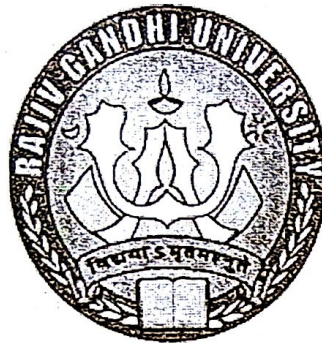# RAJIV GANDHI UNIVERSITY

(A Central University)
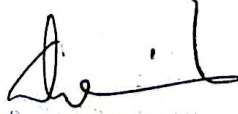
RONO HILLS :: DOIMUKH

DEPARTMENT OF MATHEMATICS

Semester wise Course Structure

B. A./B. Sc. Mathematics (Major)

w.e.f. 2019-20

(Approved by the BUGS in Mathematics held on 15 May 2019)

FIRST SEMESTER

MATH–111: *Higher Algebra and Trigonometry*

Full Marks : 100
Term end : 80
Terminal Examination duration : 3 hours
Maximum marks : 100 (Terminal–80, Sessional–20)

Unit	Contents	Marks
	Higher Algebra	**30**
I	Polynomials and division algorithm; Roots of a polynomial equations, Relations between the roots and the coefficients, Transformation of equations; Descartes rule of signs; Solution of cubic and biquadratic (quartic) equations.	15
II	Matrices, and its types; Adjoint and inverse of matrices; Rank of a matrix, Elementary row and column operations, Row-equivalence, Echelon form; System of linear equations, and Consistency of systems of linear equations, Gauss elimination.	15
III	Determinants; Characteristic equation of a matrix; Eigenvalues; Eigenvectors; Cayley-Hamilton theorem and its use in finding the inverse of a matrix.	15
IV	Relations: n-arry relation, binary relation and its different types, Equivalence relation, Equivalence classes, Functions and its types, and composition of functions.	15
	Trigonometry	**20**
V	De-Moivre's theorem for rational indices and its applications in solving polynomial equation, Expansion of sinnx and cosnx in powers of x, Exponential expressions for circular functions, Expansion of $\sin^n x$, $\cos^n x$. Complex arguments, Gregory's series, Hyperbolic functions.	20

Text Books:

1. Higher Algebra-by S. K.Mappa, Asoke prakasan.
2. Theory of Matrices – Shanti Narayan , S. Chand Publishing.
3. Set Theory- Seymour Lipschutz, Schaum's Outline series, McGraw-Hill Education; 2 edition.
4. Higher Trigonometry – B.C. Das & M. Mukherjee, U.N. Dhur & Sons (P) Ltd.

Reference Books:

1. Topics in Algebra & Matrices – S. Biswas, Narosa Publishing House.
2. Plane Trigonometry Part-II – S.L. Loney, S.Chand (G/L) & Company Ltd (1893).
3. Matrices –A.R. Vasistha, Krishna Prakashan Media.
4. Higher Algebra – M. Ray, S. Chand & Co., 1969.

SECOND SEMESTER
MATH–121: *Calculus & Differential Equations*

Full Marks : 100
Term end : 80
Terminal Examination duration : 3 hours
Maximum marks : 100 (Terminal–80, Sessional–20)

Unit	Contents	Marks
	Calculus	**40**
I	Leibnitz theorem with applications, Maxima and Minima, Basic concepts of Indeterminate forms, Tangents and Normals, Curvature, Asymptotes, Singular points, tracing of curves in Cartesian and Polar co-ordinates.	20
II	Reduction formula for $\int_0^{\frac{\pi}{2}} Sin^n x\, dx, \int_0^{\frac{\pi}{2}} Cos^n x\, dx$, $\int_0^{\frac{\pi}{2}} Sin^m x\, Cos^n x\, dx$ and its applications in evaluations; Quadrature: Plane Areas, Rectification of plane curves, Volumes and surface areas of solids of revolution.	20
	Differential Equations	**40**
V	Differential equations of first order and first degree, Homogeneous, Linear equations, Exact equations, Equation reducible to linear form, Clairaut's form, First order but not of first degree equations (up to third degree) with applications, Linear differential equations with constant coefficients.	20
VI	Linear differential equations with variable coefficients, Homogeneous Linear differential equations, Wronskian, Exact equation, Reduction to normal form, Transformation of the equation by changing the independent variable and method of variation of parameter.	20

Text Books:
1. Differential Calculus – Shanti Narayan, S. Chand and Co.
2. Integral Calculus—Das and Mukherjee. S. Chand and Co.
3. Ordinary and Partial Differential Equation – M. D. Raisinghannia, S. Chand and Co.
4. Calculus, 9th Ed. – G.B. Thomas & R.L. Finney, Pearson Education, Delhi, 2005.

Reference Books:
1. Differential and Integral Calculus – Frank Ayers and E. Mendelson. Schaum's outline series.
2. Differential Equations – Piaggo, CBS **Publishers** & Distributors (2004).
3. Differential Equations – M.R. Spiegel, McGraw-Hill Education; 4 edition.
4. Calculus, 3rd Ed. – M.J. Strauss, G.L. Bradley and K. J. Smith, Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
5. Differential Equations – S. L. Ross, Willy, 2007.

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Rono Hills, Doimukh (A.P)

MATH–231: *Co-ordinate Geometry*

Full Marks : 100
Term end : 80
Terminal Examination duration : 3 hours
Maximum marks : 100 (Terminal–80, Sessional–20)

Unit	Contains	Marks
	Analytical Geometry	
I	*Change of Axes: Transformation of coordinates, Translation of axes, Rotation of axes, Removal of xy-terms and the first degree terms, Invariants. Pair of Straight lines: Homogeneous equations of second degree, Angle between a pair of lines, Bisectors of the angles between the pair of lines, Condition for the general equation of second degree to represent a pair of lines, pairs of parallel and perpendicular lines, points of intersection of a line and curve.*	20
II	*Conic Section: General equation of conic, Centre of conics, Reduction of central and non-central conics, Tangents, Normal's, Chord of contact, Pole and polar, Chord in terms of its mid-point, Polar equation of a conic and a chord. Diameter: Conjugate diameters, Condition for conjugate diameters, Hyperbola and its asymptotes.*	20
	Solid Geometry	
III	*Introduction to three dimensional geometry: Different forms of straight lines and planes, Skew lines, Coplanar lines, Angle between two planes, Shortest distance between two lines and equations of shortest distance. Sphere: Plane section of a sphere, intersection of two spheres, sphere with a given diameter, Equation of a sphere through a given circle.*	20
IV	*Cones and Cylinders: Definition, Equation of a cone with a conic as guiding curve, the right circular cone, its definition and equation. Definition and equation of cylinder, Definition and equation of right circular cylinder. Conicoid: General equation of Conicoid, shapes of some surfaces.*	20

Text Books:
1. R. M. Khan—Analytical Geometry of two and three dimension and vector analysis. New Central Book agency.
2. Analytical Geometry of two and three dimensions – R. M. Khan, New Central Book Agency.
3. Co-ordinate Geometry two and three dimensions – E.T. Bell, McMillan & Co. Ltd

Reference Books:
1. Analytical Geometry of two dimensions – Shanti Narayan, S. Chand.
2. Analytical Geometry of three dimensions – D.K. Jha & H.K. Sinha, BPB Publication

FOURTH SEMESTER

MATH-241: Real Analysis – I

Full Marks : 100
Term end : 80
Terminal Examination duration : 3 hours
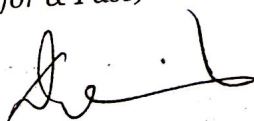Maximum marks : 100 (Terminal–80, Sessional–20)

Unit	Contains	Marks
I	Cardinality of sets, Countability and its related properties, Countability of Z and Q, Uncountability of R, Bounds, Bounded sets and their properties, Sup and Inf of sets, Bolzano-Weierstrass theorem, Interior points and limit points, Open, Closed, Compact sets, Heine-Borel-Theorem.	16
II	Limits and Continuity, Properties of continuous functions, Uniform continuity, Bounded functions, Continuous functions defined on a compact set: Their boundedness, Attainment of bounds and uniform Continuity, Intermediate Value Theorem, Discontinuities, Monotonic functions.	16
III	Differentiation: Derivatives, Darboux's Theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's mean value theorem, Taylor's theorem, Indeterminate forms.	16
IV	Sequences, Bounded sequences, Monotonic sequences and their convergence, limsup and liminf and convergence criterion using them, Subsequences, Cauchy sequences and their convergence criterion.	16
V	Infinite series and their convergence, Comparison test, D' Alembert's Ratio and Root Tests, Raabe's Test for convergence, Logarithmic Text, Gauss's test, Alternating series, Leibnitz series, Absolute convergence, Uniform convergence, Abel's Test and Dirichlet's Test.	16

Text Books:

1. Mathematical Analysis – S.C. Malik and Savita Arora, New Age International.
2. The Elements of Real Analysis – R. G. Bartle, John Wiley.
3. Principles of Mathematical Analysis – Walter Rudin, Tata McGraw-Hills.

Reference Books:

1. Differential calculus – Maity and Ghose, New Central Book Agency, Calcutta.
2. Real Analysis – S. K. Mappa, Levant Books.

Rs. 30/-

RAJIV GANDHI UNIVERSITY

(A Central University)

RONO HILLS :: DOIMUKH

DEPARTMENT OF MATHEMATICS

Semester wise Course Structure

B. A./B. Sc. Mathematics

w.e.f. 2017-18

FIFTH SEMESTER
MATH-351: Algebra

<div align="right">

Full Marks: 100
Term end: 80
Internal: 20

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Unit–I: *Binary relation, Group, Subgroups and their examples, Order of an element, Order of a group, Generators of group, Cyclic group, Normal subgroup, Coset, Quotient group, Lagrange's theorem, Centralizer, Normalizer, Centre of a group.* **Marks-15**

Unit–II: *Permutation, and operation on permutations, Cyclic permutations, Transpose, Symmetric group, Group homomorphism and Isomorphism, Fundamental theorems of Homomorphism and Isomorphism, Cayley's theorem.* **Marks-15**

Unit–III: *Definitions, Examples and the properties of Rings; Polynomial rings, Ideals, PID, UFD, Integral domains, Fields and examples.* **Marks-20**

Unit–IV: *Vector space, Subspace, Linear span, Linearly dependent sets, Linearly independent sets, Basis, Dimension, Quotient spaces.* **Marks-15**

Unit–V: *Linear Transformations, Null and Range spaces, Rank and nullity of Linear Transformation, Matrix representation of a linear transformation, Singular and non-singular transformation, Eigen values, Eigen vectors, Characteristic equation and Cayley Hamilton theorem.* **Marks-15**

Text Books:

1. Topics in Algebra – I. N Heirstein, John Wiley & Sons.
2. Modern Algebra – Surjeet Singh and Qazi Zameerudin, Vikas Pub. House.
3. Contemporary Abstract Algebra (Cengage; 8 edition (2013)) – Joseph A Gallian
4. Linear Algebra and its Applications – David C. Lay, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
5. Linear Algebra–P.K. Saikia, Pearson, 2009.

Reference Books:

1. A Course in Abstract Algebra– Khanna and Bhambri, Vikas Pub. House.
2. Fundamentals of Abstract Algebra– Malik, Morderson and M.K. Sen, Mc Graw Hill.
3. A First Course in Abstract Algebra–J.B. Fraleigh, Pearson; 7 edition (1 November 2002).
4. A course of Abstract Algebra–V K Khanna and Bhamri, S. Chand Publication, 1999.

FIFTH SEMESTER
MATH–352: Real Analysis - II

Full Marks: 100
Term end: 80
Internal: 20

Unit–I: Integration. The Riemann Integral & its properties. Integrability of continuous and monotonic functions. integral as a limit of sums, The fundamental theorem of calculus, Mean value theorems of integral calculus. **Marks-16**

Unit–II: Improper Integrals, Convergence of improper integrals, Comparison tests, Abel's and Dirichlet's tests, Beta and Gamma functions. **Marks-16**

Unit–III: Functions of two or more variables, limit and continuity of functions of more than one variable, partial derivatives and differentiability. Partial derivatives of higher order, Young's theorem and Schwarz's theorem, Change of variables, Differentiation of composite functions, Euler's theorem on homogeneous functions of n variables.

Marks-20

Unit–IV: Taylor's theorem for functions of several variables, Maximum and minimum of a function of two variables, Jacobians and functional dependence, Lagrange's method of undetermined multipliers. **Marks-12**

Unit-V: Line and double integrals, Green's theorem, change of variables, surface integrals and triple integrals, Applications to evaluation of areas and volumes. **Marks-16**

Text Books:

1. Mathematical Analysis – S.C. Malik and Savita Arora, New Age International.
2. The Elements of Real Analysis – R. G. Bartle, John Wiley
3. Principles of Mathematical Analysis – Walter Rudin, Tata McGraw-Hills

Reference Books:

1. First Course in Mathematical Analysis – Shanti Narayan, S. Chand publishing.
2. Advanced Calculus – M.R. Spiegel, Schaums' Outline Series, McGraw-Hill Education.
3. Mathematical Analysis – T. M. Apostol, Addison-Wesley Publishing Company, Inc.
4. Calculus – Thomas Fine, Pearson; 13 edition (February 24, 2014).

FIFTH SEMESTER
MATH–353: Mechanics

Full Marks: 100
Term end: 80
Internal: 20

Unit–I: Coplanar forces, Conditions of equilibrium, Centre of gravity of a plane area, Arc and a sector of a curve, C.G of solids and surface of revolution, C.G of areas bounded by a curve, Theorem of Pappus-Guldinus with applications. **Marks-15**

Unit–II: Friction, Equilibrium on rough planes and inclined planes. **Marks-10**

Unit–III: Velocities and acceleration along radial and transverse directions and along tangential and normal directions, Motion in a straight line under variable acceleration, Simple Harmonic motion and Elastic string, Motion under inverse square law. Projectiles on a plane and on an inclined plane with Range and Time of flights. **Marks- 20**

Unit–IV: Principle of energy, Conservation of energy and linear momentum, Impulse, Impulsive forces, Impact of elastic bodies (Direct and oblique impact). **Marks-10**

Unit–V: Central orbits and Kepler's law of planetary motion, Motion in resisting medium (simple cases only). **Marks-10**

Unit–VI: Moments and products of inertia, Parallel axes theorem, Theorem of six constants, D' Alembert's Principle, The Momental Ellipsoid, Equimomental system, Principal axes. **Marks- 15**

Text Books:
1. Statics – S. L. Loney, C.U.P. Palala Press.
3. Dynamics – S. L. Loney, C.U.P.
4. Dynamics I & II – A.S. Ramsay, Cambridge University Press.
5. Statics – Das and Mukherjee, U N Dhar & Sons.

Reference Books:
1. Theoretical mechanics – M.R. Speigel, Schaums' Outline Series, McGraw-Hill Education.
2. A Text Book on Statics – R.S. Verma, Allahabad : Pothishala.
3. Dynamics – M. Ray, S. Chand and Co.

Full Marks: 100
Term end: 60
Internal: 20
Practical: 20

Complex Analysis (Marks 30):

Unit–I: Complex Numbers and Conjugate, Absolute Value, Argument, Principal Argument, Principal Value of Complex Numbers and related Inequalities and Identities; Geometric Representation of Complex Numbers and their Operations; Polar form of complex number; Euler's Formula; Equations of Straight Line, Circles and Area of Triangle, Complex functions, Polynomials. **Marks- 10**

Unit–II: Limits and Continuity, Derivatives, Analytic functions, Cauchy- Riemann equations, Harmonic and conjugate functions. **Marks- 10**

Unit–III: Integration of Complex-valued Functions, Contours, Complex Line Integral and their properties, Fundamental Cauchy theorem and its applications. **Marks-10**

Numerical Analysis (Marks 30):

Unit–IV: Finite Difference operators and their operations on functions of a single variable. **Marks-10**

Unit–V: Interpolation with equal intervals, Newton's forward and backward formula, divided difference, Lagrange's interpolation formula. **Marks-10**

Unit–VI: Numerical differentiation: Forward difference, Backward difference and Central difference; Integration: Trapezoidal rule, Simpson's rule. **Marks-10**

Unit– VII: Practical in consonance with the materials covered in these courses. **Software Support:** MATLAB / MATHEMATICA etc. **Marks- 20**

Practical / Lab work to be performed on a computer (Any five modelling):

1. Plot complex numbers viz. addition, multiplication, subtraction and division.
2. Sketch lines, circles, polynomials for complex functions.
3. Sketch the area represented by the complex numbers.
4. Evaluation of complex line integration.
5. Applications of Cauchy's theorem.
6. Calculate the sum $1/1 + 1/2 + 1/3 + 1/4 + \cdots + 1/N$.
7. To find the absolute value of an integer.
8. Enter 100 integers into an array and sort them in an ascending order.
9. Lagrange's Interpolation or Newton's Interpolation
10. Examine behaviour of Integrations by trapezoidal rule, Simpson's rule.

Text Books:
1. Theory and Problems of Complex Variable - Murray R Spiegel, Schaum's Outline Series, McGraw Hill Book Company.
2. Complex Variable and Applications – J. W. Brown and R. V. Churchill, McGraw Hill Book Company.
3. H. C Saxena – Finite difference and Numerical Analysis. S Chand and Sons.

Syllabus of B. A./B.Sc. (Semester) Mathematics

4. M.K Jain and Iyenger – Numerical Methods, problem and solutions, New Age International.

Reference Books:
1. Theory of Functions of Complex variables – Shanti Narayan, S. Chand Publishing.
2. Complex Analysis – A. R. Vasistha, Krishna Prkashan Media (P) Ltd.
3. Numerical Analysis – Goyal Mittal, Pragati Prakashan.

Hydrostatics (Marks-40):

Unit–I: *Definition of Fluids, Homogeneous and Heterogeneous Fluids, Pressure equation, Condition of equilibrium, Lines of forces, Elastic fluids, Surface of equal pressure, Fluid at rest under action of gravity, Rotating fluids.* **Marks-20**

Unit–II: *Fluid pressure on plane surfaces, Centre of pressure, Resultant pressure on curved surfaces.* **Marks-20**

Mathematical Methods (Marks-40):

Unit–IV: *Solution of Legendre and Bessel's equations, Legendre and Bessel's function of first kind and their properties.* **Marks-15**

Unit–V: *Laplace transform, Inverse Laplace transform, Convolution theorem, Application of Laplace transform to solution of ordinary and partial differential equation.* **Marks- 15**

Unit–VI: *Fourier transform, Fourier integral, Sine and Cosine transform, Inverse Fourier Transform, Application of Fourier Transform to Ordinary and Partial Differential Equations.* **Marks- 10**

Text Books:

1. A Treatise on Hydromechanics part-I – W.H. Besant and A.S. Ramsey.
2. Hydrostatics – J.M. Kar, K.P. Basu pub. Co., Calcutta.
3. Theory and problems of Laplace Transform – M.R. Spiegel, Schaum's Series, Tata McGraw-Hill.

Reference Books:

1. Hydrostatics - M. Ray, S. Chand and Co.
2. Advanced Differential Equations – M.D. Raisinghannia, S. Chand and Co. Ltd.
3. Hydrostatics - B. D. Sarma, Kedar Nath Ram Nath Publisher.

Full Marks: 100
Term end: 80
Internal: 20

Number Theory (Marks – 40)

Unit–I: *Well-Ordering Principle, Divisibility, Division Algorithm, Greatest Common Divisor, Least Common Multiple, Primes, Fundamental Theorem of Arithmetic, Linear Diophantine Equation.* **Marks- 20**

Unit–II: *Definition of Congruence and Properties. Linear Congruence, Chinese Remainder Theorem. Complete Residue System, Reduced Residue System, Euler's Phi Function, Euler's Theorem, Fermat's Little Theorem and Wilson's Theorem.* **Marks- 20**

Metric Spaces (Marks – 40)

Unit–III: *Metric space – Definition and examples, Open and Closed sphere, Interior point, Interior of a set, Open set and related theorems, Closure point and Closure of a set, Dense and nowhere dense sets, Limit point, Derived sets, Closed sets, Continuous functions, Sequentially Continuous Function, Uniform Continuity, Test of function for Uniform Continuity.* **Marks-20**

Unit–IV: *Sequences in metric Space and their convergence, Difference between limit and limit point, Cauchy sequence, Complete metric space and examples, Cantor's Intersection Theorem, Baire's Theorem, Bolzano-Weierstrass Property, Bolzano-Weierstrass Theorem, Sequentially compact metric space and compactness of metric spaces, Heine-Borel Theorem.* **Marks-20**

Text Books:

1. Elementary Number Theory – D.M. Burton, Universal Book Stall, New Delhi.
2. Introduction to Topology and Modern Analysis – G.F. Simmon, Tata McGraw-Hill Education Pvt. Ltd.
3. Beginning Number Theory – Neville Robbins, Narosa Publishing House.
4. Metric Spaces – S. Shirali, H. L. Vasudeva, Springer. 2006.

Reference Books:

1. An Introduction to the Theory of Numbers – Niven, Zukerman, and Montgomery, John Wiley & Sons (Asia) Pvt. Ltd.
2. General Topology – Munkars, Pearson publication.
3. General Topology – Schaum's Outline Series, Tata McGraw-Hill.
4. Basic Number Theory – S. B. Malik, Vikas Publication 1998.

SIXTH SEMESTER
MATH-363: *Discrete Mathematics*

Unit–I: *Relation, Representation of relation as a Directed Graph, Poset, Hasse Diagram, Linearly Ordered Sets (chains), Lattices, Bounded Lattice, Complemented, Distributive and Modular Lattice, Duality, Idempotent and Absorption Laws.* **Marks-16**

Unit–II: *Boolean Function, Boolean Expression, Definition of Boolean Algebra, Boolean Identities, Logic Gates, Simplification of Boolean Function.* **Marks-16**

Unit–III: *Mathematical Logic: Propositions, Logic Connectives, Truth Table, Tautology and Contradiction, Propositional Equivalences, Normal Forms, Conjunctive Normal Forms, Disjunctive Normal Forms, Predicates, Essential and Universal Quantifiers, Inference Rule, Mathematical Induction.* **Marks-16**

Unit–IV: *Counting Theory: The Rules of Sum and Product; Permutation, Combination and its properties; Problems related to Permutation and Combinations, Pigeonhole Principle, The Inclusion-Exclusion principle; Basics of Probability and related examples.* **Marks-16**

Unit–V: *Graph, Types of Graphs, Directed Graphs, Path and Cycle of a Graph, Subgraph, Tree, Spanning tree, Bipartite and Complete graph, Adjacency matrix of a directed graph.* **Marks-16**

Text Books:

1. Discrete Mathematics, Third Edition – Seymour Lipschutz and Mark Lipson, Schaum's Outlines Series, McGraw-Hill Publishing Co.
2. Discrete Mathematics with Applications -- Susanna S. Epp., Fourth Edition- Cengage Learning.
3. Lattices and Order – B A Davey and H A Priestley, Cambridge University Press.
4. Discrete Mathematics -- Norman Biggs, Oxford, 2002.

Reference Books:

1. Discrete Mathematics and its Applications — Kenneth H. Rosen, McGraw-Hill Publishing Co.
2. Boolean Algebra – Schaum's Outlines Series, McGraw-Hill Publishing Co.
3. Boolean Algebra and its application – H. Graham Flagy, Dover Publications.
4. Introductory Discrete Mathematics – V. K. Balakrishnan, Dovers, 1991.

MATH–364: *Mathematical Statistics & Linear Programming*

Full Marks : 100
Term end : 80
Terminal Examination duration : 3 hours
Maximum marks : 100 (Terminal–80, Sessional–20)

Unit	Contains	Marks
I	Frequency distribution, Measures of central tendency: Mean, Median and Mode, Range, Quartiles, Decile, Percentile, Measure of Dispersions: Variance, Standard Deviation, Moments, Skewness and Kurtosis.	20
II	Correlation, Coefficient of Correlation, Error Calculation; Curve Fitting: Linear and Polynomial Curve Fitting, Linear Regression, Method of Least Squares.	15
III	Definitions of Probability (Mathematical, Empirical, Axiomatic) and Examples, Addition theorem of Probability, Multiplication theorem of Probability, Conditional Probability, Baye's theorem.	15
IV	Hyperplanes and Hyperspheres, Convex Sets and Their Properties: Extreme Point, Formulation of Linear Programming Problem (LPP), Graphical Solutions of LPP's, Different forms of LPP's.	15
V	Feasible and Optimal Solution, Slack and Surplus Variables, Basic and Basic Feasible Solutions, Fundamental Theorem of LPP, Condition of Optimality, Simplex Methods, Unbounded and alternative Solution.	15

Reference Books:
1. Fundamentals of Mathematical Statistics – Gupta and Kapoor, Sultan Chand & Sons
2. Probability and Statistics – Murrary and Spiegel
3. Probability and Stattistics – Schaum Outlines Series, McGraw-Hill Publishing Co.
4. Kanti Swarup, P.K. Gupta and Mon Mohan – Operation Research, Sultan Chand & Sons.

Reference Books:
1. Mathematical Statistics – Kapoor and Saxena, Sultan Chand & Sons.
2. Introduction to theory of Statistics – G. V. Yule and M. G. Kendall
3. Linear programming – S.I. Gauss, Tata McGraw Hill
4. Linear Programming – Mittal and Sethi, Pragati Prakashan
5. Introduction to Operation Research: (6th edition) – F.S. Hillier and G.J. Lieberman, McGraw Hill. International Edition: Industrial Engineering Series 1995.

Mathematics