

Sri Sathya Sai College for Women, Bhopal

(An Autonomous College affiliated to Barkatullah University, Bhopal)

(NAAC Accredited 'A' Grade)



SYLLABUS

PG

SESSION- 2023-24

Class: M.Sc. Semester-I & II

SUBJECT: Mathematics

SRI SATHYA SAI COLLEGE FOR WOMEN, BHOPAL,

(An autonomous college affiliated to Barkatullah University, Bhopal)

M.Sc. Semester wise syllabus

Recommended by Central Board of Studies, Department of Higher Education, Govt. of M.P.

Session : 2023-24

Class	- M.Sc.
Semester	- I
Subject	- Mathematics
Paper Title	- Advanced Abstract Algebra – I
Paper	- I

Max. Marks: 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To develop working knowledge on normal & subnormal series , solvable group.
- To get basic idea of extension fields , generalization of automorphisms
- To develop abstract & logical thinking.

Unit 1: Normal and Subnormal series of groups, Composition series, Jordan-Holder series.

Unit 2: Solvable & Nilpotent groups.

Unit 3: Extension fields. Roots of polynomials, algebraic and transcendental extensions. Splitting fields, separable and inseparable extension.

Unit 4: Perfect fields, Finite fields, algebraically closed fields.

Unit 5: Automorphism of extension, Galois extension. Fundamental theorem of Galois theory, solution of polynomial equation by radical, insolubility of general equation of degree 5 by radicals.

Learning outcomes:

The students will be able to

- Define solvable, nilpotent groups and modules.
- Find extension fields and Roots of polynomials algebraic and transcendental functions.

- Define finite field and their properties.
- Define the concept of linear transformation.

Text Book:-

- 1) I.N. Herstein, topics in Algebra, Wiley Eastern, New Delhi.
- 2) V.Sahai & V.Bisht, Algebra, Narosa Publishing House.
- 3) P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University press.

Reference book:-

- 1) N.Jacobson, Basic Algebra, Vol.I,II,&VIII Hindustan Publishing Company.
- 2) S. Lang, Algebra, Addition- Wesley.
- 3) I.S.Luther & I.B.S. Passi Algebra vol-1,2,3 Narosa company.







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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- I
Subject	- Mathematics
Paper Title	- Real Analysis
Paper	- II

Max. Marks: 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To introduce the students to the fundamental concepts of real analysis.
- Deeper study of the results of previous calculus courses in light of Riemann – Stieltjes integral.

- Unit 1** Definition and existence of Riemann- Stieltjes integral and its properties, Integration and differentiation.
- Unit 2** Integration of vector- valued functions, Rectifiable curves, rearrangements of terms of a series, Riemann's theorem.
- Unit 3** Sequences and series of functions, point wise and uniform convergences, Cauchy criterion for uniform, Weirstrass M test, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes intergration, uniform convergence and differentiation.
- Unit 4** Function of several variables, linear trasformations, derivatives in an open subset of R^n , chain rule, partial derivatives, differentiation, inverse function theorem.
- Unit 5** Derivatives of higher order, power series, uniqueness theorem for power series, Abel's and Tauber's theroems, Implicit function theorem.

Learning outcomes:

The students will be able to

- Define Riemann Stieltjes integrals , its existence and properties.
- Understand concept of convergence of sequece and series.

Text books:-

- 1) Walter Rudin, Principles of Mathematical Analysis, McGraw Hill.

Reference books:

- 1) T.M. Apostal, Mathematical Analysis Narosa.
- 2) H.L. Royden, Real Analysis, Macmillan (Indian Edition)

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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- I
Subject	- Mathematics
Paper Title	- Topology-I
Paper	- III

Max. Marks: 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To introduce and expose the students to the basic & important abstract notions of general topology.

- Unit 1** Countable and uncountable sets. Infinite sets and the Axiom of choice. Cardinal numbers and its arithmetic, Schroeder-Bernstein theorem, statements of Cantor's theorem and the Continuum hypothesis, Zorn's lemma, Well-ordering theorem. [G.F. Simmons and K.D. Joshi]
- Unit 2** Definition and examples of topological spaces, closed sets, closure, dense subsets, neighbourhoods, interior exterior and boundary, accumulation points and derived sets, bases and sub-bases, subspaces and relative topology. [G.F. Simmons]
- Unit 3** Alternate methods of defining a topology in terms of Kuratowski closure Operator and Neighbourhood Systems, continuous functions and homeomorphism. [G.F. Simmons, K.D. Joshi, J.R. Munkers]
- Unit 4** First and second countable spaces, Lindelof's theorems, Separable spaces, Second Countability and Separability. [G.F., Simmons]
- Unit 5** Path-connectedness, connected spaces, connectedness on real line, components, locally connected spaces. [J.R. Munkers]

Learning outcomes:

The students will be able to

- Understand the concept of topological space, types of topologies and basic definitions involved.
- Differentiate between hereditary and topological properties of a space.
- Discuss alternate methods of defining Topology

Text books:-

- 1) J.R. Munkers, Topology-A first course, Prentice-Hall of India.
- 2) G.F. Simmons, introduction to Topology and Modern Analysis, McGraw Hill
- 3) K.D. Joshi: Introduction to General Topology, Wiley Eastern.

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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- I
Subject	- Mathematics
Paper Title	- Complex Analysis-I
Paper	- IV

Max. Marks: 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objective :

- To enable the students to acquire skills of contour integration to evaluate complicated real integrals.
- To expose the students the basic ideas of Bilinear transformations.

- Unit 1** Complex integration, Cauchy Goursat theorem, Cauchy integral formula, Higher order derivative.
- Unit 2** Morera's theorem, Cauchy inequality, Liouville's theorem, The fundamental theorem of algebra. Taylor's theorem
- Unit 3** The maximum modulus principle. Schwartz lemma. Laurent series. Isolated singularities, Meromorphic functions, The argument principle. Rouché's theorem. Inverse function theorem.
- Unit 4** Residues, Cauchy's residue theorem, Evaluation of integrals, Branches of many valued function with special reference to $\arg z$, $\log z$, z^a .
- Unit 5** Bilinear transformation, their properties classification, Definitions and examples of conformal mappings.

Learning outcomes

The students will be able to

- Solve the problems of complex integration.
- Appreciate the concepts of Residue theorem, Cauchy Goursat Theorem, Morera's theorem

Text Book:

J.B. Conway, Functions of one complex variable, Springer-Verlag.

Reference Books:

- 1) S. Ponnuswamy, Foundations of complex analysis, Narosa Publishing House.
- 2) L.V Ahlfors, Complex analysis, McGraw Hill

SRI SATHYA SAI AUTONOMOUS COLLEGE FOR WOMEN, BHOPAL

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M.Sc. Semester wise syllabus

Recommended by Central Board of Studies Department of Higher Education, Govt. M.P.

Session : 2023-24

Class	- M.Sc.
Semester	- I
Subject	- Mathematics
Paper Title	- Advanced Discrete Mathematics – I
Paper	- V (Optional-I)

Max. Marks: 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course Objective :

- To enable the students to develop the concepts of Discrete Mathematics

Unit 1 Semigroups and monoids, subsemigroups and submonoids, Homomorphism of semigroups and monoids, Congruence relation and Quotient semigroups, Direct products, Basic homomorphism Theorem.

Unit 2 Lattices- Lattice as partially ordered sets, their properties, Lattice as Algebraic system, sublattice , Bounded lattices, Distributive Lattices, Complemented lattices.

Unit 3 Boolean Algebra- Boolean Algebras as lattices , various Boolean identities. Joint irreducible elements, minterms, maxterms, minterm Boolean forms, Canonical forms, Minimization of Boolean functions. Application of Boolean Algebra to switching theory (Using AND, OR & NOT gates) the karnaugh method.

Unit 4 Graph Theory- Definition and types of graphs. Path & Circuits. Connected graphs. Euler graphs, weight graphs(undirected) Dijkstra's Algorithm. Trees, Properties of Trees, Rooted and Binary Trees, spanning trees, minimal spanning tree.

Unit 5 Complete Bipartite graphs, Cut-sets, Properties of cut sets, Fundamental Cut-sets & circuits, Connectivity and Separability, Planar graphs, Kuratowski's two graphs, Euler's formula for planar graphs.

Learning outcomes :

The students will be able to

- Define Semigroups and monoids, Lattices
- Apply concepts of Boolean algebra to switching theory
- Explore the ideas of Graph Theory

Text Book :-

- 1 J.P Trembley & R. Manohar, Discrete Mathematical structures, McGraw Hill.
- 2 N. Deo. : Graph theory with applications Prentice hall.

Reference Books:-

- 1 C.L. Liu : Elements of Discrete Mathematics McGraw hill.
- 2 Seymour Lipschutz More Lipson : Discrete Mathematics McGraw hill.

Prof

P. S.

Sharma

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Session : 2023-24

Class	- M.Sc.
Semester	- II
Subject	- Mathematics
Paper Title	- Advanced Abstract Algebra-II
Paper	- I

Max. Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To design a rigorous treatment of concept of modules so as to enable students to built mathematical thinking skills.

Unit 1 Introduction to Modules, examples, submodules, quotient modules, Modules homomorphism, isomorphism, Finitely generated modules, cyclic modules.

Unit 2 Simple modules, Semisimple modules, Free modules, Schur's lemma.

Unit 3 Noetherian & Artinian modules and rings, Hilbert basis theorem. Wedderburn - Artin theorem.

Unit 4 Uniform modules, primary modules, Noether-Laskar theorem, Fundamental structure theorem of modules over a principal ideal domain.

Unit 5 Algebra of Linear Transformation, characteristic roots, Matrices, Matrix of Linear Transformations, similarity of Linear Transformation, Invariant space , Reduction to triangular forms.

Learning outcomes:

Students will be able to

- Define modules, Noetherian & Artinian modules and rings.
- Define the concept of linear transformation

Text books:-

1. P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul, Basic Abstract Algebra, Cambridge University press, (Indian Edition).
2. I.N Herstein, Topics in Algebra, Wiley Eastern.
3. S. Kumaresan, Linear Algebra-A geometric approach, Prentice Hall India Ltd.
4. Books prescribed in unified syllabus.

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Session : 2023-24

Class	- M.Sc.
Semester	- II
Subject	- Mathematics
Paper Title	- Lebesgue Measure & Integration
Paper	- II

Max. Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To introduce the students to the basic concept of Lebesgue measure.
- To train the students in the subject so that they can pursue the subject in the framework of research.

- Unit 1** Lebesgue outer measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesgue measurability, Non – measurable sets.
- Unit 2** Integration of Non – negative functions. The General integral. Integration of Series, Riemann and Lebesgue Integrals.
- Unit 3** The Four derivatives. Functions of bounded variation, Lebesgue Differential Theorem, Differentiation and Integration.
- Unit 4** The L^p -space, Convex function, Jensen's inequality, Holder and Minkowski inequalities, Completeness of L^p .
- Unit 5** Dual of space when $1 < p < \infty$, Convergence in measure, Uniform convergence and almost uniform convergence.

Learning outcomes:

The students will be able to

- Analyze measurable sets and Lebesgue measure.
- Understand the concept of L^p and dual spaces.

Text Book:

- 1) G. de Barra. Measure Theory and Integration, Wiley Eastern (Indian Edition).

Reference Books:

- 1) Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill, International student edition,
- 2) H.L. Royden, Real Analysis, Macmillan, Indian Edition.

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Session : 2023-24

Class	- M.Sc.
Semester	- II
Subject	- Mathematics
Paper Title	- Topology- II
Paper	- III

Max. Marks: 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks (with internal choice) and 1 long answer of 10 marks (with internal choice) is to be asked in the examination paper.

Course objectives:

- To give the students sufficient knowledge which can be used for future applications in their respective domain of interest.

- Unit 1** Separation Axiom T_0, T_1, T_2, T_3, T_4 , their Characteristics and basic properties, Urysohn's lemma, Tietze Extension Theorem [G.F. Simmons and K.D. Joshi]
- Unit 2** Compactness, Continuous functions and compact sets, basic properties of compactness, Compactness and finite intersection property, Sequentially and countably compact set, Local compactness. [G.F. Simmons]
- Unit 3** Tychonoff product Topology in terms of standard sub-base and its characterizations. Projection maps, Separation axioms and product space, Connectedness and product space, Compactness and product space (Tychonoff's Theorem), Countability and product space. [G.F. Simmons]
- Unit 4** Net and filter's convergence of nets, Hausdorffness and nets, Compactness and nets. Filters and their convergence, Canonical way of converting nets to filters and vice-versa. Ultrafilters and Compactness, [K.D. Joshi]
- Unit 5** The fundamental group and covering spaces-Homotopy of paths, The fundamental group, covering space, the fundamental group of circle and the Fundamental theorem of Algebra [J.R. Munkers]

Learning outcomes :

Students will be able to

- Define properties of countability, compactness, separability, connectedness.
- To explore the ideas of net and filters and fundamental groups.

Text books:-

- 1) J.R. Munkers, Topology-A first course, Prentice-Hall of India Pvt. Ltd. New Delhi.
- 2) G.F. Simmons, introduction to Topology and Modern Analysis, McGraw Hill.
- 3) K.D. Joshi: Introduction to General Topology, Wiley Eastern.

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Session : 2023-24

Class	- M.Sc.
Semester	- II
Subject	- Mathematics
Paper Title	- Complex Analysis-II
Paper	- IV

Max. Marks: 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To strength logical & critical thinking of students by exploring the new dimensions in field of complex numbers and functions.

- Unit 1** Weierstrass factorization theorem, Gamma and its properties, Riemann Zeta function. Riemann's functional equation.
- Unit 2** Mittag-Leffler's theorem, Analytic continuation, Uniqueness of direct analytic continuation, uniqueness of analytic continuation along a curve, Power series method of analytic continuation.
- Unit 3** Schwartz reflection principle, Harmonic function on a disc, Harnax inequality and theorem, Dirichlet problem, Green's function.
- Unit 4** Cannonical products, Jensen's formula, Hadamard's three circles theorem, Order of an entire function, Exponent of convergence, Borels theorem Hadamard's factorization theorem.
- Unit 5** The range of an analytic function, Bloch's theorem, The Little Picard theorem, Schottky's theorem, Montel Caratheodary and Great Picard theorem, Univalent function., Bieberbach conjecture and the $\frac{1}{4}$ - theorem.

Learning outcomes:

- Define analytic continuation , harmonic functions ,canonical products .
- Uses of Schwartz reflection principle , Bloch Theorem ,Little Picard theorem

Text Book:

- 1) J.B. Convey, Functions of one complex variable, Springer- Verlag.

Reference Books:

- 1) S. Ponnuswamy, Fundamentals of complex analysis, Narosa Publishing House.
- 2) L.V Ahlfors, Complex analysis, McGraw Hill

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M.Sc. Semester wise syllabus

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M.P.**

Session : 2023-24

Class	- M.Sc.
Semester	- II
Subject	- Mathematics
Paper Title	- Advanced Discrete Mathematics – II
Paper	- V (Optional-I)

Max. Marks: 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To develop working knowledge on Formal languages, Finite State Automata
- To get basic idea of Matrix representation of graphs

- Unit 1** Matrix representation of graphs- Incidence matrix, Cut set matrix, Path Matrix, Circuit Matrix and Adjacency Matrix. Directed graphs, Definition of types of directed graphs, Binary search trees.
- Unit 2** Discrete Numeric functions, Asymptotic , Behaviour of Numeric functions, and Generating functions. Recurrence Relations-Linear Recurrence Relations with constants coefficients, Homogeneous solutions, particular solutions, Total Solutions.
- Unit 3** Computability and Formal languages-Languages, Phrase structure grammars, Derivation, Sentential forms, Language generated by grammar. Regular, context- free and context sensitive grammar.

Unit 4 Finite State Automata, Diagram and Language determined by an Automaton, Finite State Acceptors, Deterministic and Non-Deterministic finite Automaton. Finite state Machines, their transition tables and diagrams. Equivalent machines.

Unit 5 Reduced Machines, Kleen's theorem (statement only) Pumping Lemma, Moore and Mealy Machines, Turing Machines. Regular Expressions and corresponding regular languages (definition only)

Learning outcomes :

The students will be able to

- Understand the concept of language and its use in different machines
- Understand the concepts of mathematics used in computation in the field of computer science

Text Book :-

- 1 J.P Tremblay & R.Manohar, Discrete Mathematical structures, McGraw Hill.
- 2 N. Deo. Graph Theory with applications Prentice hall.

Reference Books:-

- 1 C.L. Liu: Elements of Discrete Mathematics McGraw Hill.
- 2 Seymour Lipschutz/ Marc Lipson : Discrete Mathematics, McGraw Hill.



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SYLLABUS

PG

SESSION- 2023-24

Class: M.Sc. Semester-III & IV

SUBJECT: Mathematics

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M.Sc. Semester wise syllabus

Recommended by Central Board of Studies, Department of Higher Education, Govt. of M.P

Session : 2023-24

Class	- M.Sc.
Semester	- III
Subject	- Mathematics
Paper Title	- Functional analysis I
Paper	- I (Compulsory)

Max. Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To expose the students to the basic concepts of functional analysis.
- To develop abstract and critical thinking.

Unit I: Normed linear spaces, Banach spaces and examples. Properties of normed linear spaces.

Basic properties of finite dimensional normed linear spaces.

Unit II: Normal linear subspace, equivalent norms, Riesz lemma and compactness. Quotient space of normed linear Spaces and its completeness.

Unit III: Linear Operator. Bounded Linear Operator and continuous Operators.

Unit IV: Linear functional, bounded linear functional, Dual spaces with examples.

Unit V: Hilbert space, orthogonal complements, orthonormal sets and sequences. Representative of the functional on Hilbert spaces.

Learning outcomes:

The students will be able to

- Define Normed linear spaces , Banach space , Hilbert space and their basic properties.
- Define linear operators and linear functional and their properties.

Text Books:

1. E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons, New York 1978.
2. G. F. Simmons, Introduction to Topology & Modern Analysis McGraw Hill, New York.

References:

1. B. Choudhary and Sudarshan Nanda , Functional Analysis with applications, Wiley Eastern Ltd.

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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- III
Subject	- Mathematics
Paper Title	- Advanced Graph Theory- I
Paper	- II (Optional)

Max.Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To introduce the students to the preliminaries of Graph Theory.
- To provide an insight how graph theory can be used to find solutions of practical problems arising in other branches of science.

Unit I: Revision of graph, theoretic preliminaries. Isomorphism of graphs, sub graphs.

Unit II: Walk, Paths and circuits, Connected graphs, Disconnected graphs and components .Euler Graphs, operations on graphs , Hamiltonian paths and circuits. Travelling salesman problem.

Unit III: Trees, properties of trees, distance and centres in a tree, Rooted and Binary trees, Spanning trees, Fundamental circuits, spanning trees in a weighted graph.

Unit IV: Cut -sets, properties of a cut set, Fundamental circuits and cut-sets, connectivity and separability.

Unit V: Planar graphs, Kuratowski's two graphs, different representations of a planer graphs, detection of planarity, Geometric Dual , Combinational Dual.

Learning outcomes:

The students will be able to

- Define Graph ,Isomorphsim of graph, sub graph, walks , path , connected graph , Hamiltonian paths and circuits.
- Define trees , properties of trees ,spanning trees , cut sets , planar graph.
- Find and understand applications of graph theory in daily life.

Text Book:

1.Graph theory with application to Engineering and computer science by Narsingh Deo,Printice Hall of India

Reference Book:

1.Graph Theory by Harary

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Session : 2023-24

Class	- M.Sc.
Semester	- III
Subject	- Mathematics
Paper Title	- Advanced Special Function-1
Paper	- (Optional) III

Max.Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objective:

- To introduce the students to the fundamental concepts of special functions and their elementary properties.

Unit I: Gamma and Beta function : The Euler or Macheroni constant γ , Gamma function a series for $\Gamma(z)$, Difference equation $\Gamma(z+1) = z \Gamma(z)$, value of $\frac{\Gamma(z)}{\Gamma(1-z)}$, factorial function, Legendre's duplication formula, Gauss multiplication theorem

Unit II: Hypergeometric function and function ${}_2F_1(a,b;c;z)$. A simple integral form valuation of ${}_2F_1(a,b;c;z)$. Contiguous function relations, Hyper geometric differential equation and its solution, ${}_2F_1(a,b;c;z)$ as the function of its parameters.

Unit III: Generalized Hyper geometric function.

Unit IV: Elementary series manipulation, simple transformation, relation between function of z and $1-z$

Unit V: Confluent hyper geometric function and its properties.

Learning outcomes:

The students will be able to

- Define Beta and Gamma functions and prove its various properties.
- Defines Hypergeometric functions and its generalized form and proves various results based on it.

Books Recommended:

1. Rainville, E. D., Special Functions, the Macmillan Co., New York 1971.
2. Srivastava, H. M. Gupta K. C. and Goyal, S. P. The H- functions of one and two variables with applications, South Asian Publication New Delhi.
3. Saran N. Sharma S. D. and Trivedi-Special Functions with application, Pragati Prakashan, 1986.
4. The Saxena V. P. I-Function, Anamaya- New Delhi 2008

Reference Books:

1. Lebedev, N. N., Special Functions and their applications, Prentice Hall, Englewood Cliffs, New Jersey, USA 1995.
2. Whittaker, E. T. and Watson, G. N., A course of Modern Analysis Cambridge University Press, London, 1963.

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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- III
Subject	- Mathematics
Paper Title	- Operations Research -I
Paper	- IV (Optional)

Max.Marks:85

Note: From each unit 2 objective type questions one marks each, 1short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objective:

- To provide a substantial introduction to the subject so that the students can appreciate the importance and diverse applications of the subject in different fields.

Unit I : Operations Research and its scope, origin and development of Operations Research, characteristics of Operations Research.

Unit II: Model in Operations Research, phase of Operations Research, Uses and Limitations of Operations Research. Linear Programming Problems.

Unit III : Mathematical Formulation, Graphical Solution Method..

Unit IV: General Linear Programming Problem: Simplex method exceptional cases, artificial variable techniques: Big M method, Two Phase method, cyclic problems, and problem of degeneracy.

Unit V : Duality, Fundamental Properties of duality and theorem of duality.

Learning outcomes:

- Understand scope of Operations Research, and its characteristics.
- Understand the concept of Linear programming, feasible solution, obtain solution of linear programming problem using Simplex method, Big M method, Two phase method.

Books Recommended:

1. Kanti Swarup, P. K. Gupta and Manmohan, Operations Research. SultanChand & Sons. New Delhi.

Reference Books:

- 1 S. D. Sharma, Operations Research.
2. F. S. Hiller and G. J. Lieberman, Industrial Engineering Series, 1995.(This book comes with a CD containing software)
3. G. Hadley, Linear programming, Narosa Publishing House1995.
4. G. Hadley, Linear and Dynamic programming, Addison- Wesley Reading Mass.
5. H. A. Taha, Operations Research- An introduction, Macmillan Publishing co. Inc. New York.
6. Prem Kumar Gupta and D. S. Hira, Operations Research, An introduction, S. Chand & Company Ltd. New Delhi.
7. N. S. Kambo, Mathematical Programming Techniques, Affiliated East- West Pvt. Lt. Madras

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Session : 2023-24

Class	- M.Sc.
Semester	- III
Subject	- Mathematics
Paper Title	- Integral Transform-I
Paper	- V (Optional)

Max.Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objective:

- To introduce the students to Laplace transform, its inverse and its applications in finding solutions of heat, wave equations and in electric circuits.

Unit I: Laplace Transform, Inverse Laplace Transform, Transforms of derivatives, shifting theorem, convolution theorem.

Unit II: Application to Differential equations, Application to Integral equations, Solution of simultaneous differential equations.

Unit III: Laplace Equation in two dimensions, Wave equation in one dimension, Application to Wave equation.

Unit IV: Application of Laplace transform to electrical circuits, Application to beams.

Unit V: Heat conduction equation in one dimension, Application to heat conduction equation.

Learning outcomes:

The students will be able to

- To find Laplace transform of functions, find inverse Laplace transform, application of shifting theorems and convolution theorem.
- Apply Laplace transform to find solution of differential equations integral equation, wave equations, heat equations and in electrical circuits.

Books Recommended:

1. Integral Transforms by Goyal and Gupta.
2. Integral Transforms by Gupta and Vashith.
3. Integral Transforms by I.N.Sneddon.

SRI SATHYA SAI COLLEGE FOR WOMEN, BHOPAL

(An autonomous college affiliated to Barkatullah University , Bhopal)

M.Sc. Semester wise syllabus

Recommended by Central Board of Studies, Department of Higher Education, Govt. of M.P

Session : 2023-24

Class	- M.Sc.
Semester	- IV
Subject	- Mathematics
Paper Title	- Functional analysis II
Paper	- I (Compulsory)

Max.Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objective:

- To facilitate the study of advance mathematical structures and concepts.
- To develop thinking and reasoning power of students so as to facilitate their advances in areas of research in pure mathematics.

Unit I: Hilbert adjoint operator and its properties, self adjoint, unitary and normal operators ,positive operator.

Unit II: Zorn's lemma, Hahn- Banach theorem for real linear spaces, Hahn- Banach theorem for complex linear spaces and normed linear spaces.

Unit III: Adjoint operators on normed spaces, relation between adjoint operator and Hilbert adjoint operator ,Reflexive spaces, Reflexivity of Hilbert spaces.

Unit IV: Category theorem-Baire's Category theorem, uniform boundedness theorem and some of its application, strong and weak convergence in normed spaces.

Unit V: Convergence of sequences of operators and functionals ,open mapping theorem, closed graph theorem, contraction theorem.

Learning outcomes:

The students will be able to

- Understand the concepts of classical theorems such as Zorn's lemma , Hahn Banach theorem , Baire's category theorem .
- Define convergence of sequence of operators and functional, and their applications in proving results & theorems.

Text Books:

1. E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons, New York 1978.
2. G. F. Simmons, Introduction to Topology & Modern Analysis McGraw Hill, New York.

References:

1. B. Choudhary and Sudarshan Nanda , Functional Analysis with applications, Wiley Eastern Ltd.

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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- IV
Subject	- Mathematics
Paper Title	- Advanced Graph Theory - II
Paper	- II (Optional)

Max.Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To make students understand the applications of concepts of Graph theory in other branches of science.
- To acknowledge graphs as mathematical models for many systems for finding their solutions.

Unit I: Matrix representation of graphs, Incidence matrix, sub matrices of $A(G)$, Circuit matrix, Fundamental circuit matrix and rank of B , an application to a switching network.

Unit II: Cut set matrix, relationships among A_f , B_f , and C_f path matrix, Adjacency matrix.

Unit III: Chromatic Number, Chromatic Partitioning, Chromatic Polynomial, coverings, matching's.

Unit IV: The four color problem, directed graph, some types of Digraphs, digraphs and binary relations, Euler digraphs, Directed paths and connectedness.

Unit V: Trees with directed graphs, Arborescence, Fundamental circuits in diagraphs, Matrix A , B , and C of digraphs, Adjacency matrix of a digraph.

Learning outcomes:

The students will be able to

- Find matrix representations of graph, incidence matrix , adjacency matrix , cut set matrix .
- Define Chromatic numbers , Chromatic polynomials , Four colour problem, diagraphs and Binary Relation

Text Book:

1.Graph theory with application to Engineering and computer science by Narsingh Deo.

Reference Book:

1.Graph Theory by Harary

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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- IV
Subject	- Mathematics
Paper Title	- Advanced Special Function-II
Paper	- III (Optional)

Max. Mark. 85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks (with internal choice) and 1 long answer of 10 marks (with internal choice) is to be asked in the examination paper.

Course objective

- To acquire the knowledge of special functions & their properties.
- To investigate & derive the properties of special functions, inter relations between such functions.

Unit I: Bessel's function, Bessel's differential equations, generating function. Bessel's integral with index half and odd integer.

Unit II: Generating function for Legendre polynomials, Rodrigues formula, Bateman's generating function, Additional generating functions.

Unit III: Definition of Hermite polynomials $H_n(x)$, pure recurrence relations, differential recurrence relations, Rodrigue's formula, other generating functions, Orthogonality, Expansion of polynomials, more generating function.

Unit IV: Laguerre polynomials: The Laguerre polynomials $L_n(x)$, generating functions, pure recurrence relation, differential recurrence relation, Rodrigue's formula.

Unit V: Jacobi polynomials, generating functions, differential equation of Jacobi polynomials, Orthogonal Properties.

Learning outcomes:

The students will be able to

- Understand the definition and properties of Bessel's function, Hermite polynomials, their generating functions, Rodrigues Formula.
- Define and use Laguerre polynomials and Jacobi polynomials to derive some result.

Books Recommended

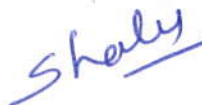
1. Rainville, E. D., Special Functions, the Macmillan Co., New York 1971.
2. Srivastava, H. M. Gupta K. C. and Goyal, S. P.: The H- functions of one and two variables with applications, South Asian Publication New Delhi.
3. Saran N. Sharma S. D. and Trivedi-special Functions with application, Pragati Prakashan, 1986.

Reference Books:

1. Lebedev, N. B., Special Functions and their applications, Prentice Hall, Englewood Cliffs, New Jersey, USA 1995.
2. Whittaker, E. T. And Watson, G. N., A course of Modern Analysis Cambridge University Press, London, 1963







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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- IV
Subject	- Mathematics
Paper Title	- Operations Research - II
Paper	- IV (Optional)

Max.Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objective:

- To introduce to students to quantitative methods & techniques of Operations Research for effective decision making in scenarios arising in field of trade & commerce, economics and other sciences.

Unit I: Transportation problems: North -West Corner method, Least -Cost method, Voggle's Approximation method, MODI method exceptional cases and problem of degeneracy.

Unit II: Assignment problems, Non linear programming techniques- Kuhn-Tucker conditions, Non negative constraints.

Unit III: Network analysis , constraints in network, construction of network, Critical Path Method (CPM), PERT calculations, Resource Levelling by Network Techniques and advances of network (CPM/ PERT)

Unit IV: Simulation: Monte- Carlo Simulation, Simulation of Networks, Advantages and limitations of Simulation.

Unit V Game theory: Two persons Zero- sum games, Maximin- Mimimax principle , games without saddle points – mixed strategies. Graphical solution of $2 \times m$, $n \times 2$ games, solution by Linear Programming.

Learning outcomes:

The students will be able to

- Study Transportation problem and Assignment Problem and their applications.
- Find solution of non linear programming problem , construct network and perform critical path method and PERT calculations.

Books Recommended:

1. Kanti Swarup, P. K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi.

Reference Books:

1. S. D. Sharma, Operations Research.
2. F. S. Hiller and G. J. Lieberman, Industrial Engineering Series, 1995. (This book comes with a CD containing software)
3. G. Hadley, Linear programming, Narosa Publishing House 1995.
4. G. Hadley, Linear and Dynamic programming, Addison- Wesley Reading Mass.
5. H. A. Taha, Operations Research- An introduction, Macmillan Publishing co. Inc. New York.
6. Prem Kumar Gupta and D. S. Hira, Operations Research, An introduction, S. Chand & Company Ltd. New Delhi.
7. N. S. Kambo, Mathematical Programming Techniques, Affiliated East- West Pvt. Lt. Madras



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M.Sc. Semester wise syllabus

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Session : 2023-24

Class	- M.Sc.
Semester	- IV
Subject	- Mathematics
Paper Title	- Integral Transform II
Paper	- V (Optional)

Max.Marks:85

Note: From each unit 2 objective type questions one marks each, 1 short answer of 5 marks(with internal choice) and 1 long answer of 10 marks(with internal choice) is to be asked in the examination paper.

Course objectives:

- To equip the students with the methods of finding Fourier transform of different functions
- To make them familiar with the methods of solving differential equations, partial differential equation, IVP and BVP.

Unit I: Fourier Transform, Infinite Fourier Transform, Complex Fourier Transform.

Unit II: Finite Fourier transform and Fourier Integral.

Unit III: Convolution theorem, Parseval's Identity for Fourier series, Parseval's Identity for Fourier Transform.

Unit IV: Application for Fourier Transform to Boundary value problems.

Unit V: Introduction to Hankel and Mellin Transforms, Fourier series and Boundary value problems.

Learning outcomes:

The students will be able to

- To find Fourier transform and Fourier integral .
- Apply Fourier transform to boundary value problems, define Hankel transform and Mellin transforms.

Books Recommended:

1. Integral Transforms by Goyal and Gupta.
2. Integral Transforms by I.N. Sneddon.
3. Integral Transforms by Gupta and Vashishtha.

