

MAHAKAUSHAL UNIVERSITY JABALPUR

As per model syllabus of U.G.C. New Delhi, drafted by
Central Board of Studies and Approved by Higher
Education and the Governor of M.P.



विज्ञान संकाय

Faculty of Science
Syllabus & Prescribed Books
Subject-Mathematics

M.Sc./ M.A. Semester Examination

I to IV Semester

Department Of Higher Education, Govt. of M.P.
Semester wise Syllabus For post graduates
As recommended by central Board of studies and
Approved by HH the Governor of M.P.

MMAT0101-T

Class : M.Sc/MA (Semeter-I)
Subject : Mathematics
Paper : I
Title : Advanced Abstract Algebra –I

Unit 1

Normal & 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. Seperable and inseperable extension.

Unit 4

Perfect fields, Finite fields, primitrive elements, Algebraically closed fields.

Unit 5

Automorphism of extension, Galois extension. Fundamental theorem of Galois theory
Solution of polynomial equations by radicals, Insolubility of general equation of
degree 5 by radicals.

Text books :

- (1) I.N. Herstein, Topics in Algebra, Wiley Eastern, New Delhi.
- (2) V.Sahai & V. Bisht, Algebra, Narosa Publishing House.

Defeneues.

- (1) P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University press.
- (2) N.Jacobson, Basic Algegra, Vol I, II & VIII , Hindustan Publishing Company.
- (3) S.Lang, Algebra, Addison-wesley.
- (4) I.S. Luther & I.B.S. Passi Algebra vol-1,2,3 Narosa company.

Department Of Higher Education, Govt. of M.P.
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MMAT0102-T

Class : M.Sc/MA (Semeter-I)
Subject : Mathematics
Paper : II
Title : Real Analysis

Unit - I

Definition and existence of Riemann- Stieltjes integral and its Properties, Integration and differentiation, The fundamental theorem of Calculus.

Unit-II

Integration of vector – valued functions, Rectifiable curves. Rearrangements of terms of a series. Riemann's theorem.

Unit - III

Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation theorem, Power series, uniqueness theorem for power series, Abel's and Tauber's theorems.

Unit - IV

Functions of several variables, linear transformations, Derivatives in an open subset of \mathbb{R}^n Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem,

Unit - V

Implicit function theorem, Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals, Partitions of unity, Differential forms, Stoke's theorem.

Text books :

1. Water Rudin, Principles of Mathematical Analysis, McGraw Hill.

Reference :

1. T.M. Apostol, Mathematical Analysis Narosa.
2. H.L. Rayden, Real Analysis, Macmillan (Indian Edition)

**Department Of Higher Education, Govt. of M.P.
Semester wise Syllabus For post graduates
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MMAT0103-T

Class : M.Sc/MA (Semeter-I)
Subject : Mathematics
Paper : III
Title : Topology - I

Unit - I

Countable and uncountable *sets*. Infinite sets and the Axiom of Choice. Cardinal numbers and its arithmetic. Schroeder-Bernstein theorem, Cantor's theorem and the continuum hypothesis. Zorn's lemma. Well-ordering theorem.

Unit II

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.

Unit III

Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood Systems. Continuous functions and homeomorphism.

Unit IV

First and Second Countable spaces. Lindelof's theorems. Separable spaces. Second Countability and Separability.

Unit V

Path-connectedness, connected spaces. Connectedness on Real line. Components, Locally connected spaces.

Text Books:

J.R.Munkres, Topology-Afirst course, Prentice-Hall of India.

References:

G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill
2, K.D.Joshi: Introduction to general topology, Wiley Eastern.

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MMAT0104-T

Class : M.Sc/MA (Semeter-I)
Subject : Mathematics
Paper : IV
Title : Complex Analysis - I

Unit - I

Complex integration, Cauchy – Goursat theorem, Cauchy integral formula, Higher order derivatives.

Unit - II

Morera's theorem. Cauchy's inequality. Liouville's theorem. The fundamental theorem of algebra. Taylor's theorem.

Unit - III

The maximum modulus principle. Schwartz lemma. Laurent series. Isolated singularities. Meromorphic functions, The argument principle. Rouché's theorem. Inverse function theorem.

Unit - IV

Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to $\arg z, \log z, z^a$.

Unit - V

Bilinear transformations, their properties and classification. Definitions and examples of conformal mappings.

Text Book :

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

References :

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

Department Of Higher Education, Govt. of M.P.
Semester wise Syllabus For post graduates
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MMAT0105(A)-T

Class : M.Sc/MA (Semeter-I)
Subject : Mathematics
Paper : V (Optional- I)
Title : Advanced Discrete Mathematics - I

Unit - I

Semigroups & Monoids-Definition-. sab semigroups and submonoids (including those pertaining to concatenation opration). Homomorphism of semigroups and monoids. Congruence relation and Quotient Semigroups. Subsemigroup and submonoids. Direct products. Basic Homomorphism Theorem.

Unit - II

Lattices-Lattices as partially ordered sets. Their properties. Lattices as Algebraic systems. Sublattices, Direct products, and Homomorphisms. Some Special Lattices e.g. Complete Complemented and distributive Lattice.

Unit - III

Boolean Algebras-Boolean Algebras as Lattices. Various Boolean Identities. The Switching Algebra example. Subalgebras, Direct Products and Homomorphisms. Join-irreducible elements, Atoms and Minterms. Boolean Forms and Their Equivalence. Minterm Boolean Forms, Sum of Products Canonical Forms. Minimization of Boolean Functions. Applications of Boolean Algebra to Switching Theory (using AND, OR a NOT gains). The Karnaugh Map method.

Unit - IV

Graph Theory-Definition of (unsarecTea} Graphs, Paths, Circuits, Cycles, & Subgraphs. Induced Subgraphs. Degree of a v e i t e x Connootivity. Planar Graphs and i heir properties Trees.

Unit - V

Euler's Formula for connected Pianar Grapes. Complete <i Compkao B ipart it e Graphs. Kuruiowsla s Theorem (statement only) and its use. Spanning Trees, Cut-sets,Fundamental Cut-sets, and Cycles. Minimal Spanning Trees and Kruskal's Algorithm. Matrix Representations of Graphs.

Texts books :

1. J.P. Tremblay & R. Manobar, Discrete Mathematical Structures, McGraw Hill.
2. N.Deo, Graph Theory with applications, Preritice-Hill.

References :

1. C.L.Liu, Elements of discrete Mathematics McGraw Hill.
2. J.L. Gersting Mathematical structures for computer Science Computer Science Press New York.

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MMAT0105(B)-T

Class : M.Sc/MA (Semeter-I)
Subject : Mathematics
Paper : V (Optional- II)
Title : Differential Equitation - I

Unit - I

Initial value problem and inn equivalent integral equation, mth. order equation in d-dimensions as a first order system, Concepts of local existence Existence uniqueness of solutions with examples.

Unit - II

Basic Theorem, Ascoli— Arzela theorem,-. Theorem on convergence of solutions of a family of initial value problems.

Unit -III

Picard-Lindelof theorem, Peano's existence theorem and corollary. Maxima! intervals of existence.Extension theorem and corollaries,Kamkes convergence theorem. Kneser's theorem (statement only).

Unit - IV

Differential inequalities and Uniqueness -Gronwall's inequality. Maximal and Minimal solutions. Differential inequalities. A Theorem of wintner. Uniqueness Theorems. Nagumo's and Osgood's criteria.

Unit - V

Egres points and Lyapunov Functions. Successive approximations. Linear Differential Equations--Linear Systems, Variation of constants, reduction to smaller systems. Basic inequalities, constant coefficients. Floquet theory, Adjoint systems, Higher order equations.

Recommended Text

R Hartman, Ordinary Differential Equations, John Wiley (1964).

References

1. W.T. Reid, Ordinary Differential quations, John Wiley a Sons, NY (1971).

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Semester wise Syllabus for Post Graduates
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MMAT0105(C)-T

Class -	M.Sc./M.A. I-Semester
Subject -	Mathematics
Paper - V	Optional - III
Paper Title -	Differential Geometry of Manifolds 1
Semester -	I

MM – 35

Unit - I

Definition and examples of differentiable manifolds, Tangent Spaces, Jacobian parameter, group transformations.

Unit - II

Lie derivatives, Immersions and imbedding Distributions, Exterior Algebra.

Unit -III

Exterior Derivatives, Topological groups, Lie groups and Lie Algebras.

Unit - IV

Product of Two Lie groups (one Parameter) Subgroups and Exponential maps, Examples of Lie groups, Homomorphism and Isomorphism.

Unit - V

Lie Transformation groups, General Lie groups, Principal Fiber bundle, Linear frame bundle, Associated fiber bundle, Vector bundle, Tangent bundle, Induced bundle, Bundle Homomorphism.

Texts Books

1. R.S. Mishra - Structures on a differentiable manifolds and their applications (Chand Prakashan Allahabad)
2. B.B. Sinha-An Introduction of Modern Differential Geometry. Kalyani Pub. New Delhi.

References

1. C.L.Liu. Elements of discrete Mathematics McGraw Hill
2. J.L. Gersting Mathematical structures for computer Science Computer Science Press New York.

References :-

K. Yano and M. Kon, Structure of manifolds (World Scientific Pub. Co.)

Department of Higher education, Govt. of M.P.

Semester wise Syllabus for Undergraduates

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Class -

M.Sc/M.A I Semester MMAT0105(D)-T

Subject -

Mathematics - Paper V Optional IV

Paper Title -

Fundamentals of Computer Science Theory and Practical - I

MM – Theory –
Practical -

Unit 1

Object oriented programming, Class and scope, nested classes.

Unit 2

Pointer class member class initialization, assignment and distribution.

Unit 3

Overload function and operators, templates including class templates.

Unit 4

Class inheritance and subtyping, multiple and virtual inheritance .

Unit 5

Data Structures – Analysis of algorithms θ , ω , \mathcal{O} , \mathcal{O} , ω notations, Lists, Stacks, and queues.

Text Book :

1. B.Stroustrup, The C++ programming language, Addison-Wesley.
2. C.J.Date , Introduction to database systems, Addison-Wesley.

References : 1. S.B.Lipman, J.lajoi, C++ primer, Addison-Wesley

3. M.A.Weiss, Data structures and algorithm analysis in C++, Addison-Wesley,

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MMAT0201-T

Class : M.Sc/MA (Semeter-II)
Subject : Mathematics
Paper : I
Title : Advanced Abstract Algebra - II

Unit - 1

Introduction to Modules. Examples, submodules quotient modules. Module 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 and its applications to finitely generated : abelian groups.

Unit - 5

Similarity of linear transformation, Invariant spaces, Reduction to triangular forms. Nilpotent transformations. Index of Nilpotency, Invariants of a nilpotent transformation. The primary decomposition theorem.

Text book :

- (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.

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MMAT0202-T

Class : M.Sc/MA (Semeter-II)
Subject : Mathematics
Paper : II
Title : Lebesgue Measure & Integration

Unit - I

Lebesgue outer measure. Measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability. Non-measurable sets.

Unit - II

Integration of Non-negative functions. The General integral. Integration of Series, Reimann and Lebesgue Integrals.

Unit - III

The Four derivatives. Functions of Bounded variation. Lebesgue Differentiation Theorem, Differentiation and Integration.

Unit - IV

The L^p -spaces, Convex functions, Jensen's inequality. Holder and Minkowski inequalities. Completeness of L^p .

Unit – V

Dual of space when $1 \leq p < \infty$ convergence in Measure, Uniform. Convergence and almost uniform convergence.

Text book :

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

References :

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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MMAT0203-T

Class : M.Sc/MA (Semeter-II)
Subject : Mathematics
Paper : III
Title : Topology - II

Unit – I

Separation axioms T_0, T_1, T_2, T_3, T_4 : their Characterizations and basic properties. Urysohn's lemma. Tietze extension theorem.

Unit – II

Compactness. Continuous functions and compact sets. Basic properties of compactness. Compactness and finite intersection property. Sequentially and countably compact compact sets. Local compactness and one point compactification. Stone-vech compactification. Compactness in metric spaces. Equivalence of compactness, countable compactness and one point compactification. Stone-vech compactification. Compactness in metric spaces. Equivalence of compactness, countable compactness and sequential compactness in metric spaces. Connected spaces. Connectedness on the line. Components. Locally connected spaces.

Unit –III

Tychonoff product topology in terms of standard sub-base and its characterizations. Projection maps. Separation axioms and product spaces. Connectedness and product spaces. Compactness and product spaces (Tychonoff's theorem) Countability and product spaces.

Unit – IV

Embedding and metrization. Embedding lemma and Tychonoff embedding. The Urysohn metrization theorem.

Net and filters. Topology and convergence of nets Hausdorffness and nets. Compactness and nets. Filters and their convergence. Canonical way of converting nets to filters and vice-versa. Ultra-filters and Compactness.

Unit –V

The fundamental group and covering spaces-Homotopy of paths. The fundamental group. Covering spaces. The fundamental group of the circle and the fundamental theorem of algebra.

Text book :

1. James R. Munkres, Topology, A First Course, Prentice Hall of India Pvt.Ltd.New Delhi.

Reference :

1. G.F. Simmons, fIntroduction to Topology and Modern Analysis,McGraw-Hill Book Company.

Semester wise Syllabus for Undergraduates
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MMAT0204-T

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

Unit - I

Weierstrass factorization theorem. Gamma and its properties. Riemann's functional equation

Unit - II

Runge's Theorem. 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 - III

Schwartz reflection principle. Monodromy theorem and its consequences. Harmonic function on a disc.

Unit - IV

Harnax inequality and theorem. Dirichlet problem. Green's function. Canonical products. Jensen's formula. Hadamard's three circles theorem. Order of an entire function. Exponent of convergence. Borel's theorem. Hadamard's factorization theorem.

Unit-V

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.

Text Book:-

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

J.B.Convey .FUNCTIONS OF ONE COMPLEX VARIABLE, Springer-Verlag

Reference s

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

Department Of Higher Education, Govt. of M.P.
Semester wise Syllabus For post graduates
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MMAT0205(A)-T

Class : M.Sc/MA (Semeter-II)
Subject : Mathematics
Paper : V (Optional (i))
Title : Advanced Discrete Mathematics-II

Unit – I

Directed graphs, Indegree and outdegree of a vertex, weighted undirected graphs dijkstra's algorithm, strong connectivity and washell's algorithm directed trees, search trees, tree traversals.

Unit –II

Introductory computability theory-Finite State Machines and their Transition Table Diagrams. Equivalence of Finite State Machines. Reduced Machines. Homomorphism. Finite Automata. Acceptors.

Unit – III

Non-deterministic Finite Automata and equivalence of its power to that of Deterministic Finite Automata. Moore and Mealy Machines.

Unit – IV

Turing Machine and Partial Recursive Functions. Grammars and Languages-Phrase-Structure Grammars. Rewriting Rules. Derivations.

Unit -V

Sentential Forms,. Language generated by grammar, Regular, Context-Free, and Context * Sensitive Grammars and Languages. Regular sets. Regular Expressions and the Pumphaj Lemma. Kleene's Theorem. Notions of Syntax Analysis. Polish Notations. Conversion of Infix Expressions to Polish + Notations. The Reverse Polish Notation.

References:

1. J.R. Treppel & R. Manohar, Discrete Mathematics and its Applications with Applications to Computer Science, McGraw-Hill Book Co., 1997.

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Semester wise Syllabus For post graduates
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MMAT0205(B) -T

Class : M.Sc/MA (Semeter-II)
Subject : Mathematics
Paper : V (Optional (II))
Title : Differential Equations-II

Unit – I

Dependence on initial conditions and parameters, Preliminaries, continuity, differentiability, Higher order differentiability.

Unit II

Poincare-Bendixson Theory-Autonomous systems. Umlanfsatz. Index of a stationary point. Poincare-Bendixson theorem Stability of periodic solutions, rotation points, foci, nodes and saddle points.

Unit III

Linear second order equations—Preliminaries, s. Basic facts. Theorems of Sturm. Sturm Liouville Boundary Value Problems. Number of zeroes,.. Nonoscillatory equations and principal solutions. Nonoscillation theorems.

Unit IV

Use of Implicit function and fixed point theorems -Periodic solutions. Linear equations. Nonlinear problems.

Unit V

Second order Boundary' value problems, Linear problems, Nonlinear problems, A priori bounds.

Recommended Text:

1. R Hartman, Ordinary Differential Equations, John Wiley (1964).

References:

1. W.T. Reid, Ordinary Differential Equations, John Wiley a Sons, NY (1971).

Department of Higher Education, Govt. of M.P.

Semester wise Syllabus for Post Graduates

As recommended by Central board of Studies and

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MMAT0205(C) -T

Class -	M.Sc./M.A.
Subject -	Mathematics
Paper -	V (Optional (III))
Paper Title -	Differential Geometry of Manifolds - II
Semester -	II

MM - 35

- Unit - I
Riemannian Manifolds, Riemannian Connection, Curvature Tensors, Sectional Curvature, Gauss Theorem.
- Unit - II
Geodesics in a Riemannian Manifold, Projective Curvature Tensors, Conformal Curvature Tensors.
- Unit - III
Sub-Manifolds of hyper surfaces, Normals, Gauss Formulae, Weingarten Equations.
- Unit - IV
Lines of Curvature, Generalized Gauss and Mainardi-Codazzi Equations.
- Unit - V
Almost Complex Manifolds, Ksijenbuis tensor, Contra variant and covariant almost analytic vector fields, F-Connections.

Texts Books

1. R.S. Mishra - A Course in Tensors with applications to Riemannian Gemetry.
2. B.B. Sinha - An Introduction to Modern Differential Geometry. Kalyani Pub. New Delhi.

References

K. Yano and M. Kon, Structure of manifolds (World Scientific Pub. Co.)

Department of Higher Education, Govt. of M.P.
Semester wise Syllabus For Undergraduates
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MMAT0205(D) -T

Class - **M.Sc./M.A. II Semester**
Subject - **Mathematics - Paper V Optional IV**
Paper Title - **Fundamentals of Computer Science Theory and Practical - II**

Unit 1

Sequential and linked representations, Trees, Binary tree-search tree implementation, B-tree (concept only).

Unit 2

Hashing - open and closed, sorting : sort, shell sort, quick-sort, heap sort and their analysis.

Unit 3

Database Systems-Role of database system, database system architecture.

Unit 4

Introduction to relational algebra and relational calculus, SQL-0 basic fetures including views, intergrity constraints, Database design-normalization upto BCNF.

Unit 5

Operating system - user interface, processor management, I/O management, memory management, concurrency and Security, network and distributed system.

Text Book :

1. S.B. Lipman, J.Lajoi : C++ Primer, Addison.
2. M.A. Weiss, Data Structure and Algorithm Analysis in C++, Addison Wesley.

उच्च शिक्षा विभाग, म०प्र० शासन

(एम.एस.सी./एम.ए. (स्नातकोत्तर) कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.

M.Sc./M.A (Post Graduates) Semester wise Syllabus

**As recommended by Central Board of Studies and
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MMAT0301 -T

कक्षा Class	:	M.Sc./M.A (Mathematics)
सेमेस्टर Semester	:	III
विषय समूह का शीर्षक Title of Subject/ Group	:	Functional Analysis -I
प्रश्न पत्र कं. Paper No.	:	1st
अनिवार्य / वैकल्पिक Compulsory/ Optional	:	Compulsory

:

Unit-1	Normed linear spaces. Banach spaces and examples. Properties of Normed linear spaces Basic properties of finite dimensional normed linear spaces.
Unit-2	Finite dimensional Non linear Spaces & Sub spaces Equivalent norms, Riesz Lemma, and compactness.
Unit-3	Quotient space of normed linear spaces and its completeness
Unit-4	Bounded Linear operators & continuous operators Non - Linear spaces operators
Unit-5	Linear functional, bounded Linear functional Dual spaces with examples.

Text Books :

- [1] E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons
New York.
- [2] G.F. Simmons, Introduction to Topology & Modern Analysis Mc Graw Hill, New
York

Reference :

- [1] B. Choudhary and Sudarshan Nanda. Functional Analysis with applications, Wiley
Eastem Ltd.

उच्च शिक्षा विभाग, म०प्र० शासन

(एम.एस.सी./एम.ए. (स्नातकोत्तर) कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.
M.Sc./M.A (Post Graduates) Semester wise Syllabus
As recommended by Central Board of Studies and
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MMAT0302-T

कक्षा Class	:	M.Sc./M.A (Mathematics)
सेमेस्टर Semester	:	III
विषय समूह का शीर्षक Title of Subject/ Group	:	Partial Differential Equations-I
प्रश्न पत्र क्रं. Paper No.	:	II
अनिवार्य/ वैकल्पिक Compulsory/ Optional	:	Compulsory

Unit-1	Transport Equation-Initial Value Problem Non-homogeneous equations, Laplace's Equations - Fundamental Solution
Unit-2	Mean Value Formula properties of Harmonic functions, Green's Functions. Energy Methods.
Unit-3	Heat Equation - Fundamental Solution,
Unit-4	Mean Value Formula, Properties of Solutions, Energy Methods
Unit-5	Wave Equation - Solution by Spherical Means, Non - homogeneous Equations, Energy Methods.

Recommended Books :-

- (1) L.C. Evans, **Partial Differential Equations, 1998.**

उच्च शिक्षा विभाग, म०प्र० शासन

(एम.एस.सी./एम.ए. (स्नातकोत्तर) कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.

M.Sc./M.A (Post Graduates) Semester wise Syllabus

**As recommended by Central Board of Studies and
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MMAT0303 -T

कक्षा Class	:	M.Sc./M.A (Mathematics)
सेमेस्टर Semester	:	III
विषय समूह का शीर्षक Title of Subject/ Group	:	ADVANCED GRAPH THEORY-I
प्रश्न पत्र क्रं. Paper No.	:	III
अनिवार्य/ वैकल्पिक Compulsory/ Optional	:	Compulsory

Unit-1	Revision of graph theoretic preliminaries, Operations on graphs. Graph Isomorphism Disconnected graph and their Components. Traveling salesman problem, round table problem,
Unit-2	Eulerian and Hamiltonian Paths and circuits.
Unit-3	Properties of trees, Distance centre, radius, diameter eccentricity and related theorems, Graph as Metric space Rooted and binary trees,
Unit-4	Labelled graph and trees spanning tree, weighted spanning tree, Shortest path,
Unit-5	Fundamental cutsets. Rank and nullity, cutsets and cut vertices, fundamental cutsets,

Text Book :-

- 1- Graph Theory with Application to Engineering and Computer Science by Narsingh Deo.

Reference Book :-

- 1- Graph Theory by Harary.

उच्च शिक्षा विभाग, म०प्र० शासन

(एम.एस.सी./एम.ए. (स्नातकोत्तर) कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.
M.Sc./M.A (Post Graduates) Semester wise Syllabus
As recommended by Central Board of Studies and
approved by the Governor of M.P.

MMAT0304 -T

कक्षा Class	:	M.Sc./M.A (Mathematics)
सेमेस्टर Semester	:	III
विषय समूह का शीर्षक Title of Subject/ Group	:	Operations Research-I
प्रश्न पत्र क्रं. Paper No.	:	IV
अनिवार्य/ वैकल्पिक Compulsory/ Optional	:	Compulsory

Unit-1	Operations Research and its scope, Origin and Development of Operations Research, Characteristics of Operations Research,
Unit-2	Model in Operations Research, Phase of Operations Research, Uses and Limitations of Operation Research, Linear Programming Problems.
Unit-3	Mathematical Formulation, Graphical Solution Method.
Unit-4	General Linear Programming Problem : Simplex Method exceptional cases, artificial variable techniques ; Big M method, two phase Method and Cyclic Problems, problem of degeneracy.
Unit-5	Duality, Fundamental Properties of duality and theorem of duality.

RECOMMENDED BOOKS :-

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

REFERENCE BOOKS:-

- 1- S.D, Sharma, Operation 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, Operation Reasearch, an Introduction, S. Chand & Company Ltd. New Delhi.
- 7- N.S. Kambo, Mathematical Programming Techniques, Affiliated East - West Pvt. Lt

उच्च शिक्षा विभाग, म०प्र० शासन

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केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.

M.Sc./M.A (Post Graduates) Semester wise Syllabus

**As recommended by Central Board of Studies and approved by the Governor
of M.P.**

MMAT0305(A) -T

कक्षा Class	:	M.Sc. / M.A. (Mathematics)
सेमेस्टर Semester	:	III
विषय समूह का शीर्षक Title of Subject/ Group	:	Mechanics -I
प्रश्न पत्र कं. Paper No.	:	V
अनिवार्य / वैकल्पिक Compulsory/ Optional	:	Optional - I

Unit-1	Cordinates. Holonomic and Non- holonomic systems
Unit-2	Scleronomic and Rheonomic system generalized potential. Larange's equation of first kind
Unit-3	Lagrange's equation of second Kind. Uniqueness of solution. Energy equation for conservation fields.
Unit-4	Hamilton's variables. Donkin's theorem. Hamilton's canonical equations. Cyclic coordinates routh's equation Poisson's bracket Poisson's Identity. Jacobi – Poisson theorem. Motivating problem problems of calculus of variations
Unit-5	Shortest distance. Minimum surface of revolution. Brachistochrone problem. Isoperinetric problem. Geodesic.

REFERENCE BOOKS:

- 1 F. Gantmacher, Lectures in Analytic Mechanics MIR Publishers.
- 2 H. Goldstein Classical Mechanics (2nd Edition), Narosa Publishing House New Delhi.

Department of Higher Education Govt. of M.P.

Semester wise syllabus for P.G.

As recommended by Central board of studies and

Approved by HE the Governor of M.P.

MMAT0305(B) -T

कक्षा Class	:	M.Sc. / M.A. MATHAMATICS
सेमेस्टर Semester	:	III
विषय समूह का शीर्षक Title of Subject/ Group	:	Programming in C
प्रश्न पत्र क्रं. Paper No.	:	V
अनिवार्य/ वैकल्पिक Compulsory/ Optional	:	Optional - II

Unit-1	An overview of programming languages
Unit-2	Classification. C Essentials – Programs development, Functions
Unit-3	Anatomy of a Function. Variables and Constants Expressions. Assignment Statements. Formatting Source files Continuation Character. The Preprocessor.
Unit-4	Scalar Data types – Declarations, Different Types of integers. Different kinds of Integer Constants Floating – point type Initialization
Unit-5	Mixing types Explicit conversions – casts. Enumeration Types. the void data type , Typedefs. Pointers.

REFERENCE BOOKS:

- 1 Samuel P. Harkison and Gly L Steele Jr. C; A Reference manual , 2an Edition Prentice hall 1984.
- 2 Brain W Kernigham & Dennis M Ritchie the C Programmed Language 2nd Edition (ANSI features), Prentice Hall 1989.

उच्च शिक्षा विभाग, म.प्र. शासन
एम.एस-सी.(स्नातकोत्तर) कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम केन्द्रीय
अध्ययन मण्डल द्वारा अनुशासित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.

M.Sc.(Post Graduates) semester wise Syllabus

As recommended by Central Board of Studies and approved by the Governor of M.P.

MMAT0401 -T

Class / कक्षा	:	M.Sc./एम.एस.सी.
Semester / सेमेस्टर	:	सेमेस्टर चतुर्थ
Title of Subject Group / विषय समूह का शीर्षक	:	Mathematics
Paper No. & Title / प्रश्नपत्र क्र. एवं शीर्षक	:	Functional Analysis-II
Compulsory / अनिवार्य या Optional / वैकल्पिक	:	Compulsory / अनिवार्य

: Particulars/ विवरण :

- Unit I** Normed linear spaces. Banach spaces and examples. Quotient space of normed linear spaces and its completeness, equivalent norms, Riesz Lemma, basic properties of finite dimensional normed linear spaces and compactness.
- Unit II** Bounded linear transformations, normed linear spaces of bounded linear transformations, dual spaces with examples.
- Unit III** Uniform boundedness theorem and some of its consequences, Open mapping and closed graph theorems, Hahn-Banach theorem for real linear spaces,
- Unit IV** Hahn-Banach theorem for complex linear spaces and normed linear spaces. Reflexive spaces. Hilbert spaces, Orthonormal Sets, Bessel's inequality. Complete orthonormal sets and Parseval's Identity, Projection Mapping, Projection theorem
- Unit V** Structure of Hilbert spaces. Riesz representation theorem. Adjoint of an operator on a Hilbert space. Reflexivity of Hilbert spaces. Self-adjoint operators, Positive operators, Projection, Normal and Unitary operators.

Text Books :

- [1] E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons New York.
- [2] G.F. Simmons, Introduction to Topology & Modern Analysis Mc Graw Hill, New York.

Reference :

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

उच्च शिक्षा विभाग, म.प्र. शासन
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Department of Higher Education, Govt. of M.P.
M.Sc.(Post Graduates) semester wise Syllabus
As recommended by Central Board of Studies and approved by the Governor of M.P.

MMAT0402-T

Class / कक्षा	:	M.Sc. /एम.एस.सी.
Semester / सेमेस्टर	:	सेमेस्टर चतुर्थ
Title of Subject Group / विषय समूह का शीर्षक	:	Mathematics
Paper No. / प्रश्नपत्र क्र.	:	II
Title / शीर्षक	:	Partial Differential Equations -II
Compulsory / अनिवार्य या Optional / वैकल्पिक	:	Compulsory / अनिवार्य

: Particulars/ विवरण :

- Unit 1-** Transport Equation-Initial Value Problem Non-homogeneous equations, Laplace's Equations - Fundamental Solution, Mean Value Formula properties of Harmonic functions, Green's Functions. Energy Methods.
- Unit 2-** Heat Equation - Fundamental Solution, Mean Value Formula, Properties of Solutions, Energy Methods Wave Equation - Solution by Spherical Means, Non - homogeneous Equations, Energy Methods.
- Unit 3-** Nonlinear First order PDE. Complete integrals, Envelopes, Characteristics, Hamilton Jacobi Equation (Calculus) of Variations, Hamilton's ODE, Legendre Transform, Hopf-Lax formulae, weak solution, Uniqueness.
- Unit 4-** Conservation Laws (Shocks, Entropy Condition Lax - Oleinik formula, Weak solutions, Uniqueness. Riemann's Problem Long Time behavior) Representation of Solution - Separation of Variables, Similarity Solutions (Plane and Traveling Waves - Solution, Similarity under Scaling).
- Unit 5-** Fourier and Laplace Transform, Hopf - Cole Transform, Hodograph and Legendre Transforms, Potential Functions, Asymptotes (Singular Perturbations, Laplace's Method, Geometric Optics, Stationary Phase Homogenization) Power Series (Non - characteristic surface, Real Analytic functions, Cauchy - Kovalevskaya Theorem).

Recommended Books :-

- (1) L.C. Evans, Partial Differential Equations, 1998.

उच्च शिक्षा विभाग, म.प्र. शासन
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अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित
Department of Higher Education, Govt. of M.P.
M.Sc.(Post Graduates) semester wise Syllabus
As recommended by Central Board of Studies and approved by the Governor of M.P.
MMAT0403 -T

Class / कक्षा	:	M.Sc. /एम.एस.सी.
Semester / सेमेस्टर	:	सेमेस्टर चतुर्थ
Title of Subject Group / विषय समूह का शीर्षक :		Mathematics
Paper No. / प्रश्नपत्र क्र.	:	III
Title / शीर्षक	:	ADVANCED GRAPH THEORY-II
Compulsory / अनिवार्य या Optional / वैकल्पिक :		Compulsory / अनिवार्य

: Particulars/ विवरण :

- Unit -1** Revision of graph theoretic preliminaries, Operations on graphs. Graph Isomorphism Disconnected graph and their Components. Traveling salesman problem, round table problem, Konisberg Bridge problem Eulerian and Hamiltonian Paths and circuits.
- Unit -2** Properties of trees, Distance centre, radius, diameter eccentricity and related theorems, Graph as Metric space Rooted and binary trees, Labelled graph and trees spanning tree, weighted spanning tree, Shortest path, Fundamental circuits, Rank and nullity, cutsets and cut vertices, fundamental cutsets.
- Unit-3** Connectivity and separability in graphs Abstract graphs geometric graphs planar graphs Kurtowski two graphs embedding and regions of a planar graphs Detection of planarity, Geometric dual and combinationa dual.
- Unit - 4** Coloring and covering of graphs, Chromatic, Polynomial chromatic partitioning Dimmer problem Domination sets independent sets, Four colour conjecture.
- Unit - 5** Digraph and types of digraphs, Digraph and binary relation Equivalence relation in a graph Directed path walk circuit and connectedness Eulerian digraph, arborscence matrices A, B and C of digraphs, Adjacency metric of a digraph, Alogorithms, Kruskal algorithm, Prism algorithm, Dijkstra Algorithm.

TEXT BOOK :-

- 1- Graph Theory with Application to Engineering and Computer Science by Narsingh Deo.

REFERENCE BOOK :-

- 1- Graph Theory by Harary

उच्च शिक्षा विभाग, म.प्र. शासन
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अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.

M.Sc.(Post Graduates) semester wise Syllabus

As recommended by Central Board of Studies and approved by the Governor of M.P.

MMAT0404 -T

Class / कक्षा	:	M.Sc./एम.एस.सी.
Semester / सेमेस्टर	:	सेमेस्टर चतुर्थ
Title of Subject Group / विषय समूह का शीर्षक	:	Mathematics
Paper No. / प्रश्नपत्र क्र.	:	IV
Title / शीर्षक	:	Operations Research -II
Compulsory / अनिवार्य या Optional / वैकल्पिक	:	Compulsory / अनिवार्य

: Particulars/ विवरण :

- Unit – 1** Operations Research and its scope, Origin and Development of Operations Research, Characteristics of Operations Research, Model in Operations Research, Phase of Operations Research, Uses and Limitations of Operation Research, Linear Programming Problems, Mathematical Formulation, Graphical Solution Method.
- Unit 2** General Linear Programming Problem : Simplex Method exceptional cases, artificial variable techniques ; Big M method, two phase Method and Cyclic Problems, problem of degeneracy. Duality, Fundamental Properties of duality and theorem of duality.
- Unit-3** Transportation problems : North - West Corner Method Least - Cost Method. Vogel's Approximation Method, MODI Method, Exceptional cases and problem of degeneracy, Assignment problems.
- Unit 4** Network analysis, constraints in Network, Construction of network, Critical Path Method (CPM) PERT, PERT Calculation, Resource Leveling by Network Techniques and advances of network (PERT/CPM) Simulation : Monte - Carlo Simulation , Simulation of Networks , Advantage and Limitation of Simulation.

Unit 5 Game theory - Two persons, Zero - Sum Games, Maximix - Minimax principle, games without saddle points - Mixed strategies, Graphical solution of $2 \times m$ and $m \times 2$ games, Solution by Linear Programming, Non-Linear programming Techniques - Kuhn - Tucker Conditions, Non - negative Constraints.

RECOMMENDED BOOKS :-

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

REFERENCE BOOKS:-

- 1- S.D, Sharma, Operation 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, Operation Reasearch, an Introduction, S. Chand & Company Ltd. New Delhi.
- 7- N.S. Kambo, Mathematical Programming Techniques, Affiliated East - West Pvt. Ltd. New Delhi. Madras.

उच्च शिक्षा विभाग, म.प्र. शासन
एम.एस-सी.(स्नातकोत्तर) कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम केन्द्रीय
अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.

M.Sc.(Post Graduates) semester wise Syllabus

As recommended by Central Board of Studies and approved by the Governor of M.P.

MMAT0405(A) -T

Class / कक्षा	:	M.Sc. /एम.एस.सी.
Semester / सेमेस्टर	:	सेमेस्टर चतुर्थ
Title of Subject Group / विषय समूह का शीर्षक	:	Mathematics
Paper No. / प्रश्नपत्र क्र.	:	V
Title / शीर्षक	:	Mechanics-II
Compulsory / अनिवार्य या Optional / वैकल्पिक	:	Optional-I

: Particulars/ विवरण :

- Unit – I** Generalized coordinates. Holonomic and Non- holonomic systems, Scleronomic and Rheonomic system generalized potential. Lagrange's equation of first kind, Lagrange's equation of second Kind. Uniqueness of solution. Energy equation for conservation fields.
- Unit – II** Hamilton's variables. Donkin's theorem. Hamilton's canonical equations. Cyclic coordinates routh's equation Poisson's bracket Poisson's Identity. Jacobi – Poisson theorem. Motivating problem problems of calculus of variations, shortest distance. Minimum surface of revolution. Brachistochrone problem. Isoperimetric problem. Geodesic.
- Unit – III** Fundamental lemma of calculus of variations Euler's equation for one dependent function and its generalization to (i) n dependent function (ii) higher order derivatives. Conditional extremum under geometric constraints and under integral constraints. Hamilton's Principle of least action Poincare Carten Integral invariant Whittaker equation Jacobi's equations. Statement of Lee HWA Chung's theorem.

Unit – IV Hamilton – Jacobi equation. Jacobi theorem. Method of separation of variables. Lagrange Brackets. Condition of canonical character of a transformation in terms of Lagrange brackets and Poisson brackets Invariance of Lagrange brackets and Poisson brackets under canonical.

Unit – V Attraction and potential of rod disc spherical shells and sphere. Surface integral of normal attraction (application & Gauss theorem) Laplace's and poisson equation. Work done by self attraction systems. Distribution for a given potential. Equipotent surfaces. Surface and solid harmonic. Surface density in terms of surface harmonics.

REFERENCE BOOKS:

- 1 F. Gantmacher, Lectures in Analytic Mechanics MIR Publishers.
- 2 H. Goldstein Classical Mechanics (2nd Edition), Narosa Publishing House , New Delhi

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Department of Higher Education, Govt. of M.P.

M.Sc./M.A. (Post Graduate) Semester wise Syllabus

As recommended by Central Board of Studies and approved by the Governor of M.P.

MMAT0405(B) -T

कक्षा Class	:	M.Sc./ M.A. (Mathematics)
सेमेस्टर Semester	:	IV
विषय समूह का शीर्षक Title of Subject/ Group	:	PROGRAMMING IN C -II
प्रश्न पत्र क्रं. Paper No.	:	V
अनिवार्य/ वैकल्पिक Compulsory/ Optional	:	Optional -II

- Unit-1** An overview of programming languages, Classification. C Essentials Programs development, Functions. Anatomy of a Function. Variables and Constants Expressions. Assignment Statements. Formatting Source files Continuation Character. the Preprocessor.
- Unit-2** Scalar Data types – Declarations, Different Types of integers. Different kinds of Integer Constants Floating – point type Initialization. mixing types Explicit conversions – casts. Enumeration Types. the void data type , Typedefs. Pointers.
- Unit -3** Control Flow – Conditional Branching, the Switch Statement. looping. nested loops. the Break and Continue statement . the goto statement infinite loop.
- Unit-4** Operators and Expressions - Precedence and associatively. Unary plus and Minus operators. Binary Arithmetic operators arithmetic assignment operators. Increment and decrement operators. Comma Operator Relational operators logical operators bit- Manipulation operators Bitwise assignment operators. Cast operators size of

Operators , Conditional Operators , memory operator.

Unit -5 Arrays and multidimensional Arrays. Storage Classes – fixed vs. Automatic Duration Scope, global variable The Register Specific Structures and Unions.

Recommended Books:

- 1 Peter A Darnell and Philip E. Margolis, C; A Software Engineering Approched narosa Publishing House (Springer International Student Edition) 1993.

Reference Books:

- 1 Samuel P. Harkison and Gly L Steele Jr. C; A Reference manual , 2an Edition Prentice hall 1984.
- 2 Brain W Kernigham & Dennis M Ritchie the C Programmed Language 2nd Edition (ANSI features), Prentice Hall 1989