

**B.A./B.Sc. (Mathematics) Syllabus  
(Semester System)  
Sri Dev Suman University, Badshahithaul (Tehri Garhwal)**

(With effect from session 2018-2019)

**B.Sc. I Semester**

S.NO.	Paper	Paper code	Maximum Marks	
			External	Internal
1	Trigonometry	BM-101	60	20
2	Matrices	BM-102	60	20
3	Differential Calculus	BM-103	70	20

**B.Sc. II Semester**

S.NO.	Paper	Paper code	Maximum Marks	
			External	Internal
1	Group Theory	BM-201	60	20
2	Vector Analysis	BM-202	60	20
3	Integral Calculus	BM-203	70	20

**B.Sc. III Semester**

S.NO.	Paper	Paper code	Maximum Marks	
			External	Internal
1	Advanced Algebra	BM-301	60	20
2	Theory of Equations	BM-302	60	20
3	Differential Equations	BM-303	70	20

**B.Sc. IV Semester**

S.NO.	Paper	Paper code	Maximum Marks	
			External	Internal
1	Linear Algebra	BM-401	60	20
2	Mechanics	BM-402	60	20
3	Real Analysis	BM-403	70	20

**B.Sc. V Semester**

S.NO.	Paper	Paper code	Maximum Marks	
			External	Internal
1	Complex Analysis	BM-501	60	20
2	Mathematical Methods	BM-502	60	20
3	Analytical Geometry	BM-503	70	20

**B.Sc. VI Semester**

S.NO.	Paper	Paper code	Maximum Marks	
			External	Internal
1	Mathematical Statistics	BM-601	60	20
2	Linear Programming	BM-602	60	20
3	Numerical Analysis	BM-603	70	20

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## B. Sc. Semester-I

### PAPER -I

### TRIGONOMETRY

- I. De Moivre's theorem and its applications.
- II. Inverse circular functions, Exponential and hyperbolic functions with their inverses.
- III. Separation into real and imaginary parts, Logarithmic of complex quantities.
- IV. Gregory's series, Summation of trigonometric series.

#### Books Recommended

1. S.L. Loney: *Plane Trigonometry (Part I, II)*, Arihant Publications.
2. M.D. Raisinghania, H.C. Sexena & H.K. Dass: *Trigonometry*, S. Chand & Company Pvt. Ltd. 2002.

### PAPER II

### MATRICES

- I. Types of matrices: Symmetric matrix, hermitian matrix, Orthogonal, Involutory matrix, Translation, dilation, Rotation, reflection in a point, Line and plane, Matrix form of basic geometric transformations.
- II. Rank of a matrix, Invariance of rank under elementary transformations, Adjoint of matrices, Inverse of matrices, Reduction to normal form.
- III. Matrices in diagonal form, Reduction to diagonal form upto matrices of order 3, Computation of matrix inverses using elementary row operations.
- IV. Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four. Solutions of a system of linear equations using matrices.

#### Books Recommended

1. A.I. Kostrikin, *Introduction to Algebra*, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, *Linear Algebra*, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, *Theory and Problems of Matrix Operations*, Tata McGraw Hill, 1989.

### PAPER III

### DIFFERENTIAL CALCULUS

- I. Limit and continuity ( $\epsilon$  and  $\delta$  definition), Types of discontinuities, Differentiability of functions, Indeterminate forms.
- II. Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.
- III. Tangents and normals, Curvature, Asymptotes.
- IV. Singular points, Maxima and minima, Tracing of curves, Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

#### Books Recommended:

1. M. Ray: *Differential Calculus*, Shiva Lal Agarwal and Co., Agra.
2. Gorakh Prasad: *Differential Calculus*, Pothashala publication, Allahabad.

## B. Sc. Semester-II

### PAPER-I

### GROUP THEORY

- I. Sets, Operations on sets, Relations, Equivalence relation and partition, Mappings.
- II. Algebraic structures, Group, Example of groups, Subgroups, Permutation group.

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- III. Order of an element, Cyclic group, Coset decomposition, Lagrange's theorem and its consequences.
- IV. Quotient group, Homomorphism, Isomorphism, Cayley's theorem, Normalizer and center of a group.

**Books Recommended**

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.

**PAPER- II**

**VECTOR ANALYSIS**

- I. Multiple products, Reciprocal vectors.
- II. Differentiation and integration of a vector function.
- III. Derivative of sum, Dot and cross product of two vectors, Gradient, Divergence and curl.
- IV. Applications of Green's theorem, Gauss's and Stoke's theorem (without proof).

**Books Recommended:**

1. Murray R. Spiegel: *Vector Analysis*, Schaum's Outline Series, McGraw Hill.
2. Shanti Narayan: *A text book of Vector Analysis*, S. Chand & Company.

**PAPER- III**

**INTEGRAL CALCULUS**

- I. Integration of rational and irrational functions, Properties of definite integrals.
- II. Gamma-Beta functions, Reduction formulae for integrals of rational, Trigonometric, Exponential and Logarithmic functions and of their combination.
- III. Areas and lengths of curves in the plane.
- IV. Volumes and surfaces of solids of revolution, Double and triple integrals.

**Books Recommended**

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

**B. Sc. Semester-III**

**PAPER-I**

**ADVANCED ALGEBRA**

- I. Normal subgroups and their properties, Simple group.
- II. Rings, various types of rings, Subrings, Properties of rings.
- III. Ideals, Quotient rings, Principal ideal ring, Characteristics of a ring.
- IV. Integral domain, Field, Skew field; Examples and its characterizations, Prime and irreducible element, Unique factorization domain.

**Books Recommended**

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.

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**PAPER-II****THEORY OF EQUATIONS**

- I. General properties of polynomials, Graphical representation of a polynomials, General properties of equations.
- II. Descarte's rule of signs, Positive and negative roots, Relation between the roots and the coefficients of equations.
- III. Symmetric functions, Applications symmetric function of the roots, Transformation of equations. Solutions of reciprocal and binomial equations.
- IV. Algebraic solutions of the cubic and biquadratic equations, Properties of the derived function.

**Books Recommended:**

1. W. S. Burnside and A.W. Panton. *The Theory of Equations*, Dublin University Press, 1954.
2. C.C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.

**PAPER-III****DIFFERENTIAL EQUATIONS**

- I. First order exact differential equations, Integrating factors, Rules to find an integrating factor, First order higher degree equations solvable for x, y, p, methods for solving higher-order differential equations, Basic theory of linear differential equations, Wronskian, and its properties.
- II. Solving a differential equation by reducing its order, Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters.
- III. The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.
- IV. Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

**Books Recommended**

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

**B.Sc. Semester IV****PAPER-I****LINEAR ALGEBRA**

- I. Vector spaces, Subspaces, Algebra of subspaces, Quotient spaces, Linear combination of vectors, Linear span, Linear independence, Basis and dimension, Dimension of subspaces.
- II. Linear transformations, Null space, Range, Rank and nullity of a linear transformation, Matrix representation of a linear transformation, Algebra of linear transformations.
- III. Dual Space, Dual basis, Double dual, Characteristic polynomial, Eigen values and eigen vectors.
- IV. Isomorphisms, Isomorphism theorems, Invertibility and isomorphisms, Change of coordinate matrix.

**Books Recommended**

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra*, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, *Introduction to Linear Algebra*, 2nd Ed., Springer, 2005

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**PAPER-II****MECHANICS**

- I. Conditions of equilibrium of a particle and of coplanar forces acting on a rigid body. Laws of friction. Problems of equilibrium under forces including friction.
- II. Centre of gravity, Work and potential energy.
- III. Newton's laws of motion, Motion under constant acceleration, Motion under inverse square law, Velocity and acceleration, Simple harmonic motion.
- IV. Angular velocity and angular acceleration, Velocity and acceleration of a particle along a curve: Radial and transverse components (plane curve), Tangential and normal components (space curve).

**Books Recommended**

1. A.S. Ramsay: *Statics*, CBS Publishers and Distributors (Indian Reprint), 1998.
2. A.P. Roberts: *Statics and Dynamics with Background in Mathematics*, Cambridge University Press, 2003.

**PAPER-III****REAL ANALYSIS**

- I. Finite and infinite sets, Examples of countable and uncountable sets, Real line, Bounded sets, Suprema and infima, Completeness property of  $\mathbb{R}$ , Archimedean property of  $\mathbb{R}$ , Intervals, Concept of cluster points and statement of Bolzano-Weierstrass theorem.
- II. Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences, Cauchy's theorem on limits, Order preservation and squeeze theorem, Monotone sequences and their convergence, Monotone convergence theorem without proof.
- III. Infinite series, Cauchy convergence criterion for series, Positive term series, Geometric series, Comparison test, Convergence of p-series, Root test, Ratio test, Alternating series, Leibnitz's test (Tests of convergence without proof), Definition and examples of absolute and conditional convergence.
- IV. Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of  $\sin x$ ,  $\cos x$ ,  $e^x$ ,  $\log(1+x)$ ,  $(1+x)^n$ .

**Books Recommended**

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R. Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia), P. Ltd., 2000.
3. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics*, Springer Verlag, 2003.

**B. Sc. Semester-V****PAPER-I****COMPLEX ANALYSIS**

- I. Limits, Limits involving the point at infinity, Continuity, Properties of complex numbers, Regions in the complex plane, Functions of complex variable, Mappings, Derivatives, Differentiation formulas, Cauchy-Riemann equations, Sufficient conditions for differentiability.
- II. Analytic functions, Examples of analytic functions, Exponential function, Logarithmic function, Trigonometric function, Derivatives of functions.
- III. Definite integrals of functions, Contours, Contour integrals and its examples, Upper bounds for moduli of contour integrals, Cauchy-Goursat theorem, Cauchy integral formula.
- IV. Liouville's theorem and Taylor and Laurent series and its examples.

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### Books Recommended

1. James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications*, 8th Ed., McGraw-Hill International Edition, 2009.
2. Joseph Bak and Donald J. Newman, *Complex analysis*, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

### PAPER-II

### MATHEMATICAL METHODS

- I. Laplace Transforms: Definition, Existence theorem, Linearity property, Laplace transforms of elementary functions, Heaviside Step and Dirac Delta Functions, First Shifting Theorem, Second Shifting Theorem.
- II. Initial-Value Theorem, Final-Value Theorem. The Laplace Transform of derivatives, Integrals and Periodic functions.
- III. Inverse Laplace transforms: Inverse Laplace transforms of simple functions, Inverse Laplace transforms using partial fractions, Convolution, Solutions of differential and Integro-differential equations using Laplace transforms. Dirichlet's condition.
- IV. Fourier Transforms: Fourier Complex Transforms, Fourier sine and cosine transforms, Properties of Fourier Transforms, Inverse Fourier transforms.

### Books Recommended:

1. Murry R. Spiegel: *Laplace Transform (SCHAUM Outline Series)*, McGraw-Hill
2. J. F. James: *A student's guide to Fourier transforms*, Cambridge University Press.
3. Ronald N. Bracewell: *The Fourier transforms and its applications*, McGraw Hill.
4. J. H. Davis: *Methods of Applied Mathematics with a MATLAB Overview*, Birkhäuser, Inc., Boston, MA, 2004.

### PAPER-III

### ANALYTICAL GEOMETRY

- I. Techniques for sketching parabola, Ellipse and hyperbola.
- II. Definition and equation of sphere, Intersection of a sphere and a line, Intersection of two spheres, Tangent plane, Plane of contact, Angle of intersection of two spheres.
- III. Definition and equation of a cone, Guiding curve, Intersection of a line with cone, Tangent line and tangent plane, Reciprocal cone, Right circular cone.
- IV. The cylinder, Right circular cylinder, Enveloping cylinder, Central conicoids.

### Books Recommended:

1. Shanti Narayan: *A Text book of Analytical Geometry*, S. Chand, & company, New Delhi.
2. H. Burchard Fine and E. D. Thompson: *Coordinate Geometry*, The Macmillan Company.
3. P. K. Jain and Khalil Ahmed: *A textbook of Analytical Geometry*, New Age, Delhi.

## B. Sc. Semester-VI

### PAPER-I

### MATHEMATICAL STATISTICS

- I. Frequency distribution, Measure of central tendency, Measure of dispersion, Moments, Skewness and kurtosis.
- II. Probability, Random experiment, Elementary properties of probability, Conditional probability, Additive and multiplicative laws of probability.
- III. Inverse probability, Baye's theorem, Mathematical expectation.
- IV. Correlation and its calculations, Rank correlation coefficient, Regression and equations of lines of regression.

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**Books Recommended:**

1. S. C. Gupta & V. K. Kapoor: *Mathematical Statistics*, Sultan Chand & co. Ltd, New Delhi.
2. J. N. Kapoor & H. C. Saxena: *Mathematical Statistics*, S. Chand & co. Ltd, New Delhi.
3. M. Ray & H. S. Sharma: *A text book of Statistics*, S. Chand & co. Pvt. Ltd. New Delhi.

**PAPER-II**

**LINEAR PROGRAMMING**

- I. Linear programming problems, Graphical approach for solving some LPP, Convex sets, Supporting and separating hyperplanes.
- II. Theory of simplex method, Optimality and unboundedness, The simplex algorithm, Simplex method in tableau format, Introduction to artificial variables.
- III. Two-phase method, Big-M method and their comparison.
- IV. Duality, formulation of the dual problem, Primal-dual relationships, Economic interpretation of the dual.

**Books Recommended**

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear programming and Network Flows*, 2nd Ed., John Wiley and Sons, India, 2004.
2. F.S. Hillier and G.J. Lieberman, *Introduction to Operations Research*, 8th Ed., Tata McGraw Hill, Singapore, 2004.
3. Hamdy A. Taha, *Operations Research, An Introduction*, 8th Ed., Prentice-Hall India, 2006.

**PAPER-III**

**NUMERICAL ANALYSIS**

- I. Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel methods.
- II. Lagrange and Newton interpolation: Linear and higher order, Finite difference operators.
- III. Numerical differentiation: Forward difference, Backward difference and central difference.
- IV. Numerical integration: Trapezoidal rule, Simpson's rule.

**Recommended Books**

1. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 5th Ed., New age International Publisher, India, 2007.

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