

SYLLABUS

M.Sc. Ist SEMESTER

2020-21

Department of Mathematics

**Mata Gujri Mahila
Mahavidyalaya,(Auto),**

Jabalpur

MATA GUJRI MAHILA MAHAVIDYALAYA(AUTO.), JABALPUR

DEPARTMENT OF MATHEMATICS 2020-21

M.Sc. (MATHEMATICS) FIRST SEMESTER

Semester	Course	Title of papers	Max. Marks Theory/CCE	Mini. Passing Marks Theory/CCE	Total Marks
First	Paper-I	Advanced Abstract Algebra-I	35/15	12/05	300
	Paper-II	Complex Analysis-I	35/15	12/05	
	Paper-III	Functional Analysis	35/15	12/05	
	Paper-IV	Real Analysis	35/15	12/05	
	Paper-V	Topology	35/15	12/05	
			Seminar and Attendance	50 = 40+10	

Note: The Seminar is conducted by at least two examiners. In seminar 40 marks allocated. 20 marks is of presentation and 20 marks in file.

MATA GUJRI MAHILA MAHAVIDYALAYA(AUTO.), JABALPUR

DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (Mathematics) First Semester

Paper I: ADVANCED ABSTRACT ALGEBRA - I

Max. Marks: 35

Min. Pass. Marks: 12

- Unit-I:** Another Counting Principle, Conjugacy relation, Normalizer, Class Equation, Cauchy theorem, Sylow's theorems, Double coset, Second & Third part of Sylow's theorem, Application of Sylow's theorems in finite groups.
- Unit-II:** Series of Groups: Normal and Subnormal series, Composition series, Zassenhaus lemma, Schreier refinement theorem, Jordan Holder theorem.
- Unit-III:** Solvable Groups and its properties, Commutator subgroup, Nilpotent Groups and its properties..
- Unit-IV:** Fields: Extension field, Finite extension, Algebraic element, Algebraic and transcendental extension, Roots of polynomials, Splitting field.
- Unit-V:** More about roots: Derivative of a polynomial, Simple extension, Primitive element, Separable and inseparable extension, Perfect field, Finite field.

Text Books:

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975. (For Units I, III, IV, and V)
2. Vivek Sahai & Vikas Bist, Algebra, Narosa Publishing House, 1999 (For Unit-II).

Reference Books:

1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Ed.), Cambridge University Press, Indian Edition, 1997.
2. I.S. Luther and I.B.S. Passi, Algebra, Vol. I - Groups, Narosa Publishing House, 1996.
3. Surjeet Singh and Quazi Zameeruddin, Modern Algebra, Vikas Publishing House Pvt. Ltd., 1990.
4. N. Jacobson, Basic Algebra, Vols. I & II, Hindustan Publishing Company, 1980.
5. S. Lang, Algebra, 3rd Edition, Addison-Wesley, 1993.

MATA GUJRI MAHILA MAHAVIDYALAYA(AUTO.), JABALPUR

DEPARTMENT OF MATHEMATICS 2020-21

M.Sc. (Mathematics) First Semester

Paper II: COMPLEX ANALYSIS – I

Max. Marks: 35
Min. Pass. Marks: 12

- 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:

J.B. Conway, Functions of one complex variable, Springer- Verlag, 1980.

Reference Books:

1. S. Ponnuswamy, Foundations of complex analysis, Narosa Publishing House, 1997.
2. L.V. Ahlfors, Complex Analysis, McGraw Hill, 1979.

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DEPARTMENT OF MATHEMATICS 2020-21

M.Sc. (Mathematics) First Semester

Paper III: FUNCTIONAL ANALYSIS

Max. Marks: 35

Min. Pass. Marks: 12

- Unit-I:** Convergence, Completeness and Baire's Theorem, Cantors intersection Theorem, Continuous mappings, Uniformly continuous mapping, Spaces of continuous functions.
- Unit-II:** Euclidean and Unitary spaces, Cauchy, Minkowski and Holders inequalities, Normed linear spaces, Examples and elementary properties, Equivalence of norms, Banach space and examples, Continuous linear transformations.
- Unit-III:** Functionals and their extensions, related Lemma, Hahn-Banach Theorem for normed linear spaces, Conjugates of normed linear spaces, The natural embedding of normed linear space in its second conjugate space, Reflexive Banach spaces, open mapping theorem, Closed graph theorem.
- Unit-IV:** Conjugate of an operator, Uniform boundedness principle and its applications, Inner product spaces and their elementary properties, Parallelogram law, Schwartz inequality and polarization identity, Hilbert Space and examples. orthogonal complements in Hilbert spaces.
- Unit-V:** Orthonormal sets, Bessel's inequality, Gram Schmidt orthonormalization process, Conjugate Space of Hilbert Space, Riesz representation theorem. Adjoint of an operator, Properties.

Text Book:

G.F. Simmons, Topology and Modern Analysis, McGraw Hill International Edition, 1963.

Reference Books:

1. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978.
2. R.E. Edwards, Functional Analysis, Dover Publ., New York, 1995. P.K. Jain, O.P. Ahuja and Khalil Ahmed, Functional Analysis, New Age International (P) Ltd. Publ.

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DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (Mathematics) First Semester

Paper IV: REAL ANALYSIS

Max. Marks: 35
Min. Pass. Marks: 12

- 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 Book:

Water Rudin, Principles of Mathematical Analysis, McGraw Hill, 1978.

Reference Books:

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

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DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (Mathematics) First Semester

Paper V: TOPOLOGY

Max. Marks: 35

Min. Pass. Marks: 12

- Unit-I:** Definition and examples of topological spaces, Basis for a topology, Standard topology, lower limit topology, The order topology, The product topology on $X \times Y$. Projections, The Subspace topology, Closed sets and limit points, Closure and interior of a set, Hausdorff spaces.
- Unit-II:** Continuous functions, Equivalence with ε - δ condition, Examples of continuous functions, the alternative conditions of Continuity, Homeomorphisms, topological property, topological Imbedding, Examples of Homeomorphisms, Rules for Constructing continuous functions, The Pasting lemma, Maps into products, The product topology, Box topology, Projection mapping, comparison of the product topology and the box topology.
- Unit-III:** The Metric topology, Metrizable space, Standard bounded metric, The spaces \mathbf{R}^n and \mathbf{R}^w , Euclidean metric, square metric, Metrizability of \mathbf{R}^n and \mathbf{R}^w , Uniform metric, The sequence lemma, Uniform limit theorem.
- Unit-IV:** Connected space, Separation, Definition and examples, Cartesian product of connected spaces, Connected sets in the real line, Linear continuum, Intermediate value theorem, Path connectedness, Definition and examples, Dictionary order topology on $I \times I$, Comb space and deleted comb space, Topologist's sine curve.
- Unit-V:** Compact spaces, Finite product of compact spaces, The Tube Lemma, Finite intersection condition, compact sets in the real line, Maximum and minimum value theorem, Limit point compactness, The Lebesgue number Lemma, Second countable and first countable spaces, Separation Axioms (T_1 , T_2 , T_3 spaces).

Text Book:

James R. Munkres, Topology: A First Course, Prentice Hall of India, 1988.

Reference Books:

1. G.F. Simmons, Topology and Modern Analysis, McGraw Hill International Edition, New York, 1963.
2. J. Dugundji, Topology, Prentice Hall of India, 1975.
3. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.

SYLLABUS

M.Sc. IInd SEMESTER

2020-21

Department of Mathematics

Mata Gujri Mahila Mahavidyalaya,(Auto),

Jabalpur

MATA GUJRI MAHILA MAHAVIDYALAYA(AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2020-21
M.Sc. (MATHEMATICS) SECOND SEMESTER

Semester	Course	Title of papers	Max. Marks Theory/CCE	Mini. Passing Marks Theory/CCE	Total Marks
Second	Paper-I	Advanced Abstract Algebra-II	35/15	12/05	300
	Paper-II	Advanced Discrete Mathematics	35/15	12/05	
	Paper-III	Complex Analysis-II	35/15	12/05	
	Paper-IV	Lebesgue Measure and Integration	35/15	12/05	
	Paper-V	Ordinary and Partial Differential Equations	35/15	12/05	
		Seminar & Attendance	50 = 40+10		

Note: The Seminar is conducted by at least two examiners. In seminar out of 40 marks, 20 marks is of power point presentation and 20 marks in file.

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DEPARTMENT OF MATHEMATICS 2020-21
M.A./M.Sc. (MATHEMATICS) SECOND SEMESTER
Paper I: ADVANCED ABSTRACT ALGEBRA – II

Max. Marks: 35
Min. Pass. Marks: 12

- Unit-I:** The elements of Galois theory: Automorphism of a field, Group of automorphisms of a field, Fixed field, Normal extension, Galois group of a polynomial, Fundamental theorem of Galois theory, Solution of polynomial equations by radicals, Insolvability of the general equation of degree 5 by radicals.
- Unit-II:** Introduction to Modules, Examples, Submodules and Direct sum of submodules, R-homomorphisms and Quotient modules, Finitely generated modules, Cyclic module.
- Unit-III:** Simple modules, Semi-simple modules, Schur's lemma, Free modules, Rank of a module.
- Unit-IV:** Noetherian and Artinian modules, Ascending and Descending chain condition(ace & dcc), Noetherian and Artinian rings, Examples, Hilbert basis theorem.
- Unit-V:** Fundamental Structure theorem of finitely generated modules over a Principal Ideal Domain and its applications to finitely generated abelian groups.

Text Books:

1. I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975. (For Unit-I).
2. P. B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Ed.), Cambridge University Press, Indian Edition, 1997. (For Units II, III, IV and V).

Reference Books:

1. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.
2. N. Jacobson, Basic Algebra, Vols. I & II, Hindustan Publishing Company, 1980.
3. S. Lang, Algebra, 3rd Edition, Addison-Wesley, 1993.
4. I.S. Luther and I.B.S. Passi, Algebra, Vol. III - Modules, Narosa Publishing House, 1996.
5. Surjeet Singh and Quazi Zameeruddin, Modern Algebra, Vikas Publishing House Pvt. Ltd., 1990.
6. Ramji Lal, Algebra, Vols. I & II, Shail Publication, 2002.

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DEPARTMENT OF MATHEMATICS 2020-21
M.A./M.Sc. (Mathematics) Second Semester
Paper II : ADVANCED DISCRETE MATHEMATICS

Max. Marks: 35
Min. Pass. Marks: 12

- Unit-I:** Algebraic Structures : Introduction, Algebraic Systems : Examples and General Properties : Definition and examples, Some Simple Algebraic Systems and General properties, Homomorphism and isomorphism, congruence relation, Semigroups and Monoids : Definitions and Examples, Homomorphism of Semigroups and Monoids.
- Unit-II:** Lattices: Lattices as Partially Ordered Sets : Definition and Examples, Principle of duality, Some Properties of Lattices, Lattices as Algebraic Systems, Sublattices, Direct product, and Homomorphism.
- Unit-III:** Some special Lattices, e.g. Complete, Complemented and Distributive Lattices, Boolean Algebra: Definition and Examples, Subalgebra, Direct product and Homomorphism, join irreducible, atoms and antiatoms.
- Unit-IV:** Graph Theory: Definition of a graph, applications, Incidence and degree, Isolated and pendant vertices, Null graph, Path and Circuits: Isomorphism, Subgraphs, Walks, Paths and circuits, Connected graphs, disconnected graphs, and components, Euler graph.
- Unit-V:** Trees: Trees and its properties, minimally connected graph, Pendant vertices in a tree, distance and centers in a tree, rooted and binary tree. Levels in binary tree, height of a tree, Spanning trees, rank and nullity.

Text Books:

1. J. P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co.,1997(for Units I, II, and III).
2. N. Deo, Graph Theory with Applications to Engineering and Computer Sciences, Prentice Hall of India (for Units IV and V).

Reference Books:

1. C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co.
2. S. Wiitala, Discrete Mathematics- A Unified Approach, McGraw-Hill Book Co.
3. Seymour Lipschutz, Finite Mathematics, Schaum Series, MGH.
4. J. L. Gersting, Mathematical Structures for Computer Science (3rd ed.) Computer Science Press, New York.

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DEPARTMENT OF MATHEMATICS 2020-21
M.A./M.Sc. (Mathematics) Second Semester
Paper III: COMPLEX ANALYSIS - II

Max. Marks: 35
Min. Pass. Marks: 12

Unit-I: Weierstrass factorization theorem, Gamma function and its properties, Bohr-Mollerup theorem, Riemann zeta function, Extension of Zeta function.

Unit-II: Riemann's functional Equation, The Riemann's Hypothesis, Application of Riemann's Hypothesis in number theory(Euler's theorem), Rung's theorem Analytic continuation, Uniqueness of Analytic continuation, Schwartz Reflection principle.

Unit-III: Harmonic function, Harmonic functions on a disk, Harnack's inequality and Harnack's theorem, The Dirichlet Problem.

Unit-IV: Green's function, Jensen's formula, Poisson-Jensen Formula, Growth of Entire function, Hadamard's three circle theorem.

Unit-V: Rank of an Entire function, Order of an entire function, Exponent of Convergence, Hadamard's factorization theorem, Bloch's theorem, The Little Picard theorem.

Text Book:

J.B. Conway, Functions of one complex variable, Springer-Verlag, International student-Edition, Narosa publishing house, 1980.

Reference Books:

1. L.V. Ahlfors, Complex Analysis, McGraw Hill, 1979.
2. E.C. Titchmarsh, The theory of functions, Oxford University, Press, London.
3. S. Ponnusamy, Fundamental of complex Analysis, Narosa Publishing House, 1997.

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DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (Mathematics) Second Semester

Paper IV: LEBESGUE MEASURE AND INTEGRATION

Max. Marks: 35

Min. Pass. Marks: 12

- 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 $1 \leq P \leq \infty$, Convergence in Measure, Uniform Convergence and almost Uniform Convergence.

Text Book:

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

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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DEPARTMENT OF MATHEMATICS 2020-21**

M.A./M.Sc. (Mathematics) Second Semester

Paper V: ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Max. Marks: 35

Min. Pass. Marks: 12

- Unit-I:** Lagrange's identity, Sturm-Liouville differential equation, Eigen values, The normal form, Change of independent's variable, Lagrange's method of variation of parameters.
- Unit-II:** Partial differential equations, Lagrange's linear equation, Charpit's general method of solutions, Green's functions, Domain and range of the operators, One dimensional Green's functions, Construction of Green's functions, Applications of Green's functions to solve differential equations.
- Unit-III:** Power series solutions, Series solution of first order linear equations, Ordinary points, Singular points, Regular and Irregular singular points, Gauss's hypergeometric series.
- Unit-IV:** Laplace Transforms, Integral transforms, A few remarks on the theory, Conditions for the existence of Laplace transforms, Applications to differential equations.
- Unit-V:** Derivatives and integrals of Laplace transforms, Convolutions and Abel's Mechanical problem, More about convolutions, The unit step and impulse functions.

Text Books:

1. G.F.Simmons, Differential Equations with applications and Historical Notes, McGraw Hill International Editions, 1991 (for Units IV & V).
2. B.P.Parashar; Differential and Integral Equations , CBS publishers and Distributors Ltd. 1992 (for Units I, II, & III).

Reference Books:

1. H.T.H.Piaggio, An Elementary Treatise on differential Equations and Their Applications, Indian Reprint, 1966.
2. E.A. Coddington, An Introduction, The Solution of Ordinary Differential Equations, Indian reprint.
3. B.L.Ince and I.N.Sneddon, The Solution of Ordinary Differential Equations, Longman. 1987.
4. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill International Editions, 1957.

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M.Sc. IIIrd SEMESTER

2020-21

Department of Mathematics

Mata Gujri Mahila Mahavidyalaya,(Auto),

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DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (MATHEMATICS) THIRD SEMESTER

PAPER I: APPLIED FUNCTIONAL ANALYSIS

Max. Marks: 35

Min. Pass. Marks: 12

Unit-1	Hilbert spaces obtained from Hilbert spaces, Cartesian and Tensor product of Hilbert spaces, convex sets and projections. Projection on a cone and a linear subspace.
Unit-2	Weak convergence, Weak compactness properties, Baire's Category Theorem, sequence of continuous linear functional, Banach Saks, Theorem, Weak semi continuity, Continuity of Projection on a closed convex set.
Unit-3	Convex sets and convex programming elementary notions, internal, bounding and external points. Support functional of a Convex set, simple example, Minkowski functional support plane through a boundary point, support mapping, Separation theorem.
Unit-4	Functions transformations and operators, Linear operators and their adjoints, bounded and unbounded operators projection operator and differential operator.
Unit-5	Spectral theory of operators, resolvent of operator, resolvent set and spectrum. Spectral radius, Compact operators, its characterizing property.

Text Books :

1. V. Balakrishnan : Applied Functional Analysis, Springer Verlag, New York.

Reference :

1. Ervin Kreyszig : Introductory Functional Analysis with Applications, John Wiley and Sons.

2. B.V. Limaye : Functional Analysis II Edition, New Age International Publishers.

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DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (MATHEMATICS) THIRD SEMESTER

PAPER II: LINEAR PROGRAMMING

Max. Marks: 35

Min. Pass. Marks: 12

Unit-1:	General Linear Programming Problem, Formulation of the Linear Programming Problem, Solution by Graphical method, Simplex method.
Unit-2:	Solution of a Linear Programming Problem by Big-M method, Two phase method, concept of duality, Fundamental theorem of duality, Dual simplex method.
Unit-3:	Assignment problem, Solution of assignment problem, Unbalanced Assignment Problem, Crew Assignment problem, Traveling Salesman problem.
Unit-4:	Transportation problem, Initial basic feasible solution, Vogel's Approximation method, Optimality test by MODI method, Stepping Stone method, Degeneracy in Transportation Problem.
Unit-5:	Sequencing problem, processing n jobs on two machines, n jobs on three machines, n jobs on m machines, processing two jobs through m machines.

TEXT BOOKS:

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.H. Hadley, Linear and Dynamic programming, Addison-Wesley Reading Mass.
- 4.H.A. Taha, Operations Research- An introduction, Macmillan Publishing Co. Inc. New York.
- 5.Prem Kumar Gupta and D. S. Hira, Operations Research, an Introduction, S. Chand & Company Ltd. New Delhi.
- 6.N. S. Kambo, mathematical Programming Techniques, Affiliated East- West Pvt. Ltd. New Delhi, Madras.

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DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (MATHEMATICS) THIRD SEMESTER

PAPER III: PROGRAMMING IN C (THEORY AND PRACTICAL)

Max. Marks: 25

Min. Passing Marks:09

Unit-1: Machine assembly and high level language ,structured programming concept ,modular programming , top down programming approach, features of algorithm and flow-charts, history of 'c', salient feature of 'c', structure of 'c' program.

Unit-2 : Character set, identifiers, keywords, variable, and constant, types of constants, operator, expression, operator precedence and associativity, Data type.

Decision control statement: if statement, switch statement, loops- While, Do-while and for loops, go to statement, break and continue statement.

Unit -3 : Function: - definition, declaration and type of function, Function prototype, call by value, call by reference, recursion.

Pointer:- Pointer and this characteristics, Address and Indirection operator, pointer Declaration, Pinter Arithmetic.

Unit -4 : Array: - one dimensional Array declaration initialization, finding the biggest & Smallest elements in an array, Two dimensional Array: -Declaration, addition and multiplication of arrays.

Unit-5 :Structure and union: -Declaration of structure, accessing the member of structure, structure and union, concept of file in c.

TEXT BOOKS:

1. E. Balagurusamy , “ Programming in ANSI C”
2. “How to solve it by computer” by R.G.Dromy, PHI
3. “Let us C” by Yashwant Kanetkar

REFERENCES BOOKS:

1. “Programming in C” :Denis Ritchie
2. “C The Complete Reference”, H. Schildt, Tata McGraw Hill
3. Programming and problem solving through 'C'(Elsevier)

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DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (MATHEMATICS) THIRD SEMESTER

PAPER IV: FUZZY SETS AND THEIR APPLICATIONS – I

Max. Marks: 35

Min. Pass. Marks: 12

Unit-I	Idea of fuzzy set and membership function, Definition of a fuzzy set, membership function, representation of membership function, General definitions and properties of fuzzy sets, Support, height, equality of two fuzzy sets, containment, examples.
Unit-II	Union and Intersection of two fuzzy sets, Complement of a fuzzy set, normal fuzzy set, α -cut set of a fuzzy set, strong α -cut, convex fuzzy set, a necessary and sufficient condition for convexity of a fuzzy set (Theorem 1), Decomposition of fuzzy sets, Degree of sub sethood, Level set of a fuzzy set, Cardinality, fuzzy cardinality, examples.
Unit-III	Other important operations on fuzzy sets, Product of two fuzzy sets, Product of a fuzzy set with a crisp number, Power of a fuzzy set, Difference of two fuzzy sets, Disjunctive sum of two fuzzy sets, example.
Unit-IV	General properties of operations on fuzzy sets, Commutativity, associativity, distributivity, Idempotent law, identities for operations, Transitivity, involution, Demorgans laws, proofs and examples, Some important theorems on fuzzy sets, set inclusion of fuzzy sets and corresponding α -cuts and strong α -cuts (Theorem 1).
Unit-V	Comparison of α -cut and strong α -cut, Order relation of scalars α is inversely preserved by set inclusion of corresponding α -cuts and strong α -cuts, α -cut of union and intersection of two fuzzy sets, α -cut of complement of a fuzzy set (Theorem 2), Examples, α -cuts and strong α -cuts of union and intersection of arbitrary collection of fuzzy sets.

Text book –

- 1 Fuzzy Sets and their Applications by Pundir and Pundir, Pragati Prakashan .

Reference Books:

1. Fuzzy sets and Fuzzy Logic by G.J. Klir and B. Yuan, Prentice Hall of India, New Delhi, 1995.
2. Fuzzy set Theory and its Applications by H.J. Zimmermann, Allied publishers Ltd, New Delhi 1991.

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DEPARTMENT OF MATHEMATICS 2020-21

M.A./M.Sc. (MATHEMATICS) THIRD SEMESTER

PAPER V: INTEGRAL TRANSFORM-I

Theory Max.Marks:35

Max.Pass. Marks:12

Unit-I	Application of Laplace Transforms to Differential Equations.
Unit-II	Laplace's Equations.
Unit-III	Laplace's Wave Equations.
Unit-IV	Applications of Laplace Transforms.
Unit-V	Heat Conduction Equation.

Text Books:

(1) Integral Transforms by Goyal and Gupta.

(2) Integral Transforms by Sneddon.

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M.Sc. IVth SEMESTER

2020-21

Department of Mathematics

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DEPARTMENT OF MATHEMATICS 2020-21

M.Sc. (MATHEMATICS) FOURTH SEMESTER

Paper I: Operations Research

Max. Marks: 35

Min. Pass. Marks: 12

Unit I	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 Operations Research, Linear Programming Problems, Mathematical Formulation, Graphical Solution Method.
Unit II	Inventory theory : Inventory models on economic lot size system with uniform and non uniform demand, Economic lot size with finite rate of replenishment, A simple order level system with constant rate of demand with shortage, Generalized economic lot size model, Multi items deterministic models, Probabilistic model, Instantaneous demand, no setup cost model, Uniform demand, no setup cost model
Unit III	Waiting lines, distribution theorem, classification of queuing model: models: (M/M/1): (∞ /FCFS), (M/M/1) (N/FCFS). General Erlang queuing model, (M/M/S): (∞ /FCFS), (M/M/S): (N/FCFS), (M/E _k /1): (∞ /FCFS).
Unit IV	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), Replacement problem: Replacement problem when money value does not change/changes with Time, Group replacement policy, Mortality theorem.
Unit V	Game theory- Two persons, Zero-sum Games, Maximin - Minimax principle, games without saddle points- Mixed strategies, Graphical solution of 2xm and mx2 games, Solution by Linear Programming, Non-Linear programming Techniques-Kuhn-Tucker Conditions, Non-negative Constrains.

TEXT BOOKS:

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

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DEPARTMENT OF MATHEMATICS 2020-21

M.Sc. (MATHEMATICS) FOURTH SEMESTER

PAPER II: Programming in 'C++'(Theory and Practical)

Max. Marks: 25
Min. Passing Marks:09

Unit-I: Principles of Object Oriented Programming : Procedure oriented programming and Object-Oriented Programming Paradigm, Object oriented programming concept: Class, Object, Data abstraction , Encapsulation, Inheritance, Polymorphism & Message Passing, Benefits of OOPS. **Introduction to C++:** Tokens, Keywords, Identifiers, Data Types, Constants, Variables, Operators and Functions in C++.

Unit-II: Classes and Objects : Structure of class , declaration of class , member function, declaring function outside of class, A C++ Program with class, Static Data members, Static Members functions, Arrays of Object.

Control Structure: Sequence Selection and Iteration, Structured data types : arrays, Function, recursive function, Inline Function.

Unit – III : Constructors- Parameterized Constructors, Copy Constructor, default constructor , constructor overloading, Destructors, friend function.
Friend function, polymorphism - Virtual Function , this pointer. Create program using class.

Unit – IV : What is function Overloading, rules for function overloading, Operator overloading, rules for Operator overloading, Overloading Unary Operator, Overloading Binary Operator, overloading assignment operator , Pointers, Declaration and Initialization of Pointers.

Unit – V: Inheritance: Introduction, types of derivation – public, private, protected inheritance. Types of Inheritance (Simple, Multilevel, Multiple, Hierarchical and Hybrid). Create program using inheritance.

Text Books:

1. Object Oriented Programming with C++ by E. Balaguruswamy.
2. Object Oriented Programming with C++ by Nabjyoti Babkakat Sams Phi. Pvt.ltd.
3. Object Oriented Programming with Turbo C++ by Ashok Kamthane (Pearson Education).

Reference Books –

1. The C++ Programm Language (4th Edition) by Bjarne Stroustrup
2. Object Oriented Programming in C++(4th Edition) by Lafore
3. Programming with C++ (2nd edition) – D. Ravi Chandra

MATA GUJRI MAHILA MAHAVIDYALAYA(AUTO), JABALPUR

DEPARTMENT OF MATHEMATICS 2020-21

M.Sc. (MATHEMATICS) FOURTH SEMESTER

Paper III : Theory of Linear operators

Max. Marks: 35

Min. Pass. Marks: 12

Unit-I	Spectral theory in normed linear spaces, resolvent set and spectrum, spectral properties of bounded linear operators, Properties of resolvent and spectrum, Spectral mapping theorem for polynomials
Unit-II	Spectral radius of a bounded linear operator on a complex Banach space, Elementary theory of Banach algebras, General properties of compact linear operators,
Unit-III	Spectral properties of compact linear operators on normed spaces, Behaviours of compact linear operators with respect to solvability of operators equation,
Unit-IV	Fredholm type theorems. Fredholm alternative theorem, Fredholm alternative for integral equations, Spectral properties of bounded self-adjoint linear operators on a complex Hilbert space,
Unit-V	Positive operators, Monotone sequence theorem for bounded self- adjoint operators on a complex Hilbert space, Square roots of a positive operator, Projection operators.

Text Books:

1. E. Kreyszig, Introductory Functional Analysis with Applications, John-Wiley & Sons, New York, 1978.

Referance Books:

1. P.R. Halmos, Introduction to Hilbert Space and the Theory of Spectral Multiplicity, Second Edition, Chelsea Publishing Co., New York, 1957.
2. N. Dunford and J.T. Schwartz, Linear Operators 3 Parts, Interscience/Wiley, NewYork,1958-71.
3. G. Bach man and L. Narici, Functional Analysis, Academic Press, York, 1966.

MATA GUJRI MAHILA MAHAVIDYALAYA (AUTO.), JABALPUR
DEPARTMENT OF MATHEMATICS 2020-21
M.A./M.Sc. (MATHEMATICS) FOURTH SEMESTER
Paper IV : FUZZY SETS AND THEIR APPLICATIONS – II

Max. Marks: 35
 Min. Pass. Marks: 12

UNIT I	Fuzzy sets: Basic Definition, α -level sets, Convex fuzzy set, Basic operations on fuzzy sets, types of fuzzy sets, Extensions: Types of fuzzy sets, Further operations on fuzzy sets, Cartesian product, Algebraic products, Bounded sum and difference, t-norm & t-conorm.
UNIT II	Extension principle and application, Zadeh extension principle, image and inverse image of fuzzy sets, fuzzy numbers, algebraic operations with fuzzy numbers, extendent operation and its properties, Special extended operation, addition, subtraction, product and division of fuzzy numbers.
UNIT III	Fuzzy relations on fuzzy sets, The union & intersection of fuzzy relations, Composition of fuzzy relations, Composition of fuzzy relations, max-* and max-product compositions, min-max composition and its properties, reflexivity, symmetry, transitivity and their examples, special fuzzy relations, similarity relation.
UNIT IV	Fuzzy graphs: Definition and examples, Fuzzy sub graph, Spanning sub graph, path in a fuzzy graph ,strength and length of a path, - length and –distances, connected nodes, fuzzy forest, fuzzy tree, Examples, Fuzzy Analysis: Fuzzy function on fuzzy sets, classical function, fuzzy function, Examples.
UNIT V	Fuzzy Logic; classical logic an overview, multi-valued logic, proposition unconditional and unqualified proposition, unconditional and qualified proposition, conditional and unqualified proposition, conditional and qualified proposition, Fuzzy qualifiers, Linguistic hedges. An overview of classical logic, its connectives, Tautology, Contradiction, Fuzzy

Text Book:

1. Fuzzy set theory and its Applications by H.J. Zimmermann, Allied Publishers Ltd., New Delhi, 1991 .
2. Fuzzy sets and Fuzzy Logic Theory & Application by G.J. Klir and B. Yuan, Prentice Hall of India, New Delhi, (2000) .

Reference Books:

1. 1. Fuzzy Logic with Engineering Applications by T.J. Ross, John Wiley & Sons, IInd Ed., 2005

MATA GUJRI MAHILA MAHAVIDYALAYA(AUTO), JABALPUR

DEPARTMENT OF MATHEMATICS 2020-21

M.Sc. (MATHEMATICS) FOURTH SEMESTER

Paper V: Integral Transform – II

Max.Marks:35

Min PassingMarks:12

Unit-I	Application of Laplace Transforms :Laplace's Equations, Laplaces Wave Equations Application to Dynamics.
Unit-II	Application of Laplace Transforms in Heat Conduction Equation.
Unit-III	Application of Laplace Transforms to Boundary value problems. Electric Circuit, Application to Beams.
Unit-IV	The Complex Fourier Transforms, Inversion Formula, Fourier cosine and sine Transforms.Properties of Fourier Transforms, Convolution and Parseval's identity.
Unit-V	Fourier Transforms of the Derivatives , Finite Fourier Sine and Cosine Transform , Inversion operational and combined properties Fouries transform.

Text Books:

1. Integral Transforms by Goyal and Gupta.
2. Integral Transforms by Sneddon.