# NORTH MAHARASHTRA UNIVERSITY,

## JALGAON - 425 001

### T.Y.B.Sc. MATHEMATICS

SYLLABUS FROM JUNE,1994

PAPER-I

METRIC SPACES AND LEBESGUE INTEGRATION
(FIRST TERM METRIC SPACES)

1) Functions, Composite function, Inverse function, Characteristic function, Introduction to equivalent sets, Denumerable sets.

2) Metric spaces : Limit in metric spaces, Continuous functions on metric spaces, Open sets, Closed sets.

3) Connected metric spaces : bounded sets & totally bounded sets, Complete metric spaces.

4) Compact metric spaces : Continuous functions on compact metric spaces, continuity of inverse functions, uniform continuity.

BOOKS :-

1) Set theory & related topics -
by Schaum's series.

2) Method of real analysis -
By R.R. Goldberg.
(Topic No.4.2, 4.3,5.3,5.4,5.5,6.1 to 6.8).

SECCND TERM

(LEBESGUE INTEGRATION)

1. Measurable sets and Functions :-

Length of open & closed subsets in real line. Inner & outer measures & measurable sets. Properties of measurable sets, Real valued measurable functions, sequence of measurable functions.

2. Lebesgue Integrals :-

Definations & existance of lebesgue integrals for bounded functions Characterisation of Lebesgue functions. Sufficient conditions for Lebesgue integrability, properties of Lebesgue integrals, Lebesgue integral for unbounded functions, Lebesgue integral on measurable subsets of bounded & closed real interval & their properties. Lebesgue dominated convergence theorm, Fatou's lemma, Space of square Lebesgue integrable functions, The Schwartz's inequality, the Minkowski inequality.

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RECOMMENDED BOOKS :

1) R.R. Goldberg - Methods of real analysis (Oxford IBH Publication) Chapter XI Except 11.9.

REFERENCE BOOKS :-

1) S.C. Saxena & S.M. Shah : Introduction to real variable theory (Pre-Hall of India).

T.Y.B.Sc. MATHEMATICS

PAPER-II

REAL ANALYSIS

FIRST TERM

1) Riemann Integration.

Definition and Existence of the Integral, The meaning of $\int_a^b f dx$ when $b < a$ Inequalities for integral. Refinement of partitions, Darboux's. Theorem (without proof) Conditions of integrability. Integrability of the sum and difference of integrable functions. Integrability of the product, Quotient and the modulus of Integrable functions. The Integral as limit of sum (Riemann sums) some Integrable functions. Integration and Differentiation (The primitive) The fundamental Theorem of calculus, Mean value Theorms of Integral calculus. First mean value theorem. Second mean value Theorem Abel's lemma (without's proof).

2) Improper Integrals :

Integration of unbounded functions with finite limits of Integration comparison Tests for convergence of $\int_a^b f dx$, comparison Test I comparison Test II. A useful comparison Integral, Deduction of two comparison Tests which are of practical utility. General Test for convergence. Absolute convergence Infinite range of Integration. Comparison Tests for convergence at $\infty$ (without proof), General Test for convergence at $\infty$, Caucy's test. Absolute convergence. Integrals as produce of functions. A Test for Absolute convergence. Test for convergence. Able's Test, Dirchlat's Test (Proof for integration $\int_a^b f dx$).

3) Beta and Gramma Integrals :

Convergence of Beta and Gamma Integrals properties of Beta & Gamma functions Relation between Beta and Gamma functions Duplication formula. Evaluation of Integrals using Beta and Gamma Integrals.

SECOND TERM

4) Series of real numbers :

Convergence and divergence. Series with non-negative terms.

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Alternating series, Conditional convergence and absolute convergence. Rearrangement of series Test for absolute convergence. Series whose terms form a non-increasing requence. Summation by parts.

5) Sequences and Series Functions:

Pointwise convergence of sequences of functions. Uniform convergence of sequences of functions. Consequences of uniform convergence. Convergence & uniform convergence of series of functions. Integration & differentiation of series of functions.

6) Fourier Series :

Fourier series & fourier coefficients, Dirichlet's condition of convergence (statement only). Fourier series for even & odd functions. Sine & consine series in half range.

RECOMMENDED BOOKS :

1) MATHEMATICAL ANALYSIS (2ND EDITION).
-by S.C.MALIK, SAVITA ARORA(WILEY EASTERN)

ARTICAL- I : 1, 1.1, 1.2, 1.3, 2, 3, 4, 5.1, 6, 7, 8, 9, 10.1, 10.2, 13.1
" II : 2, 3, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4, 4.1, 4.2, 4.3, 4.5, 4.6, 4.7, 5, 5.1, 5.2.
VI : 6.1, 6.2, 6.3, 6.4, 6.5,

2) METHODS OF REAL ANALYSIS :
-by R.R. Goldberg (oxford & IBH pub.)

ARTICAL-III : 3.1, 3.2, 3.3, 3.4, 3.5(A,B,C,D,E,F), 3.6, 3.7, 3.8.
IV : 4.1, 4.2, 4.3, 4.4, 4.5
V : 5.1, 5.2, 5.3, 5.4

REFERENCE BOOKS :

1. Mathematical Analysis- by S. K. Chattergee (Oxford & IBH pub.)
2. Introduction to reel variable theory - by S.C. Saxena & S. M. Shah.
3. A course of mathematical analysis. - by Shanti Narayan (S. Chand & company)
4. Principles of mathematical analysis. - by Walter radin (MC Graw Hill)

P A P E R - III

PROBLEM COURSE BASED ON PAPER I & II.

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P A P E R - IV

## A L G E B R A

( FIRST TERM : ABSTRACT ALGEBRA )

1) NORMAL SUBGROUPS :

Definition of normal subgroups, Proper & improper subgroups, simple groups, Commutator subgroups, Quotient groups.

2) PERMUTATION GROUPS :

Transpositions, cycles, odd, even permutations, Properties permutation group.

3) HOMOMORPHISM OF GROUPS :

Definition of homomorphism & examples, Isomorphism & Isomorphic theorms.

4) RINGS:-

Definitions & examples. Basic propeties, Integral domain & Fields, Characteristic of rings, Fields of quotients of integral domain.

IDEALS :-

Left & right ideals, Principle ideals, Maximal ideals, Prime ideals, Properties & Quotient rings.

5)HOMOMORPHISM OF RINGS :-

Definition & examples, Ring isomorphism, Fundamental theorm of ring homomorphism.

6) POLYNOMEAL RINGS :- Degree of polynomeal & properties, Division algorithm, Reducible & irreducible polynomeals.

SECOND TERM

(LINEAR ALGEBRA)

1) VECTOR SPACES :-

Examples, Properties, Subspaces, Necessary & sufficient conditions, Results, regarding addition, intersection & union of subspaces, Quotient space, Linear span, & properties, Linear dependence, Basis & Dimension of finite dimentional vector spaces, coordinates, existenance theorm, Invarience of number of elements in a basis, Extension theorm, theorms on basis & dimensions.

2) LINEAR TRANSFORMATIONS :-

Range & null space, Rank & nullity Vector space L (V,W), Algebra of linear transformations, Invertible L-transformation, singular & non singular L- Transformations, Representation of L.T. by matrix.

3) EIGEN VALUES & EIGEN VECTORS :-

Matrix Polynomial characteristic polynomial minimal polynomial, Eigen values and Eigen vectors of L.T. Similarly, Diagonalisation (statement), Caley Hamilton theorm.

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RECOMMENDED BOOKS :-

1) TOPICS IN ALGEBRA - by I.N. HERSTEIN.
2) A FIRST COURSE IN ABSTRACT ALGEBRA - by J.B. Fraleigh.
3) UNIVERSITY ALGEBRA - by N.G. Gopalkrishan.
4) ABSTRACT ALGEBRA - by Schaums outline series.
5) MODERN APPLIED ALGEBRA - by GARRET BIRKHOT & THOMOS C BARTEE.
6) LINEAR ALGEBRA - by HOFFMAN & KUNZE.

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PAPER-V

DYNAMICS AND DIFFERENTIAL EQUATIONS

(FIRST TERM : DYNAMICS)

1) KINEMATICS :-

1.1 Displacement.
1.2 Motion in straight line, velocity & acceleration.
1.3 Motion in a plane, velocity & acceleration.
1.4 Radial & Transverse components of velocity & acceleration.
1.5 Angular velocity & acceleration.
1.6 Tangential & normal components of velocity & acceleration.
1.7 Relative Motion.

2) RECTILINEAR MOTION :-

2.1 Motion in a st. line with constant acceleration.
2.2 Motion of a train between two stations.
2.3 Simple Harmonic motion.
2.4 Hooke's law :- a) Harizontal elastic strings.
b) Vertical elastic strings.
2.5 Repulsion from a fixed point varying as the distance from that point.
2.6 Motion under inverse square law.

3) UNIPLANAR MOTION :-

3.1 Projectile - Introduction.
3.2 Projectile.
3.3 Projection to pass through a given point.
3.4 Range on an inclined plane.
3.5 Envelope of the paths.

4) CENTRAL FORCES :-

4.1 Motion of particle under central force.
4.2 Use of pedal co-ordinates & equation.
4.3 Apses.
4.4 Time in an orbit.

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RECOMENDED BOOKS

A TEXT BOOK ON DYNAMICS - by M.Ray (Pub.s. Chand & company, New Delhi.)

I. Art. 1.1,1.2,1.3,1.4,1.5,1.6,1.7.
II. 2.1,2.2,2.3,2.4,2.5,2.6.
III. 3.1,3.2,3.3,3.4, 3.5.
VIII. 8.1,8.2,8.3,8.4.

REFERENCE BOOKS :-

1. A Text Book of Dynamics - by F. Chorlton.
2. A Text book of dynamics-by A.S. Ramsey.
3. Dynamics of particle & rigid body - by S.L. Loney (Surjeet Pub.)
4. A particle dynamics - by Sansilal (S. Chand & sons, New Delhi.)

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SECOND TERM

( DIFFERENTIAL EQUATIONS )

1. Exact Differention Equations of higher order.
   1. Exact Differentiol equation.
   2. Condition of exactness.
   3. Integrating factor.
   4. Exactness of mon-linear equation solution by Inspection.
   5. Equations of the forms.

$$\frac{d^n y}{dx^n} = f(x), \quad \frac{d^2 y}{dx^2} = f(y)$$

2. Linear differential Equation of second order.
   1) General form.
   2) Method of solution by
      (a) Change of dependent variable.
      (b) Removal of first order derivative.
      (c) Change of independent variable.

3. Ordinary differential equations in three varibles.
   1) Surface and curves in three dimensions.
   2) Simutaneous differential equation of first order and first degree.
   3) Methods of solution of

$$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$$

   4) Orthogonal trajectories of a system of curves on a surface.
   5) Pfaffian differential forms and equation; Theorems.
   6) Solution of pfaffine dift. equation in three variables and geome. geometrical meaning of integral curves..

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4. Partial Differential Equation of first order.
   1) Partial differential equation.
   2) Origin of first order partial differential equation.
   3) Linear equations of first order.
   4) Integral surfaces passing through a given curve.
   5) Surface of orthogonal to given system of surfaces.
   6) Compatible system of first order equations.
   7) Charpit's method.
   8) Special types of first order equations.
   9) Solution satisfying given conditions.
   10) Jacobi's method.

RECOMMENDED BOOKS

1) Advanced Differential Equations,
   By. M.D.Raisinghania (for 1&2) (S.chand and compancy New-Delhi).
2) Elements of partial differential equations.
   Ian Sneddon (For 3and 4)
   Ch.1 (Art 1.1 to 1.6)
   Ch.2 (Art 2.1, 2.2, 2.4, 2.5, 2.6, 2.9, 2.10, 2.11, 2.12, 2.13)

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## P A P E R - VI

Problem Course based on PaperIV and Paper V.

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## T.Y.B.Sc MATHEMATICS
## P A P E R - VII (A)

### NUMERICAL ANALYSIS AND OPERATIONS RESEARCH:
### ( FIRST TERM: NUMERICAL ANALYSIS )

1. Solution of non-linear equation:
   Sturm's theorem (without proof), Horner's method (solution to two places of decimals), Iterative method ($x=\phi(x)$), Method of false position, Newton-Raphson method.
2. System of linear Equations:
   Gauss elimination method, Gauss seidal iteration method.
3. Fitting of polynomials: Collocation and least square method.
4. Interpolation operators E, [illegible] and their relation. Newton's forward & backward interpolation formulae, Lagrange's interpolation formula.
5. Numerical Integration: Trapegoidal rule, simpson's $\frac{1}{3}$ & $\frac{3}{8}$ rule.

6. Differential Equations of first order: Solution by Taylor's series, Euler's method, Runge kutta method (fourth order only).

RECOMMENDED BOOKS :

1. S.S.Sastry : Introductory methods of Numerical Analysis (prentice Hall of India).
2. H.C.Saxena : Finite differences & Numerical Analysis. (S.Chand & Comp. Ltd.)

REFERENCE BOOKS.

1. P.P.Gupta, G.S.Malik : Calculus of finite differences and numerical Analysis. (Krishna Prakashan Mandir).
2. J.B.Scarborough : Numerical Mathematical Analysis oxford & IBH Publi. comp.
3. A. Ralstone : A first course in numerical Analysis Mc Graw Hill comp.
4. F. Scheild : Numerical Analysis schaum's outline series.
5. F.B.Hildebrand : Introduction to Numerical Analysis (Tata Mc Graw Hill).
6. W.S.Bernside and A.W.Panton : Theory of equations (S.Chand & comp. Ltd.).

( SECOND TERM : OPERATION RESEARCH )

1. Linear Programming Problem : Mathematical formulation of L.P.P. Graphical solution. Method with exceptional cases.
2. Simplex Method : Slack & Surplus variable, Reformulation of general L.P.P., solution of L.P.P. By simplex method, problem of degenracy & its resolution, concept of duality fundametal theorem of duality. Dual problem & their interpretion solution by simplex.
3. Transporftion problem : Transporfation tables, North-West corner rule, Matrix-Miniml method, Vogel's Approximation method (VAM). Optimality test by U-V method, stepping stone(method) Degenercy & its resolution, Assignment problem.
4. Theory of Games : Two person Zero sum game, Maxima & Minima principle Games without saddle point, Mixed strategies, Graphical solution of 2*n and m*2 games Dominace theory. The modified dominace property. Reducing the game problem to L.P.P. Minimax and sadle point theorem. Fundamental theoren of games.

RECOMMENDED BOOKS :

1. Kanti Swrup, P.K.Gupta.
   Operations Research (S.Chand & Sons).
2. Loomba : Linear Programming (Tata Mc Graw Hill)

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REFERENCE BOOK .

1. Taha H.A. Operations Research (McMillance.)
2. Gupta and Hira : Operations Research.
3. Mittal : Optimization methods.

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## P A P E R VII (B)

Differential Geometry
(First Term Syllabus)

1. Curves in space :-

Parametric and vector representation of curves. Tangent line, Principal normal and Binormal at a point on a space curve. Osculating plane, normal plane and rectifying plane at a point on a space curve Torsion, curvature radij of torsion and curvture Serret-Frenet formulae. Expression for curbature and torsion Helices. Circle of curvature and sphere of cutvature. Properties of locii of Centres of circle of cutvature and sphere of cutature Involutes and Evolutes special indicatrices. Bartrand curves Intrinsic equations Fundamental theorem for space curves.

2. Developble Surfaces :-

Parmetric representation of sufaces, Tangent plane and normal line. Characteristics, envelope, edge of regression to one parameter family of surfaces. Envelope to two parameter family of surfaces.

Developable surfaces General differenatial equation of a developable surface. Derolopables associated with a space curve. Properties of associated developables.

Ruled surfaces Criterion for skew and developable surfaces Tangent plane to ruled surfaces.

### SECOND TERM

3. Curres on surfaces :-

Curvitinear co-ordinates, parametric curres. First and second funcamental magnitudes. Fundamental forms. Derivatives of surface normal. Direction coefficients. Angle between intersecting curves on a surface. Angle between two directions Orthogonality. Curvature of normal section. Meanier's theorem.
Principal directions. principal curvatures. First and second curvatures. minimal surface. Umbilic point. Rodrigue's theorem. Joachimsthals theorem Dupins. Indicatrix.

Conjugale directions. Asymptotic, lines. Conjugale directions and parametric curves. parametric curves and asymptotic lines.

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4. Geodesics :-

Differential equation of Geodesic canonical geodesic equation. Extremal property. Normal property. Analytical property. Condition's for parametric curves to be geodesic. Geodesic on the surface of revolution. clairaut's theorem. curvature and torsion of geodesics.

RECOMMANDED BOOKS :-

1. Differential Geometry-by Bansilal.

REFERENCE BOOKS :-

1. Differential Geometry By- H.C.Saxena.
2. Differential Geometry By- Mittal & Agrawal.
3. Differential Geometry By- C.E.Weatherburn.
4. Differential Geometry By- Atmaram & Others.

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## P A P E R VII (C)

## COMPUTER PROGRAMMING

## (FORTRAN 77)

### FIRST TERM

1. Number Systems :- Decimal, Binary, B.C.D. Conversion from one system into another.
2. Introduction :- Types of computers (Analog Computer, Digital Computers). Main frame, Mini, Micro Computers, Generations Block diagram of a computer, compiler, Input, Output divices, Computer hardware and software Programming Language.
3. Flow-charting :- Flow chart symbol, Flow-chart of daily life examples.
4. FORTRAN Programming Preliminaries :- Higher level languages for computers, FORTRAN -77 characters, FORTRAN constants, Variable name. Type declaration for integers and reals.
5. Arithmatic Expressions :- Arithmatic operators and modes of expression, Integer expressions, real expressions, operator precedences, Arithmatic statements, defining variables, problems due to rounding of real numbers, mixed-mode expression, special functions and their uses.
6. Input-Output statements :- List directed input and output statement, writing simple FORTRAN programs based on above topics.
7. Control statements :- Relational operators, logical operator, If statement, statement labels, Go-To Statements, Nested logical if statement Arithmatic if statements, computed Go-to Statement.

and Computer Science.

2. Harary : Graph theory.
3. J.P.Tremblay ; Discrete Mathenation structures.
4. Greaitzer : General lattice Theory.
5. Rutherford : Lattice Theory.
6. Dilwarth : Algebraic Lattice Theory.

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## P A P E R-VIII (B)

## ASTRONOMY

### FIRST TERM

1. Spherical Trignometry --:
Angle of intersection of two great circles secondaries. Relation between arc of a small circle & arc of a great circle.
Spherical Triangle
Polar triangle.
Sine rule, Cosine rule, cotangent rule, Supplemental cosine rule, Sine cosine rule, sine cosine Tangent of angle & half angle as functions of sides and vice-versa.

2. Napier's Delambre's anologies --:
Right angled spherical triangles, Napier's rule of circular parts in right angled spherical triangle.

3. Astronomy --:
Cellestial sphere & different systems of cellestial co-ordinates
Rising setting conditions of a star.
Motion of the sun.
Siderial time.
Rate of change of zenith distance & azimath.

4. Twilight --:
Atmospheric refractin.
Refraction in Zenith distance.
Cassini's hypothesis.
Differential equation for refraction.
Simpon's & braddley's hypothesic.
Refraction in any direction.
Refraction in right ascersion & declination.

### SECOND TERM

5. Kepler's laws of planetory motion --:
True anomaly, Eccentric anomaly, Mean anomaly.
Kepler's equation.
Expressions of anomalies in terms of each other.

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6. Siderial Time.
   Mean Time.
   Conversion of time.
   Equation of time.
   Seasons.
   Sinodic period.
   Geocentric & Heliocentric conjuctions.

7. Geocentric motion of a planet.
   Elongation of a planet.
   Phases of the moon.
   Brightness of the planet.

8. Procession & Nutation.
   Procession in right ascension & declination.
   Nutation in right ascension & declination.
   Independent day numbers.

RECOMMANDED BOOKS --:

1. Spherical trinometry : Tpdhunter(Revised by GORAKH-PRASAD)
2. Spherical Astronomy : Gorakh - Prasad
   ( Published by Pothishala, Allahabad ).

REFERENCE BOOK -

1. Spherical Astronomy : Smart W.M.
   (published by : Vikas Publishing House,
   Pvt. Ltd. New Delhi.)

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## P A P E R VIII (C)

## MATHEMATICAL MODELLING

### FIRST TERM

1. MATHEMATICAL MODELLING --:
   Need, Technique, Classifications, characteristics & simple illustrations, m.m. throgh geometry, algebra trignometry & claculus limitations of m.m.

2. Mathematical modelling through ordinary, differential equations, Linear & non-linear growth & decay models, compartment models, m.m. in dynamics & geometrical problems.

3. Mathematical modelling through systems of ordinary differential equations of the first order, Mathematical modelling in population dynamics, Compartment models, Models in economic, Medicine battles dynamics.

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8. Do Statement :- General format of Do statement and examples. The REPEAT WHILE structure, comparision of Do and REPEAT WHILE statements.

SECOND TERM

9. Subscripted Variables :- Use of subscript, subscript expressions, Dimension statement, Implied Do-list.

10. Format specification :- Format description for numerical data for READ statement, FORMAT Description for PRINT : statement Multi-recordes Format, Hollerith field declaration, Specifications in A, Format, Generalised Input and output statements.

11. Logical expressions and decision tables :- Logical constants, Variables and expressions, Boolean Algebra, Examples of decision, tables;

12. Functions and Subroutines :- Statement functions, function subprograms, Syntax rules for subprograms Subroutines, The COMMON declaration, labelled COMMON, Placement of array element in COMMON, Execurtion time DIMENSION for arrays, use of procedure names as arguments.

RECOMMANDED BOOKS

TEXT BOOKS 1) V. Rajaramn- Principles of computer programming FORTRAN 77 (Third Edition ) PHI.
2) V. Rajaraman computor primer.

REFERENCE BOOKS 1) S.Lipschut and A.Poe- Programming with FORTRAN Mc-Graw Hill.
2) Ram Kumar - FORTRAN 77.
3) G.B.Davis, T.R.Hoffmann- FORTRAN 77, A structured Diseiplined style Mc-Graw Hill.

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T.Y.B.Sc.

P A P E R VIII (A) Distrete Mathematics.

Syllabus.

Mathematical Logic.

1. Algebra of Proposition.

Statements and negation, conjuction, disjunction, conditional bijconditional, truth tables, tautology and contradiction Logical equivlence, logical implications.

2. Logical reasoning.

Arguments, Arguments and Venndiagrams, Arguments and proposistions, Arguments and quantifiers, conditinal statements and variations.

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3. Quantifiers.

Universal and existential quantifiers, Negation of proposition containing quantifiers.

Lattices

1. Poset, Definition and examples, Maximal and minimal elements, upper and lower bounds, chains.
2. Lattices as partially ordered sets, lattices as algebraic systems, Hasse Diagram, Principle of duality, inequalities, modular and distributive lattice and their properties, complemented lattices.

SECOND TERM

Boolean Algebra

1. Boolean Algebra : Introduction, definition and examples, operations, axioms for Boolean Algebra, Lattice, Atoms, Symmetric difference, Boolean expression Boolean rings.

Graph Theory

1. Graphs : Definition Handshaking lemma, Types of graphs, complete graph, regular graph, bipartite graph, null graph, complete bipartite graph subgraph, isomophision of graphs.
2. Operations of graphs : Vertex deletion, edge deletion, deletion, Union and intersection of graphs, fusion of vertices, contraction of an edge, sum of graphs, ring complement of graph.
3. Matrix representation of a graph : Adjacency matrix, incidence matrix.
4. Connectedness : Walk, path, cycle (circuit), connected graph, disconnedted graphs, Eulerian graph, chinese postman problem, Koning seven bridge problem, Hamoltonian path, Hamoltonian ciruits, Travelling salesman problem. (TSP)
5. Cut set and vertices : cut set, edge connectivity, separable graphs.
6. Trees : Trees, centres, spanning trees, Kruskles Algorthm to find the shortes spanning tree.

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Prescribed Books

1. Schaum's Series : Set Theory and related topics.
2. Schaum's Series : Boolean Algebara and Switching Circuits.
3. Mrs. N.S.Bhave and Dr.T.T.Raghunathan : Elements of graph Theory.

Reference Books :

1. Narsing Deo : Graph theory with applications to Engineering

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SECOND TERM

4. Mathematical modelling through ordinary differential equations of second order, planetory motion, Circular motion & motion of satellites.

5. Mathematical modelling through difference equations. Need for m.m. through difference equation, Basic theory of linear difference equation with difference equations with constant coefficients,m.m. through difference equations in economics, finance.

6. Mathematical modelling through graphs, models in terms of directed graphs signal graphs, weighted diagraphs, unoriented diagraphs.

7. Mathematical modelling through calculus of variations, optimigation principles and Techniques, mathematical modeling through calculus of variations.

PRESCRIBED TEXT BOOK :-

Mathematical modeling :- J.N. Kapur. willey Eastern ltd.1988.
Ch- 1,2,3, Ch- 4 articles 4.1, 4.2
Ch--5 article 5.1, 5.2, 5.3
Ch- 7 Ch- 9 articles 9.1, 9.2

REFERENCE BOOKS :-

1. An introduction to mathematical modeling G.A. Bender (wiley interscience).
2. Mathematical Modeling courses by. J.S. Berry. D.N. Bughes I.D. Huntley D.A.G. James & A.D. Mos Cardini. (Ellis Howard & john wiley)
3. Mathematical methods in the physical silence by Mary L.Boas. (John wiley & Sons).

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P A P E R - IX

Problem Course based on paper VII and VIII.

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