GOVT. BILASA GIRLS' P.G.(AUTONOMOUS) COLLEGE

BILASPUR (C.G.)

M.Sc. Mathematics

(First & Second Semester)

SESSION : 2019-20

M. Sc. Mathematics

First & Second Semester

SESSION : 2019-20

There shall be five papers. All papers are compulsory.

Paper	Title	Max. Marks		Min. Passing Marks	
		Ext.	Int.	Ext.	Int.
I	Advanced Abstract Algebra	80	20	29	07
II	Real Analysis	80	20	29	07
III	Topology	80	20	29	07
IV	Complex Analysis	80	20	29	07
V	Advanced Discrete	80	20	29	07

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Normal series - Normal and subnormal series composition series Jordan Holder theorem, Solvable groups, Nilpotent groups. Rings and Ideals - Definitions, Maximal and prime ideals, Nilpotent and Nil ideals Zorn's Lemma (Statement Only) its application to obtain Maximal ideal.

Definition and examples sub modules quotient modules direct sums, Modules generated by a set, Homomorphism of modules, isomorphism theorems, Exact sequence of modules, Short exact sequence, Cyclic modules Simple modules, Semi-simple modules Schur's lemma, Free modules.

Field Theory - Extension fields, Algebraic and transdental extensions, separable and inseparable extension, Normal extensions, Perfect fields, Finite Fields, Primitive Elements, Algebraically closed fields, Automorphism of extensions, Galois Extension, Fundamental theorem of Galois theory, Solution of Polynomial equations by radicals.

Text Book:

P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul Basic Abstract Algebra IInd Edition Cambridge University, Press Indian Edition.

Reference Books:

1. I.S. Herstein - Topics in Algebra Wiely Eastern Ltd. New Delhi (1975).

2. M.Artin Algebra Prentice Hall of India 1991.

3. D.S.Malik, J.N.Mordeson & M.K. Sen Fundamentals of Abstract Algebra, McGraw - Hill International Edition 1997.

1.   2.   3.   4.   5.   6.

GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M.Sc. MATHEMATICS

FIRST SEMESTER

PAPER II - REAL ANALYSIS –I

Session 2019-20

Maximum Marks: 80

The Riemann - Stieltjes Integral: Definition and existence of Riemann- Stieltjes integral, Properties of the Integral, Integration and differentiation, the fundamental theorem of Calculus, integration of vector-valued function Rectifiable curves.

Functions of Several Variables : Linear transformation, Derivatives in an open subset of R^n, Contraction principle, Inverse function theorem, Implicit function theorem, Derivatives of higher orders, Differentiation of integrals.

Sequences and series of Functions : Point wise 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 : Uniquencess theorem for power series, Abel's and Tauber's theroem .

REFERENCES :

[1] Walter Rudin:Principles of Mathematical Analysis' (3re edition) Mc Graw Hill, Kogakusha, 1976, International student edition.

[2] P.K. Jain and V.P. Gupta: Lebesgue Measure and Integration, New age International (P) Limited published, New Delhi 1986 (Reprint 2000).

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M.Sc. MATHEMATICS
FIRST SEMESTER
PAPER III – TOPOLOGY -I
Session 2019-20

Max. Marks. 80

Definition and examples of topological spaces. Closed sets, Closure, Dense subsets Neighbourhoods, Interiors, exteriors and boundary points, Accumulation point and derived sets, Bases and sub-bases, subspaces and relative topology.

Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood systems.

Continuous functions and Homeomorphism   .

First and second countable spaces, Lindelof's theorems,Seperable Spaces, Second Countability   and Seperability, Seperation axioms, T_0, T_1 T_2 $T_{31/2}$,T_4: their Characterization and basic properties. Uryshohn's lemma and Tietz Extension Theorem .

REFERENCES::

1.G.F. Simmons :Introduction to Topology and Modern Analysis, Mc Graw -Hill

2.J.N .Sharma: Topology, Krishna Prakashan Mandir, Meerut

3.M.J.Mansfield: Introduction to Topology. **Van Nostrand. Princeton, New Jersey, l963**

4.Jame R. Munkres: Topology, A First Couse. **Prentice Hall, Incorporated, 1974**

5. K.D.Joshi: Introduction to General Topology , New Age International(P) Ltd. New Delhi.

6.J Dugundji. Topology. Boston: Allyn and Bacon, 1966. [OP]

7.B.Mendelson: Introduction to Topology, **Dover Publications, 1990**.

1.   2.   3.   4.   5.   6.

GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M.Sc. MATHEMATICS

FIRST SEMESTER

PAPER IV : COMPLEX ANALYSIS- I

Session 2019-20

Max. Marks. 80

Complex Integration. Cauchy-Goursat Theorem. Cauchy's integral Formula. Higher order derivatives. Morera's theorem. Cauchy inequality and Liouville theorem. The fundamental theorem of Algebra. Taylor's theorem. Maximum modulus principle, Scwartz lemma. Laurent's series isolated singularities, Meromorphic functions.

The Argument principle. Rouche's theorem, Inverse function theorem.

Residues, Cauchy's residue theorem. Evaluation of integrals. Branches of many values functions with special references to argz. logz. and z^a .

Bilinear transformations their properties and classification. Definitions and examples of Conformal mappings.

Spaces of Analytical functions,Hurwitz's Theorem, Montel's theorem , Riemann mapping theorem

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REFERENCES:-

1.   J.B. Convay : Functions of one complex variable. Springer-Verlag international student Edition. Narosa. publishing House. 1980.

2.   D. Sarason : Complex Function theory. Hindustan Book Agency. Delhi 1994.

3.   S.Ponnusamy : Foundation of complex Analysis. Narosa publishing house 1997.

4.   J.N. Sharma.: Functions of a complex variable , Krishna Prakashan Mandir, Meerut

5.   B.S.Tyagi: Functions of a Complex Variable, Kedar Nath Ram Nath Prakashan, Meerut ,1981.

1.   2.   3.   4.   5.   6.

GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M.Sc. MATHEMATICS
FIRST SEMESTER

PAPER V : ADVANCED DISCRETE MATHEMATICS - I
Session 2019-20

Max. Marks. 80

Formal logic : Statement and Notation, Connectives – Negation, Conjuction, Disjunction, Truth Table,Coditional and Biconditional , statement well formed formula, Tautology, Equivalent formula, Duility Lan functionally complete set of connectives, two state devices and statement logic, Normal form, Principle conjuctives and Principle Disjunctive Normal forms, The theory of interface for the statement , calculus, Rules of Interface,Automatic Theorem proving , the predicate calculus, Quantifiers, Predicate formulas, Free and Bound variables, Interface theory of predicate calculus, valid formulas, over finite universe, valid formulas, involving quantifiersformulas involving more than one quantifiers.

Algebraic Structure: : Algebraic system**,** Semigroups and Monoids (including those pertaining to concatenation operation), Homomorphism of semigroups and monoids, Congruence relation and Quotient Semigroups, Sub semigroup and Sub Monoids. Direct products. Basic Homomorphism theorem.

Lattices : Lattices as partially ordered sets and their properties. Lattices as Algebraic systems, Sub lattices, Direct products, and homomorphism. Complete, Complemented and Distributive Lattice.

Boolean Algebra : Boolean Algebras as lattices. Various Boolean Identities. The switching Algebra example. Subalgebra, Direct products and Homomorphism. Join-irreducible elements. Atoms and minterms. Boolean forms and their Equivalence. Minterm Boolean forms. Sum of products canonical forms. Minimization of Boolean functions Application of Boolean Algebra Switching theory (Using AND, OR, NOT gates) The Karnaugh Map Method).

REFERENCES:
1.   J.P. Tremblay & R. Manohar:. Discrete Mathematical structure with application to computer sciences. McGraw Hill Book Co. 1997.
2.   Seymour Lepschutz.: Finite Mathematics (International edition 1993) McGraw Hill Book Co. New York.

3.   N. Deo: Graph Theory with applications to Engineering and Computer Sciences. Prentice Hall of India.
4.   S. Wiitala: Discrete Mathematics - A unified approach McGraw Hill Book Co. New York.
5.   C.L. Liu: Elements of Discrete mathematics. McGraw Hill Book Col.

6.   M.K.Gupta: Discrete Mathematics , Krishna Prakashan Mandir(P) Ltd., Meerut.

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)
M.Sc. MATHEMATICS

SECOND SEMESTER
PAPER I : ADVANCED ABSTRACT ALGEBRA - II
Session 2019-20

Maximum Marks: 80

Noetherian and Artinian Modules and rings, Hilbert's Basis theorem, Wedderburn Artin Theorem,

Smith Normal form over a PID and Rank.

Fundamental structure theorem for finitely generated modules over a principal Ideal Domain and its applications to finitely generated abelian groups.

Text Books:

1. P.R. Bhattacharya, S.K. Jain and S.R.Nagapaul Basic Abstract Algebra IInd Edition cambridge University press Indian Edition 1997.

2. I.N.Herstein Topics in Algebra, Wiley Eastern Ltd. New Delhi 1975.

Reference Books:

1. M.Artin Algebra, Prentice Hall of India 1991.

2. D.S.Malik, J.N. Mordeson & M.K. Sen, Fundamentals of Abstract Algebra Mc-Graw Hill International Edition.

1.   2.   3.   4.   5.   6.

Measurable sets : Lebesgue outer measure, Lebesgue measure, Properties of measurable sets, Borel sets and their measurability characterization of measurable sets, Non measurable set.

Measurable functions : Definition and properties; Simple, Step and characteristics function, Continuous function, sets of measure Zero. Sequence of functions, Egoroff's theorem structure of measurable function, Lusin theorem, Frechet theorem, Convergence in measure, Riesz theorem.

Lebesgue Integral : Lebesgue integral of a bounded function, Comparison of Riemann integral and Lebesgue integral, Bounded Convergence Theorem, Integral of non negative measurable functions, Fatou's lemma, Monotone convergence theorem, General Lebesgue integral, Lebesgue dominated convergence theorem.

Differentiation and integration : Dini derivatives, Differentiation of monotone functions, Lebesgue theorem, Function of bounded variation, Differentiation of an integral, Lebesgue sets, Absolutely Continous Functions, Integral of the derivatives

Lebesgue L^p spaces : The classes L^p, Holder and Minikowski inequalities, L^p Banach Spaces, Convergences in the mean

REFERENCES :
[1] Walter Rudin, :Principles of Mathematical Analysis' (3re edition) Mc Graw Hill, Kogakusha, 1976, International student edition.
[2] P.K. Jain and V.P. Gupta: Lebesgue Measure and Integration, New age International (P) Limited published, New Delhi 1986 (Reprint 2000).

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M.Sc. MATHEMATICS

SECOND SEMESTER

PAPER III – TOPOLOGY -II

Session 2019-20

Max. Marks. 80

Compactness continous functions and compact sets, Basic properties of compactness, compactness and Finite Intersection Property ,Sequentially and Countably compact sets,Local Compactness in Metric space Equivalence of compactness , countable compactness and sequential compactness in metric space.

Connected spaces, connectedness on the real line,Components, Locally connected spaces.

Net and filters. Topology and convergence of Nets,Hausdorffness and nets, Filters and their convergence of nets.

Tychonoff product topology in terms of standard sub-base and its characterization. . Projection Maps,Connectedness and product space. Compactness and Product space (Tychonoffs theorem)

REFERENCES:

1. G.F. Simmons :Introduction to Topology and Modern Analysis, Mc Graw -Hill
2. J.N .Sharma: Topology, Krishna Prakashan Mandir, Meerut
3. M.J.Mansfield: Introduction to Topology. **Van Nostrand. Princeton, New Jersey, l963**
4. Jame R. Munkres: Topology, A First Couse. **Prentice Hall, Incorporated, 1974**
5. K.D.Joshi: Introduction to General Topology , New Age International(P) Ltd. New Delhi.
6. J Dugundji. Topology. Boston: Allyn and Bacon, 1966. [OP]
7. B.Mendelson: Introduction to Topology, **Dover Publications, 1990**.

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)M.Sc. MATHEMATICS

<u>**SECOND SEMESTER**</u>

PAPER IV : COMPLEX ANALYSIS- II

Session 2019-20

Max. Marks. 80

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ENTIRE FUNCTIONS

Weierstrass factorization theorem Gamma function and its properties. Riemann Zeta function. Riemann's functional equation. Runge's theorem. Mittag Leffler's theorem. Analytic continuation uniqueness of direct analytic continuation. Uniqueness of analytic continuation along curve.

Power series method of analytic continuation. Schwartz's Reflection Principle. Monodromy theorem and it consequences.Harmonic functions on a disc , Harnack's Inequality and theorem , Dirichlet's Problem , Green's theorem .

Canonical products . Jensen's formula. Poisson - Jenson Formula. Hadamard's three circles theorem. Order of an entire function. Exponent of covergence, Borel's theorem. Hadamard's factorization theorem.

The range of an analytic function. Bloch's theorem. The little Picard theorem.

Schottky's theorem. Montel Caratheodory and the Great Picard theorem.

 Univalent functions. Bieberbach's conjecture (statement only) and the " 1/4 - theorem.

REFERENCES:-

1.   J.B. Convay : Functions of one complex variable. Springer-Verlag international student Edition. Narosa. publishing House. 1980.

2.   D. Sarason : Complex Function theory. Hindustan Book Agency. Delhi 1994.

3.   S.Ponnusamy : Foundation of complex Analysis. Narosa publishing house 1997.

4.   J.N. Sharma.: Functions of a complex variable , Krishna Prakashan Mandir, Meerut

5.   B.S.Tyagi: Functions of a Complex Variable, **Kedar Nath Ram Nath Prakashan, Meerut ,1981.**

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M.Sc. MATHEMATICS

SECOND SEMESTER

PAPER V : ADVANCED DISCRETE MATHEMATICS - II

Session 2019-20

Max. Marks. 80

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Grammar and Language: Phase structure grammar, Rewriting Rules, ,Derivation, Sentential forms, context –sensitive context, Free and Regular grammars and languages, Notion of syntext, Analysis, Polish Notation, Conversion of Infix experience to Polish Notation. The Rename Polish Notation.Regular sets and regular expression

Introductory Computability Theory : Finite state Machines and their Transition, Table diagrams, Equivalence of Finite state Machines, reduced machines, Homomorphism Finite automata, and equivalence of its power to that of Deterministic finite automata.

Graph Theory : Definition of (undirected) graph, Paths, Circuits Cycles & Sub graphs, Induced Sub graphs, Degree of a vertex, Connectivity, Planar Graphs and their properties, Trees, Euler's Formula for connected planner Graphs.Complete and complete Bipartite graphs, Kuratowski's Theorem.(statement only), and it's use, Spanning trees. Cut sets. Fundamental Cut sets and cycles. Minimal spanning trees. Matrix representation of graphs, Euler's theorem on the Existence of Eulerian Paths, and circuit, Directed Graphs, In degree and out degree of a vertex. Weighted undirected Graphs.

REFERENCES:
1.   J.P. Tremblay & R. Manohar:. Discrete Mathematical structure with application to computer sciences. McGraw Hill Book Co. 1997.
2.   Seymour Lepschutz.: Finite Mathematics (International edition 1993) McGraw Hill Book Co. New York.
3.   N. Deo: Graph Theory with applications to Engineering and Computer Sciences. Prentice Hall of India.
4.   S. Wiitala: Discrete Mathematics - A unified approach McGraw Hill Book Co. New York.
5.   C.L. Liu: Elements of Discrete mathematics. McGraw Hill Book Col.
6.   M.K.Gupta: Discrete Mathematics , Krishna Prakashan Mandir(P) Ltd., Meerut.

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GOVT. BILASA GIRLS' P. G. (AUTONOMOUS) COLLEGE

BILASPUR (C.G.)

M.Sc. Mathematics

(Third & Fourth Semester)

SESSION : 2019-20

GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M. Sc. Mathematics

Third & Fourth Semester

SESSION : 2019-20

There shall be five papers. Two compulsory & three optional paper.

Paper	Title	Max. Marks		Min. Passing Marks	
		Ext.	Int.	Ext.	Int.
I	Functional Analysis	80	20	29	07
II	Mechanics	80	20	29	07
III (Optional)	Programming in C (With ANSI Features)	50	20	18	07
III (Practical)		30		11	
IV (Optional)	Information Theory Or Fuzzy Sets and their Application	80	20	29	07
V (Optional)	Operation Research	80	20	29	07

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

<u>THIRD SEMESTER</u>

M.Sc. [Mathematics]

PAPER - I(Compulsory): Integration Theory and Functional Analysis -I

Session 2019-20

Max. Marks. 80

Signed measure. Hahn decomposition theorem, mutually singular measures. Radon-Nikodym theorem. Lebesgue decomposition. Riesz representation theorem. Extension theorem (Caratheodory).

Lebesgue-Stieltjes integral, product measures, Fubini's theorem. Tonnelle's theorem,Integral operator,Inner measure,Extension by set of measure zero, Caratheodory outer measure. Hausdorff measure., Differentiation and Integration. Decomposition into absolutely continuous and singular parts.

Baire sets. Baire measure, continuous functions with compact support. Regularity of measures on locally compact spaces.

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REFERENCES:

1.H.L. Royden: Real Analysis, Macmillan Publishing Co. Inc., New York, 4th Edition, 1993.
2.B.Choudhary and Sudarsan Nanda: Functional Analysis with Applications Wiley EasternLtd., 1989
3. J.H. Williamson: Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962
4. P.R. Halmos: Measure Theory, Van Nostrand, Princeton, 1950.
5. T.G. Hawkins: Lebesgue's Theory of Integration: Its Origins and Development, Chelsea, New York, 1979.

6. B.V.Limaye: Functional Analysis, Wiley Eastern Ltd.

7. G.de. Barra: Measure Theory & Integration, Wiley Eastern Ltd, 1981.

8. Walter Rudin: Real & Complex Analysis, Tata McGraw Hill Publishing. Company, New Delhi.

9. P.K.Jain , O.P.Ahuja & Khalid Ahmad: Functional Analysis, New Age International (P)Ltd., New Delhi.

10.A.Siddiqui: Functional Analysis with Applications: Tata McGraw Hill Publishing Company, New Delhi.

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)
THIRD SEMESTER
M.Sc. [MATHEMATICS]
PAPER – II(Compulsory) : Partial Differential Equations, Mechanics & Gravitation - I
Session 2019-20

Max. Marks. 80

Partial Differential Equations

Laplace's Equation- Fundamental solution, Mean value formulae, Properties of Harmonic function, Green function, Energy method

Heat Equation: Fundamental solution, Mean value formulae, Properties of solution, Energy method .

Wave Equation: Solutions by spherical means, Homogeneous equations, Energy method.

Non-linear first order PDE, complete integrals, Envelopes characteristics, Hamilton Jacobi equations (calculus of variations, Hamiltons ODE), Conservation Laws, Representation of solutions, Separation of variables.

Laplace and Fourier Transforms and their applications, Legendre Transform.

Attraction: Attraction of rod, disc, spherical shell and sphere,

Surface integral of normal attraction .

REFERENCES :
1.D.Raisinghania :Ordinary and Partial Differential Equation, S.Chand , New Delhi.
2.Gupta ,Kumar & Sharma: Classical - Mechanics, Pragati Prakashan,
3.S.L. Loney :An Elementary Treatise On Statics,University Press.
4.I.N. Sneddon: Partial Differential Equation , Mc Graw Hill Book Co.Ltd.
5.H.Goldstem: Classical Mechanics, Addition Wesley.
6.Narayan Chandra Rana & Pramod Sharad, Chandra Joag: Classical Mechanics. Tata McGraw-Hill Publishing Company, 1991.
7.B.D. Gupta & Satya Prakash: Mechanics Relativity .Pragati Prakshan, Meerut.

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M.Sc. [Mathematics]
THIRD SEMESTER
PAPER III(Optional) : Programming in C (with ANSI features) –I
Session 2019-20

Max. Marks. 80

[THEORY 50+PRACTICAL 30]

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An overview of programming.   Programming language, Classification.

C-Essentials Program Development. Functions. Anatomy of a C Function. Variables and Constants.

Expressions. Assignment Statements. Formatting Source Files. Continuation Character. The Preprocessor.

Scalar Data Types- Declarations, Different Types of Integers, Different kinds of Integer Constants. Floating- Point Types. Initialization. Mixing Types ,   Explicit Conversions-Casts. Enumeration Types, The Void Data Type, Typedefs, Finding the Address of an object. Pointers.

 Control Flow-Conditional Branching. The Switch Statement. Looping. Nested Loops. The break and continue Statements. The goto statement. Infinite Loops.

REFERENCES:

1. Peter A. Darnell and Philip E. Margolis, C: A Software Engineering Approach,
   Narosa Publishing House (Springer International Student Edition) 1993.
2. Brian W. Kernighan & Dennis M. Ritohie: The C Programme Language, 2nd
     Edition (ANSI Features), Prentice Hall 1989.
3. Yashwant Kanetkar: Let Us C, 8th Edison, B P B Publications 2007.
4. E. Balagurusamy: Programming in C (ANSI), 4th Edison, Tata Mac Graw Hill.

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)
THIRD SEMESTER
M.Sc. [Mathematics]
PAPER – IV(Optional) : Fuzzy Sets and their Applications –I
Session 2019-20

Max. Marks. 80

Fuzzy sets: Basic definitions α - cuts, Convex fuzzy sets, Basic operations on fuzzy sets, Types of fuzzy sets, properties of α-cuts, representation of fuzzy sets, First and Second decomposition theorem, Extention Principle for fuzzy sets, fuzzy complements, the two characterization theorems on fuzzy Complements, t-norms and t-conorms. Algebraic product and sum, bounded difference and sum, statements of characterization theorem for t-norms and t-conorms, combination of operaters.

Fuzzy Arithmetic: Fuzzy numbers, Arithmetic operations on fuzzy numbers, Lattices of fuzzy numbers, fuzzy equations.

Fuzzy Relations : Fuzzy relations on fuzzy sets, fuzzy binary relations and fuzzy equivalence relations. Fuzzy morphism, standard composition, sup i composition, inf –wi composition of fuzzy relations.

Fuzzy Relations Equations : Problem partitioning, solution methods, fuzzy relation equations based upon sup i composition and inf–wi composition, approximate solution.

REFERENCES:

1. G.J. Klir and B. Yuan : Fuzzy Sets and Fuzzy logic, Prentice Hall of India New Delhi
2. H.J. Zimmermann : Fuzzy Sets and Fuzzy logic, Prentice Hall of India New Delhi
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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)
THIRD SEMESTER

M.Sc. [Mathematics]

PAPER IV(Optional) : INFORMATION THEORY - I
Session 2019-20

Max. Marks. 80

Measure of Information- Axioms for a measure of uncertaintity. The Shannon entropy and its properties. Joint and conditional entropies. Transformation and its properties.Some Intuitive properties of a measure of entropy - Symmetry, normalization, expansibility, boundedness, recursivity, maximality, stability, additivity, subadditivity, nonnegativity, continuity, branching etc. and interconnections among them. Axiomatic characterization of the Shannon entropy due to Shannon and Fadeev. Axiomatic characterization of the Shannon entropy due to Tverberg and Leo.

Information functions, the fundamental equation of Information, information function continuous at the origin, nonnegative bounded information functions, measurable information functions and entropy. The fundamental theorem of Information Theory and its strong and weak converses.

REFERENCES:

1.R.ASH: Information Theory , Inter science Publishers, New York, 1965.

2.F.M.REZA: An Introduction to Information Theory, McGraw Hill Book Company, Inc.,1961

3.J,Aczel and Z.Daroczy: On Measures of Information and their characterization, Academic Press, New York

1.   2.   3.   4.   5.   6.

GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)
THIRD SEMESTER
M.Sc. [Mathematics]
PAPER V (Optional) : Operations Research –I
Session 2019-20

Max. Marks. 80

Operations Research and its Scope. Necessity of Operations Research in Industry. Linear Programming-graphical method of solutions, Simplex Method. Theory of the Simplex Method. Two phase method, Big M method of solution to an LPP. Duality in linear programming, Duality theorems, Dual Simplex method. Other Algorithms for Linear Programmrng-Dual Simplex Method.

 Parametric Linear Programming. Upper Bound Technique. Interior Point Algorithm. Linear Goal Programming. Assignment Problems, It's mathematical formulation, Solution of assignment problems, Optimality test. Transportation problems, Formulation of transportation problems, Solutions of Transportation problems, North-West corner method, Least cost method, Vogel's approximation method, Test for optimality U-V method.
Network Analysis-Shortest Path Problem.Minimum Spanning Tree Probiem.Maximum Flow I Problem. Minimum Cost Flow Problem. Network Simplex Method. Project Planning and Control I with PERT CPM.

REFERENCES :
1. F.S. Hillier and G.J. Ueberman: Introduction to Operations ResBareft (Sixth Edition), McGraw Hill International Edition, Industrial Engineering Series, 1995 Affiliated East-West Press Pvt. Ltd., New Delhi, Madras.
2. G. Hadley: Linear Programming, Narosa Publishing House, 1995.
3. G. Hadly, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
4. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali: Linear Programming and Network flows, John Wiley I ' & Sons, New York, 1990.
5. H.A. Taha: Operations Researc~-An introduction, Macmillan Publishing Co., Inc., New Yark.
6. K. Swarup, P.K. Gupta and M. Mohan: Operations Research, Sultan Chand & Sons, N.Delhi.
7. S.S. Rao: Optimization Theory and Applications, Wiley Eastern Ltd., New Delhi.
8. P. K.. Gupla and D.S. Hira, : Operations Research ,S. Chand & Co. Ltd., N.Delhi.
9. N.S. Kambo, Mathematical Programming Techniques, Affiliated East-West

 Press Pvt. Ltd., New Delhi, Madras.
10. S.D.Sharma: Operations Research, Kedar Nath Ram Nath Publication, Meerut.

1.   2.   3.   4.   5.   6.

M.Sc. [Mathematics]

PAPER I (Compulsory) : Integration Theory and   Functional Analysis   - II

Session 2019-20

Max. Marks. 80

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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. Weak convergence and bounded linear transformations, normed linear spaces of bounded linear transformations, dual spaces with examples .

Uniform boundedness theorem and some of its consequences. Open mapping and closed graph theorems. Hahn-Banach theorem for real linear spaces, complex linear spaces and normed linear spaces. Reflexive spaces. Weak Sequential Compactness. Compact Operators. Solvability of linear equations in Banach spaces (Fredholm alternatives). The closed Range Theorem.

Inner product spaces. Hilbert spaces. Orthonormal Sets. Bessel's inequality. Complete orthonormal sets and Parseval's identity. Structure of Hilbert spaces. Projection theorem. Riesz representation theorem. Adjoint of an operator on a Hilbert space. Reflexivity of Hilbert spaces. Self-adjoint operators, Positive, projection, normal and unitary operators.

REFERENCES:

1.H.L. Royden: Real Analysis, Macmillan Publishing Co. Inc., New York, 4th
    Edition, 1993.
2.B.Choudhary and Sudarsan Nanda: Functional Analysis with Applications
    Wiley EasternLtd., 1989
3. J.H. Williamson: Lebesgue Integration, Holt Rinehart and Winston, Inc. New
    York. 1962
4. P.R. Halmos: Measure Theory, Van Nostrand, Princeton, 1950.
5. T.G. Hawkins: Lebesgue's Theory of Integration: Its Origins and
    Development, Chelsea, New York, 1979.

6. B.V.Limaye: Functional Analysis, Wiley Eastern Ltd.

7. G.de. Barra: Measure Theory & Integration, Wiley Eastern Ltd, 1981.

8. Walter Rudin: Real & Complex Analysis, Tata McGraw Hill Publishing. Company, New Delhi.

9. P.K.Jain , O.P.Ahuja & Khalid Ahmad: Functional Analysis, New Age

    International (P)Ltd., New Delhi.

10.A.Siddiqui: Functional Analysis with Applications: Tata McGraw Hill Publishing Company, New Delhi.

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PAPER – II (Compulsory): Partial Differential Equations, Mechanics & Gravitation - II

Session 2019-20

Max. Marks. 80

Analytical Dynamics

Generalised Co-ordinates, Holonomic and Non-holonomic Systems. Scleronomic and Rheonomic System, Generalised Potentials.

Lagrange's equations of first kind, Lagrange's equations of second kind . Uniqueness of solution,Energy equation for conservation fields.

Hamilton's variables.. Hamilton canonical equations. Cyclic coordinates. Routh's equations.

Poisson's Bracket. Poisson's Identity. Jacobi-Poisson Theorem. Motivating problems of calculus of variations, Shortest distance. Minimum surface of revolution. Brachistochrone problem. Isoperimetric problem. Geodesic,.Lagranges bracket and its properties, Fundamental lemma of calculus of variations. Euler's equation for one dependent function and its generalization to (i) independent functions, (ii) higher order derivatives. Conditional extremum under geometric constraints and under integral constraints.

Gravitation

Potential of rod, disc, spherical shell and sphere, spherical shell of finite thickness. Distributions for a given potential. Equipotential surfaces. Surface and solid harmonics. Surface density in terms of surface harmonics. Guass's theorem , Laplace and Poisson equations, work done by self attracting system.

REFERENCES :
1.D.Raisinghania :Ordinary and Partial Differential Equation, S.Chand , New Delhi.
2.Gupta ,Kumar & Sharma: Classical - Mechanics, **Pragati Prakashan,**
3.S.L. Loney :An Elementary Treatise On Statics,University Press.
4.I.N. Sneddon: Partial Differential Equation , Mc Graw Hill Book Co.Ltd.
5.H.Goldstem: Classical Mechanics, Addition Wesley.
6.Narayan Chandra Rana & Pramod Sharad, Chandra Joag: Classical Mechanics. **Tata McGraw-Hill Publishing Company, 1991.**
7.B.D. Gupta & Satya Prakash: Mechanics Relativity .Pragati Prakshan, Meerut.

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

M.Sc. [Mathematics]
FOURTH SEMESTER
PAPER III (Optional) : Programming in C (with ANSI features) –II
Session 2019-20

Max. Marks. 80

[THEORY 50+PRACTICAL 30]

Operators and Expressions-Precedence and Associativity. 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. CastOperator. Size of Operators. Conditional Operator. Memory Operators.

Arrays - Declaring an Array. Array and Memory. Initializing Arrays. Encryption and Decryption..

Storage Classes-Fixed vs. Automatic Duration. Scope. Global variables. The Register Specifier. ANSI rules for the syntax and Semantics of the storage – clas s keywords.

Pointers - Pointer Arithmetic. Passing Pointers as Function Arguments. Accessing Array Elements through Pointers. Passing Arrays as Function Arguments. Sorting Algorithms.Strings. Multidimensional Arrays. Arrays of Pointers. Pointers to Pointers.

Functions-Passing Arguments. Declarations and Calls. Pointers to Functions. Recursion. The main Function. Complex Declarations.The C Preprocessor-Macro Substitution. Conditional Compilation. Include Facility. Line Control.

Structures and Unions-Structures. Dynamic Memory Allocation. Linked Lists. Unions, enum Declarations.

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REFERENCES:

1. Peter A. Darnell and Philip E. Margolis, C: A Software Engineering Approach,

   Narosa Publishing House (Springer International Student Edition) 1993.

2.Brian W. Kernighan & Dennis M. Ritohie: The C Programme Language, 2nd

   Edition (ANSI Features), Prentice Hall 1989.

3. Yashwant Kanetkar: Let Us C, 8th Edison, B P B Publications 2007.
4. E. Balagurusamy: Programming in C (ANSI), 4th Edison, Tata Mac Graw Hill.

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)

FOURTH SEMESTER
M.Sc. [Mathematics]

PAPER IV (Optional) : Fuzzy Sets and their Applications –II
Session 2019-20

Max. Marks. 80

Possiblity Theory : Fuzzy measures, evidence theory, possliblity theory, necessity measure, fuzzy sets and possibility theory, possiblity theory versus probability theory.

Fuzzy logic : An overview of classical logic. Multivalued logics, Fuzzy propositions, Fuzzy quantifiers, Linguistic Hedges, Inference from conditional and qualified fuzzy proposition, the compositional rule of inference.

Approximate reasoning : An overview of fuzzy expert systems, Fuzzy implications and their selection, Multi conditional approximate reasoning, the role of fuzzy relation equations.

An introduction to fuzzy control : Fuzzy controllers, Fuzzy rule base. Fuzzy inference engine, Fuzzification. Defuzzification and various defuzzification methods (the center of area, the center of maxima, and the mean of maxima methods.)

Decision Making in Fuzzy Environment- Individual decision making . Multiperson decision making. Multicriteria decision making. Multistage decision making. Fuzzy ranking methods . Fuzzy linear programming.

REFERENCES:

1. G.J. Klir and B. Yuan : Fuzzy Sets and Fuzzy logic, Prentice Hall of India New Delhi
2. H.J. Zimmermann : Fuzzy Sets and Fuzzy logic, Prentice Hall of India New Delhi.

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GOVT. BILASA GIRLS' P. G. COLLEGE, BILASPUR (C.G.)
FOURTH SEMESTER

M.Sc. [Mathematics]

PAPER -IV (Optional) : INFORMATION THEORY - II
Session 2019-20

Max. Marks.80

Information Functions: The general solution of the fundamental equation of information. Derivations and their role in the study of information functions.

Continuous Channels: The time -discrete Gaussian channel.Uncertaintity of an absolutely continuous random variable. The converse to the coding theorem for time-discrete Gaussian channel.The time –discrete Gaussian channel, Band-limited channels.

Noisless Coding- Ingradients of noiseless coding problem. Uniquely decipherable codes. Necessary and Sufficient condition for the existence of instantaneous codes. Construction of optimal codes.

Discrete Memoryless Channel ; Classification of channels. Information processed by a channel. Calculation of channel capacity. Decoding schemes. The ideal observer.

REFERENCES:

1.R.ASH: Information Theory , Inter science Publishers, New York, 1965.

2.F.M.REJA: An Introduction to Information Theory, McGraw Hill Book Company, Inc.,1961

3.J,Aczel and Z.Daroczy: On Measures of Information and their characterization, Academic Press, New York.

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Max. Marks. 80

Dynamic Programming-Deterministic and Probabilistic Dynamic programming.

Game Theory-Two-Person, Zero-Sum Games. Games with Mixed Strategies. Graphical Solution. Solution by Linear Programming.

Integer Programming

Queueing system: Deterministic Queueing system, probability distribution in Queueing, classification of Queueing models, Poission Queueing system ((M/M/I): (∞/FIFO), (M/M/I): (/SIRO) (M/M/I): (N/FIFO)), Inventory control : The concept of EOQ, Deterministic inventory problem with no shortages.

Nonlinear Programming- One and Multi-Variable Unconstrained Optimization. Kuhn-Tucker Conditions for Constrained Optimization. Quadratic Programming. Separable Programming. Convex Programming. Non-convex Programming.

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REFERENCES :
1. F.S. Hillier and G.J. Ueberman: Introduction to Operations ResBareft (Sixth Edition), McGraw Hill International Edition, Industrial Engineering Series, 1995 Affiliated East-West Press Pvt. Ltd., New Delhi, Madras.
2. G. Hadley: Linear Programming, Narosa Publishing House, 1995.
3. G. Hadly, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
4. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali: Linear Programming and Network flows, John Wiley I ' & Sons, New York, 1990.
5. H.A. Taha: Operations Researc~-An introduction, Macmillan Publishing Co., Inc., New Yark.
6. K. Swarup, P.K. Gupta and M. Mohan: Operations Research, Sultan Chand & Sons, N.Delhi.
7. S.S. Rao: Optimization Theory and Applications, Wiley Eastern Ltd., New Delhi.
8. P. K.. Gupla and D.S. Hira, : Operations Research ,S. Chand & Co. Ltd., N.Delhi.
9. N.S. Kambo, Mathematical Programming Techniques, Affiliated East-West Press Pvt. Ltd., New Delhi, Madras.
10. S.D.Sharma: Operations Research,Kedar Nath Ram Nath Publication, Meerut.

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