorem, Heine Borel theorem, Compact set and connected set and their properties.

UNIT - II

- (i) Sequence, Bounded sequence, monotonic sequence, limit of a sequence, convergent sequence, properties of convergent sequence, Cauchy first and second theorems on limits, subsequence and its properties, Cauchy sequence and its properties, Cauchy general principle of convergence, Examples of convergent sequences.
- (ii) Series: Convergence and divergence of an Infinite series of real numbers, the necessary and sufficient conditions, various tests of convergence problems and their illustrations with regard to infinite series of positive terms. Series: Alternating series and Leibnitz test, absolute and semi (or conditional) convergence.

UNIT-III

Riemann Integration: Upper and Lower Darboux sum, Upper and Lower Riemann integrals, Riemann integrability of a bounded function in a closed interval, the necessary and sufficient condition for R integrability in terms of Darboux sums, properties of R -integrable functions, Fundamental theorem of integral Calculus.

UNIT - IV

- (i) Uniform convergence of sequences and series of functions, various tests including M_n -test and Weirstrass M-test, relations of uniform convergence with the continuity of the limit and the sum functions and also with term by term differentiation and term by term integration.
- (ii) Fourier series representation of periodic functions which are even, odd and none of these in the full interval or half the interval.

UNIT - V

- (i) Convergence of improper integrals - various tests and their applications, Evaluation of such integrals.
- (ii) Equivalent sets and their examples, nature of the relations of equivalence. Denumerable and non numerable sets, countable and uncountable sets, Nature of subsets of a countable set and that of a denumerable (countable) sets, union of denumerable (countable) sets, Denumerability of the sets of integers and rational numbers and non denumerability of the closed unit interval $[0, 1]$ and the sets of real numbers and irrational numbers.

References:

1. T. M. Apostol : Mathematical Analysis.
2. R. R. Goldbeg : Real Analysis
3. Walter Rudin : Principles of Mathematical Analysis
4. P.K. Jain & S. K. Kaushik : An introduction to Real Analysis.
5. D. Somasundaram & B. Chaudhary : A First Course of Mathematical Analysis.
6. G. F. Simmon : Introduction to Topology.
7. Bhargava & Goyal : Real Analysis.
8. Gokhroo & others : Real Analysis.
9. Sharma & Purohit : Elements of Real Analysis.

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THIRD YEAR B.Sc. MATHEMATICS 2017-18

PAPER – II
ABSTRACT ALGEBRA

Duration: 3 Hours

Max. Marks: 75

UNIT – I

Rings, definition and examples of various kinds of rings, integral domain, division ring, field, characteristic of a ring and integral domain, subring and subfield With examples. Left and right ideals with examples and properties, Principal ideal, principal ideal ring. Maximal, prime and Principal ideals in Commutative rings and their theorems.

UNIT -II

Quotient ring, Homomorphism and isomorphism in rings, kernel of homomorphism, Fundamental theorem of ring homomorphism. The three isomorphism theorems in rings, Embedding of a ring into a ring with unity and also into a ring of endomorphism of some abelian groups, Quotient field of an integral domain.

UNIT - III

Definition and various examples of vector spaces, subspaces and examples, Intersection, sum and direct sum of two subspaces, Linear span, Linear dependence, independence and their basic properties and problems.

UNIT- IV

Basis, Dimension and examples, Finite dimensional vector spaces, Existence theorem for a basis, Extension theorem, Invariance of the number of elements of a basis set, Existence of complementary subspaces of a subspace of a finite dimensional vector space, Dimension of sum (and direct sum) of two subspaces, Quotient space and its dimension.

UNIT - V

Linear transformations, Rank and Nullity of a linear transformation, Sylvester law of nullity, to obtain a matrix from a linear transformation and vice-versa and their problems relating to the same and different bases. The algebra of linear transformations, dual space and dual basis and dimension of dual space, bidual space and natural isomorphism (Reflexivity).

References:

1. Surjeet Singh and Quazi Zarneeruddin : Modern Algebra.
2. I.N.Herstein : Topics in Algebra.
3. R.S.Agrawal : Algebra.
4. Gokhroo, Saini : Advance Abstract Algebra.
5. Shanti Narayan : A Text-Book of Modern Abstract Algebra.
6. Hoffman and Kunze : Linear Algebra, (Second Edition).
7. Purohit, Pareek and Sharma : Linear Algebra.
8. Halmos, Paul R : Finite - Dimensional Vector spaces.

Paper –III (Optional): Any one of the following papers –

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR
THIRD YEAR B.Sc. MATHEMATICS 2017-18

PAPER -III (A)
DISCRETE MATHEMATICS

Duration: 3 Hours

Max. Marks: 75

UNIT – I

Sets and propositions – cardinality, Mathematical Induction, Principle of Inclusion and exclusion. Computability and formal language- ordered set. Language phrase structure Grammars. Types of Grammars and languages. Permutation and combinations: Simple problems.

UNIT –II

Relations and functions:- Binary Relations, Equivalent Relations and Partitions, Partial order relations and lattices, Pigeon Hole principle. Graphs and planar graphs: - Basic Terminology; Multigraphs, weighted graphs, paths and circuits shortest paths. Eulerian paths and circuits. Planar graphs.

UNIT – III

Trees: Rooted trees, Binary tree, Decision or sorting tree, spanning tree, minimal spanning tree. Pumping lemma. Finite state machine: Equivalent machines, Finite state machine as Recognizers. Analysing Algorithms– Time complexity, complexity of problems.

UNIT –IV

Recurrence Relations and Recursive Algorithms: Linear Recurrence Relations with constant coefficients, Homogeneous solutions, Particular solution, Total solution, Solution by the method of generating functions.

UNIT – V

Brief review of groups and Rings. Boolean Algebras – Lattices and Algebraic structures. Duality, Distribution and complemented Lattices, Boolean Lattice and Boolean Algebras, Boolean function and expressions, Propositional calculus, Design and Implementation of Digital network - Switching circuits.

References:

1. C.L. Liu : Elements of Discrete Mathematics
2. K.D. Joshi : Foundation of Discrete Mathematics
3. Mradula Garg & R. Panday : fofodrxf.kr
4. Gokhroo et.al : fofodrxf.kr

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PAPER- III (B)

NUMERICAL ANALYSIS AND OPERATIONS RESEARCH

Duration: 3 Hours

Max. Marks: 75

UNIT - I

Differences, Relation between differences and derivatives, differences of Polynomial, Newton-Gregory formula for forward and backward interpolation, divided differences. Newton's General interpolation formula, Lagranges's interpolation formula.

UNIT - II

Gauss's central difference formula, Stirling's and Bessels interpolation formula, Inverse interpolation. Numerical differentiation, Derivatives from Interpolation formulae, Method of operators, Numerical Integration: Newton-cotes Quadrature formula, Trapezoidal, Simpson's one third, Simpson's three-eight rules.

UNIT-III

Gauss Quadrature formulae, Estimation of errors in quadrature formula, location of roots by Descarte's method of sign, Newtons theorem on multiple roots, Numerical solution of Algebraic and Transcendental equations, Bisection method, Regula-Falsi method, Method of integration .

UNIT-IV

Introduction to linear programming problems, Mathematical formulation Graphical method of solution of linear programming problems (Problems of two variables only), Theory of convex sets, Theory of Simplex method and its applications to simple linear programming problems.

UNIT - V

Concepts of duality in linear programming, formation of dual problems, Elementary theorems of duality. Assignment and transportation problems and their optimum solutions.

References:

1. C. E. Froberg : Introduction to Numerical Analysis
2. M. K. Jain, S. R. K. Iyenger and R.K. Jain : Numerical methods: Problems & solutions
3. G. Hadley : Linear Programming
4. Kanti Swaroop, P. K. Gupta and Man Mohan : Operation Research
5. H.C. Saxena : Numerical Analysis
6. Goyal, Mittal : Numerical Analysis
7. Goyal, Mittal : Numerical Analysis (Hindi ed.)
8. Goyal, Mittal : Numerical Analysis (Hindi ed.)
9. Goyal, Mittal : Operations Research
10. S.D.Sharma : Operations Research
11. Gokhroo, Saini, Jain : Operations Research (Hindi ed.)
12. Bhargava, Bhati, Sharma : Linear Programming (Hindi ed.)
13. Gokhroo, Saini, Jain : Linear Programming (Hindi ed.)

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

THIRD YEAR B.Sc. MATHEMATICS 2017-18

PAPER- III(C)

MATHEMATICAL STATISTICS

Duration: 3 Hours

Max. Marks: 75

UNIT -I

Probability: Definitions of Probability, Addition and Multiplication laws, Conditional probability , Independent events, Baye's Theorem.

UNIT II

Random variable, Distribution function, Probability mass & density functions, probability distribution, Joint, marginal and conditional probability functions.

UNIT –III

Mathematical expectation and Moments, Addition & Multiplication law, Covariance, Expectation and Variance of linear combination of two variables, Moment generating, cumulant generating & characteristic functions.

UNIT –IV

Theoretical Probability distributions- Binomial, Poisson and Normal distributions and their properties.

UNIT –V

Curve fitting by the principle of least squares, fitting of straight line and parabola, Bivariate linear correlation and regression.

Books Recommended:

1. Mathematical Statistics, J. N. Kapur & H.C. Saxana, S. Chand & Co., New Delhi.
2. Fundamentals of Mathematical Statistics, V. K. Kapoor & S.C. Gupta, Sultan Chand & Sons, New Delhi.
3. Mathematical Statistics by Dr. Gokhroo & Saini.

NOTE:

Candidates who have offered Statistics as an optional subject will not be permitted to offer the paper III (B) and III (C). Candidates who have offered Computer science as an optional subject will not be permitted to offer paper III (B).