GOVT. N.P.G. COLLEGE OF SCIENCE, RAIPUR (C.G.)

Department of Mathematics

Syllabus for

M.Sc. (Mathematics)

Semester System

2019-20

Programme Specific Outcome

01- Students will be able to apply critical thinking to solve the problems that can be modelled mathematically.
02- Students solve critical problem by applying mathematical tools.
03- Students will be able to read and construct the mathematical arguments and prove to use computer technology appropriately to solve problems and to promote understanding.

Programm Outcome:

1- On successful completion of this programme the students will have the ability to solve the problems in areas mathematical science.
2- Students will have the knowledge to crack the competitive examination, lectureship, NET,SET, UPSC etc.
3- Students can provide high quality education in mathematics within the environment of teaching.

Course Outcomes:

M.Sc. I Semester

On completion of the course , students will be able to
1- Understand the concept of topological space, subspace, base, derived set, compactness, connectedness etc.
2- Have the knowledge of solvable groups, Nilpotent groups, Galois Theory, extension field, Perfect field etc.
3- Describe fundamental properties of the real numbers and real valued function, have the knowledge uniform convergence, power series etc.
4- Have the knowledge of complex integral and Residues, knowledge of complex variables.
5- Understand Lattices, Grammar and language phrase structure Grammar.

M.Sc. II Semester

On completion of the course, students will be able to
1- Understand the concept of product Topology. .
2- Develop the ability of proving mathematical result and establishing theorem from complex analysis.
3- Develop the concept of Lebesguemeasure, measurable sets, bounded variation, complex function.
4- Aware about modules, smith normal forms of a matrix, linear transformation etc.

M.Sc. III Semester

On completion of the course, students will be able to

1- Inculcate knowledge on maximise the profit and minimise the cost in every place.

2- Develop the knowledge of operation research and the use of OR in Real world problem.

3- Make aware the students for creating linear programming models for transportation problem .

4- Recognize the major classification of partial differential equation and the qualitative difference between the class of a equation .

M.Sc. IV Semester

On completion of the course, students will be able to

01- Explain fundamental concept of functional analysis and their role in modern mathematics.

02- Propose the best strategy using decision making model under game theory.

GOVT. N.P.G. COLLEGE OF SCIENCE
RAIPUR(C.G.)
SCHEME OF EXAMINATION AND MARKS
M.Sc. /M.A. MATHEMATICS (SEMESTER SYSTEM)
2018-19 & ONWARDS

There shall be five papers (Theory/ practical) in each M.Sc. (first—fourth semester) mathematics. In 1st, 2nd semester all papers are compulsory. Each paper will be of 100 marks (80 Theory+ 20 Internal)

M.Sc. MATHEMATICS 1st semester

PAPER	SUBJECT	MAXIMUM MARKS		MAXIMUM MARKS		Credit Point	T0TAL MARKS
		THEORY		INTERNAL TEST			
		Max.	Min.	Max.	Min.		
I.	Advanced Abstract algebra(I)	80	16	20	04	05	100
II.	Real Analysis(I)	80	16	20	04	05	100
III.	Topology(I)	80	16	20	04	05	100
IV	Advanced Complex Analysis(I)	80	16	20	04	05	100
V.	Advanced Discrete Mathematics(I)	80	16	20	04	05	100

In semester 1st two unit test each of 20 marks in each paper will be conducted and the average of marks of two tests will be awarded to the candidates.

M. Sc. MATHEMATICS 2nd semester

PAPER	SUBJECT	MAXIMUM MARKS		MAXIMUM MARKS		Credit	T0TAL MARKS
		THEORY		INTERNAL SEMINAR			
		Max.	Min.	Max.	Min.		
I.	Advanced Abstract algebra(II)	80	16	20	04	05	100
II.	Real Analysis(II)	80	16	20	04	05	100
III.	Topology(II)	80	16	20	04	05	100
IV	Advanced Complex Analysis(II)	80	16	20	04	05	100
V.	Advanced Discrete Mathematics(II)	80	16	20	04	05	100

In each paper of semester II, 1 seminar of 20 marks will be conducted under internal assessment.

Distribution of Marks (80 Marks) :

Multiple Choice Questions : 10 X 1 Marks = 10 Marks
Short Answer Questions : 5 X 4 Marks = 20 Marks
Long Answer Questions : 5 X 10 Marks = 50 Marks
Total = 80 Marks

Distribution of Marks (56 Marks) :

Multiple Choice Questions : 6 X 1 Marks = 06 Marks
Short Answer Questions : 5 X 3 Marks = 15 Marks
Long Answer Questions : 5 X 7 Marks = 35 Marks
Total = 56 Marks

M.Sc. MATHEMATICS 3rd semester

PAPER	SUBJECT	MAXIMUM MARKS		MAXIMUM MARKS			Credit	TOTA
		THEORY		INTERNAL				
		Max.	Min.	Max.	Min.	TICAL		
I. COMPUL-SARY PAPERS	Integration Theory & functional analysis (I)	80	16	20	04	NIL	05	100
II.	Partial differential equations & mechanics(I)	80	16	20	04	NIL	05	100
III. (OPTIONAL PAPERS)	1. Fundamentals of computer science	56	16	14	04	30	05	100
	2. FUZZY sets and their applications	80	16	20	04	NIL	05	
	3. DIFFERENCE equations	80	16	20	04	NIL	05	
	4.GRAPH THEORY(I)	80	16	20	04	NIL	05	
	5. WAVELETS(I)	80	16	20	04	NIL	05	
IV.	Operations Research(I)	80	16	20	04	NIL	05	100
V.	Programming in C(I) (WITH ANSI FEATURES)	56	11	14	03	30	03 (Th)+	100
TOTAL								500

NOTE: In semester III, two unit tests will be conducted and average of which will be awarded to the candidates.

PRACTICAL EXAMINATION SCHEME:

MAX. MARKS-30	TIME
DURATION -3 hours	
PRACTICAL (TWO)	20
MARKS (10 MARKS EACH)	
VIVA	05
MARKS	
SESSIONAL	05
MARKS	

M.Sc. MATHEMATICS 4th semester

PAPER	SUBJECT	MAXIMUM MARKS		MAXIMUM MARKS			Credi	TOT
		THEORY		INTERNAL				
		Max	Min.	Max	Min.	TICA		
I. COMPULSARY PAPERS	Integration Theory & functional analysis(II)	80	16	20	04	NIL	05	100
II.	Partial differential equations & mechanics(II)	80	16	20	04	NIL	05	100
III. (OPTIONAL PAPERS)	1.Fundamentals of computer science	56	11	14	04	30	05	100
	2.FUZZY sets and their applications	80	16	20	04	NIL	05	
	3.DIFFERENCE equations	80	16	20	04	NIL	05	
	4.GRAPH THEORY(II)	80	16	20	04	NIL	05	
	5.WAVELETS(II)	80	16	20	04	NIL	05	
IV.	Operations	80	16	20	04	NIL	05	100

	Research (II)							
V.	**Programming in C(II) (WITH ANSI FEATURES)**	56	11	14	03	30	03	100
TOTAL								500

NOTE: In each paper of semester IV, 1 seminar will be conducted under internal assessment.

EXAMINATION SCHEME:

MAX. MARKS-30	TIME DURATION -3 hours
PRACTICAL (TWO)	20 MARKS (10 MARKS EACH)
VIVA	05 MARKS
SESSIONAL	05 MARKS

M.Sc./M.A. Course (First Semester)
PAPER -I

Advanced Abstract Algebra (I)

M.M. 80

Unit-I Groups - Normal and Subnormal series. Composition series. Jordan-Holder theorem. Solvable groups. Nilpotent groups.

Unit-II Field theory- Extension fields. Algebraic and transcendental extensions. Separable and inseparable extensions. Normal extensions.

Unit-III Perfect fields. Finite fields. Primitive elements. Algebraically closed fields.

Unit-IV Automorphisms of extensions. Galois extensions. Fundamental theorem of Galois theory.

Unit-V Solution of polynomial equations by radicals. Insolvability of the general equation of degree 5 by radicals.

Books Recommended:

1. P.B.Bhattacharya, S.K.Jain, S.R.Nagpaul : Basic Abstract Algebra, Cambridge University press
2. I.N.Herstein : Topics in Albegra, Wiley Eastern Ltd.
3. Quazi Zameeruddin and Surjeet Singh : Modern Algebra

References

1. M.Artin, Algeabra, Prentice -Hall of India, 1991.
2. P.M. Cohn, Algebra,Vols. I,II &III, John Wiley & Sons, 1982,1989,1991.
3. N.Jacobson, Basic Algebra, Vols. I , W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
4. S.Lang, Algebra, 3rd edition, Addison-Wesley, 1993.
5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I-Groups, Vol.II-Rings, Narosa Publishing House (Vol.l-1996,Vol. II-1999)
6. D.S.Malik, J.N.Mordeson, and M.K.Sen, Fundamentals of Abstract Algebra, Mc Graw-Hill, International Edition,1997.
7. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.
8. I. Stewart, Galois theory, 2nd edition, chapman and Hall, 1989.
9. J.P. Escofier, Galois theory, GTM Vol.204, Springer, 2001..
10. Fraleigh , A first course in Algebra Algebra, Narosa,1982.

M.Sc./M.A. Course (First Semester)
PAPER-II

Real Analysis (I)

Max. Marks. 80

Unit-I 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, definition and simple properties of Riemann-Stieltjes integral, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation theorem.

Unit-II Power series, uniqueness theorem for power series, Abel's and Tauber's theorems. Rearrangements of terms of a series, Riemann's theorem.

Unit-III Functions of several variables, linear transformations, Derivatives in an open subset of R^n, Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem, Implicit function theorem.

Unit-IV Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals.

Unit-V Partitions of unity, Differential forms, Stoke's theorem.

Recommended Books:

1. Principle of Mathematical Analysis By W.Rudin
2. Real Analysis By H.L.Roydon

References

1. Walter Rudin, Principles of Mathematical Analysis (3rd edition) McGraw-Hill, Kogakusha, 1976, International student edition.

2. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985.
3. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar,Inc. New York,1975.
4. A.J. White, Real Analysis; an introduction, Addison-Wesley Publishing Co.,Inc.,1968.

5. G.de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
6. E. Hewitt and K. Stromberg. Real and Abstract Analysis, Berlin, Springer, 1969.
7. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Limited Published, New Delhi, 1986 Reprint 2000).
8. I.P. Natanson, Theory of Functions of a Real Variable. Vol. l, Frederick Ungar Publishing Co., 1961.
9. H.L. Royden, Real Analysis, Macmillan Pub.Co.Inc.4th Edition, New York .1962.
10. Richard L. Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc.1977.
11. J.H. Williamson, Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962.
12. A. Friedman, Foundations of Modern Analysis, Holt, Rinehart and Winston, Inc., New York, 1970.
13. P.R. Halmos, Measure Theory, Van Nostrand, Princeton, 1950.
14. T.G. Hawkins, Lebesgue's Theory, of Integration: Its Origins and Development, Chelsea, New York, 1979.
15. K.R. Parthasarathy, Introduction to Probability and Measure, Macmillan Company of India Ltd., Delhi, 1977.
16. R.G. Bartle, The Elements of Integration, John Wiley & Sons, Inc. New York, 1966.
17. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1969.
18. Inder K. Rana, An Introduction to Measure and Integration, Norosa Publishing House, Delhi, 1997.
19. Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing Co.Ltd. New Delhi, 1966.

M.Sc./M.A. Course (First Semester)
PAPER-III

Topology

Max. Marks. 80

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. 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-II Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood Systems. Continuous functions and homeomorphism. First and Second Countable spaces. Lindeloff's theorems. Separable spaces. Second countability and separability.

Unit-III Separation axioms; their Characterizations and basic properties. Urysohn's lemma, Tietze extension theorem.

Unit-IV Compactness. Continuous functions and compact sets. Basic properties of Compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness and one point compactification. Stone-Cech compactification.

Unit-V Compactness in metric spaces. Equivalence of compactness, countable compactness and sequential compactness in metric space. Connected spaces. Connectedness on the real line. Components. Locally connected spaces.

Recommended Books:

1. Topology By James R.Munkres
2. Topology By K.D.Joshi

References

1. James R.Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd., New Delhi,2000.

2. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.).

3. George F.Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company, 1963.

4. K.D.Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.

5. J.Hocking and G Young, Topology, Addison-Wiley Reading, 1961.
6. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York,1995.
7. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.
8. W.Thron, Topologically Structures, Holt, Rinehart and Winston, New York,1966.
9. N. Bourbaki, General Topology Part I (Transl.),Addison Wesley, Reading, 1966.
10. R. Engelking, General Topology, Polish Scientific Publishers, Warszawa, 1977.
11. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York,1964.
12. E.H.Spanier, Algebraic Topology, McGraw-Hill, New York,1966.
13. S. Willard, General Topology, Addison-Wesley, Reading, 1970.
14. Crump W.Baker, Introduction to Topology, Wm C. Brown Publisher, 1991.
15. Sze-Tsen Hu, Elements of General Topology, Holden-Day,Inc.1965.
16. D. Bushaw, Elements of General Topology, John Wiley & Sons, New York, 1963.
17. M.J. Mansfield, Introduction to Topology, D.Van Nostrand Co. Inc.Princeton,N.J.,1963.
18. B. Mendelson, Introduction to Topology, Allyn & Bacon, Inc., Boston,1962.
19. C. Berge, Topological Spaces, Macmillan Company, New York,1963.
20. S.S. Coirns, Introductory Topology, Ronald Press, New York, 1961.
21. Z.P. Mamuzic, Introduction to General Topology, P. Noordhoff Ltd.,Groningen, 1963.
22. K.K.Jha, Advanced General Topology, Nav Bharat Prakashan, Delhi.

M.Sc./M.A. Course (First Semester)
PAPER-IV

Complex Analysis (I)

Max. Marks. 80

Unit-I Complex integration, Cauchy-Goursat. Theorem. Cauchy's integral formula. Higher order derivatives. Morera's Theorem. Cauchy's inequality and Liouville's theorem. The fundamental theorem of algebra. Taylor's theorem. Laurent's series. Isolated singularities. Meromorphic functions.

Unit-II Maximum modulus principle. Schwarz lemma. The argument principle. Rouche's theorem Inverse function theorem.

Unit-III Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to arg z, logz and z^a.

Unit-IV Bilinear transformations, their properties and classifications. Definitions and examples of Conformal mappings.

Unit-V Spaces of analytic functions. Hurwitz's theorem. Montel's theorem Riemann mapping theorem.

Recommended Books:

1. L.V. Ahlfors, Complex Analysis, MCGraw - Hill, 1979.
2. D. Sarason, Complex Function Theory, Hindustan Book Agency, Delhi, 1994.
3. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student-Edition, Narosa Publishing House,1980.

References

1. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990.
2. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996.
3. S. Lang, Complex Analysis, Addison Wesley, 1977.
4. Mark J.Ablowitz and A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University press, South Asian Edition, 1998.
5. E. Hille, Analytic Function Theory (2 Vols.) Gonn & Co., 1959.
6. W.H.J. Fuchs, Topics in the Theory of Functions of one Complex Variable, D.Van Nostrand Co., 1967.

7. C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964.
8. M.Heins, Complex Function Theory, Academic Press, 1968.
9. Walter Rudin, Real and Complex Analysis, McGraw-Hill Book Co., 1966.
10. S.Saks and A.Zygmund, Analytic Functions, Monografic Matematyczne, 1952.
11. E.C Titchmarsh, The Theory of Functions, Oxford University Press, London.
12. W.A. Veech, A Second Course in Complex Analysis, W.A. Benjamin, 1967.
13. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

M.Sc./M.A. Course (First Semester)
PAPER-V

Advanced Discrete Mathematics (I)

Max. Marks. 80

Unit-I Formal Logic-Statements. Symbolic Representation and Tautologies. Quantifiers, Predicates and Validity. Propositional Logic. Semigroups & Monoids-Definitions and Examples of Semigroups and monoids (including those pertaining to concatenation operation).

Unit-II Homomorphism of semigroups and monoids. Congruence relation and Quotient Semigroups. Subsemigroup and submonoids. Direct Products. Basic Homomorphism Theorem.

Unit-III 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 Lattices. Boolean Algebras-Boolean Algebras as Lattices. Various Boolean Identities. The Switching Algebra example. Subalgebras,

Unit-IV 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 & NOT gates). The Karnaugh Map Method.

Unit-V Grammars and Languages-Phrase-Structure Grammars. Rewriting Rules. Derivations. Sentential Forms. Language generated by a Grammar. Regular, Context-Free, and Context Sensitive Grammars and Languages. Regular sets, Regular Expressions and the Pumping Lemma. Kleene's Theorem. Notions of Syntax Analysis, Polish Notations. Conversion of Infix Expressions to Polish Notations. The Reverse Polish Notation.

Recommended Books:

1. Elements of Discrete Mathematics By C.L.Liu
2. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.

References

1. J.L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.
2. Seymour Lepschutz, Finite Mathematics (International) edition 1983), McGraw-Hill Book Company, New York.
3. S.Wiitala, Discrete Mathematics-A Unified Approach, McGraw-Hill Book Co.
4. J.E. Hopcroft and J.D Ullman, Introduction to Automata Theory, Languages & Computation, Narosa Publishing House.
5. C.L Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co.
6. N. Deo. Graph Theory with Application to Engineering and Computer Sciences. Prentice Hall of India

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

PAPER-I

Advanced Abstract Algebra (II)

Max. Marks 80

Unit-I Modules - Cyclic modules. Simple modules. Semi-simple modules. Schur's Lemma. Free modules. Noetherian and artinian modules and rings-Hilbert basis theorem. Wedderburn Artin theorem. Uniform modules, primary modules, and Noether-Lasker theorem.

Unit-II Linear Transformations - Algebra of linear transformation, characteristic roots, matrices and linear transformations.

Unit-III Canonical Forms - Similarity of linear transformations. Invariant subspaces. Reduction to triangular forms. Nilpotent transformations. Index of nilpotency. Invariants of a nilpotent transformation. The primary decomposition theorem. Jordan blocks and Jordan forms.

Unit-IV Smith normal form over a principal ideal domain and rank of a matrix. Fundamental structure theorem for finitely generated modules over a Principal ideal domain and its applications to finitely generated abelian groups.

Unit-V Rational canonical form. Generalised Jordan form over any field.

Books Recommended:

1. P.B.Bhattacharya, S.K.Jain, S.R.Nagpaul : Basic Abstract Algebra, Cambridge University press
2. I.N.Herstein : Topics in Albegra, Wiley Eastern Ltd.
3. Quazi Zameeruddin and Surjeet Singh : Modern Algebra

References

1. M.Artin, Algeabra, Prentice -Hall of India, 1991.
2. P.M. Cohn, Algebra,Vols. I,II &III, John Wiley & Sons, 1982,1989,1991.
3. N.Jacobson, Basic Algebra, Vols. I & II,W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
4. S.Lang, Algebra, 3rd edition, Addison-Wesley, 1993.
5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I-Groups, Vol.II-Rings, Narosa Publishing House (Vol.l-1996,Vol. II-1999)
6. D.S.Malik, J.N.Mordeson, and M.K.Sen, Fundamentals of Abstract Algebra, Mc Graw-Hill, International Edition,1997.
7. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi,2000.
8. S.K.jain,A. Gunawardena and P.B Bhattacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag),2001.
9. S.Kumaresan, Linear Algebra, A Geometric Approach, Prentice-Hall of India, 2000.
10. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.
11. I. Stewart, Galois theory, 2nd edition, chapman and Hall, 1989.
12. J.P. Escofier, Galois theory, GTM Vol.204, Springer, 2001.
13. T.Y. Lam, lectures on Modules and Rings, GTM Vol. 189, Springer-Verlag,1999.
14. D.S. Passman, A Course in Ring Theory, Wadsworth and Brooks/Cole Advanced Books and Softwares, Pacific groves. California, 1991.
15. Fraleigh , A first course in Algebra Algebra, Narosa,1982.

M.Sc./M.A. Course (Second Semester)
PAPER-II

Real Analysis (II)

M.M. 80

Unit-I Definition and existence of Riemann-Stieltjes integral, Properties of the Integral, integration and differentiation, the fundamental theorem of Calculus, integration of vector-valued functions, Rectifiable curves.

Unit-II Lebesgue outer measure. Measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability. Non-measurable sets. Integration of Non-negative functions. The General integral. Integration of Series.

Unit-III Measures and outer measures, Extension of a measure. Uniqueness of Extension. Completion of a measure. Measure spaces. Integration with respect to a measure. Reimann and Lebesgue Integrals.

Unit-IV The Four derivatives. Lebesgue Differentiation Theorem. Differentiation and Integration.

Unit-V Functions of Bounded variation. The L^p-spaces. Convex functions. Jensen's inequality. Holder and Minkowski inequalities. Completeness of L^p, Convergence in Measure, Almost uniform convergence.

Recommended Books:
1. Principle of Mathematical Analysis by W. Rudin
2. Real Analysis by H. L. Roydon

References

1. Walter Rudin, Principles of Mathematical Analysis (3rd edition) McGraw-Hill, Kogakusha, 1976, International student edition.
2. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985.
3. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar,Inc. New York,1975.
4. A.J. White, Real Analysis; an introduction, Addison-Wesley Publishing Co.,Inc.,1968.

5. G.de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
6. E. Hewitt and K. Stromberg. Real and Abstract Analysis, Berlin, Springer, 1969.
7. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Limited Published, New Delhi, 1986 Reprint 2000).
8. I.P. Natanson, Theory of Functions of a Real Variable. Vol. l, Frederick Ungar Publishing Co., 1961.
9. H.L. Royden, Real Analysis, Macmillan Pub.Co.Inc.4th Edition, New York .1962.
10. Richard L. Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc.1977.
11. J.H. Williamson, Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962.
12. A. Friedman, Foundations of Modern Analysis, Holt, Rinehart and Winston, Inc., New York, 1970.
13. P.R. Halmos, Measure Theory, Van Nostrand, Princeton, 1950.
14. T.G. Hawkins, Lebesgue's Theory, of Integration: Its Origins and Development, Chelsea, New York, 1979.
15. K.R. Parthasarathy, Introduction to Probability and Measure, Macmillan Company of India Ltd., Delhi, 1977.
16. R.G. Bartle, The Elements of Integration, John Wiley & Sons, Inc. New York, 1966.
17. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1969.
18. Inder K. Rana, An Introduction to Measure and Integration, Norosa Publishing House, Delhi, 1997.
19. Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing Co.Ltd. New Delhi, 1966.

M.Sc./M.A. Course (Second Semester)
PAPER-III

General and Algebraic Topology

M.M. 80

Unit-I Product topology in terms of standard sub-base and its characterizations. Projection maps. Separation axioms.

Unit-II Product spaces. Connectedness and product spaces. Compactness and product spaces (Tychonoff's theorem). Countability and product spaces.

Unit-III Embedding and metrization. Embedding lemma and Tychonoff embedding. The Urysohn metrization theorem. Metrization theorems and Paracompactness-Local finiteness. The Nagata-Smirnov metrization theorem. Paracompactness. The Smirnov metrization theorem.

Unit-IV Nets and filter. 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

Recommended Books:

1. James R.Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd., New Delhi,2000.
2. K.D.Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.

References

1. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.).
2. George F.Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company, 1963.
3. J.Hocking and G Young, Topology, Addison-Wiley Reading, 1961.
4. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York,1995.
5. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.

6. W.Thron, Topologically Structures, Holt, Rinehart and Winston, New York,1966.
7. N. Bourbaki, General Topology Part I (Transl.),Addison Wesley, Reading, 1966.
8. R. Engelking, General Topology, Polish Scientific Publishers, Warszawa, 1977.
9. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York,1964.
10. E.H.Spanier, Algebraic Topology, McGraw-Hill, New York,1966.
11. S. Willard, General Topology, Addison-Wesley, Reading, 1970.
12. Crump W.Baker, Introduction to Topology, Wm C. Brown Publisher, 1991.
13. Sze-Tsen Hu, Elements of General Topology, Holden-Day,Inc.1965.
14. D. Bushaw, Elements of General Topology, John Wiley & Sons, New York, 1963.
15. M.J. Mansfield, Introduction to Topology, D.Van Nostrand Co. Inc.Princeton,N.J.,1963.
16. B. Mendelson, Introduction to Topology, Allyn & Bacon, Inc., Boston,1962.
17. C. Berge, Topological Spaces, Macmillan Company, New York,1963.
18. S.S. Coirns, Introductory Topology, Ronald Press, New York, 1961.
19. Z.P. Mamuzic, Introduction to General Topology, P. Noordhoff Ltd.,Groningen, 1963.
20. K.K.Jha, Advanced General Topology, Nav Bharat Prakashan, Delhi.

M.Sc./M.A. Course (Second Semester)
PAPER-IV

Advanced Complex Analysis (II)

Max. Marks. 80

Unit-I Weierstrass' factorisation theorem. Gamma function and its properties. Riemann Zeta function. Riemann's functional equation. Runge's theorem. Mittag-Leffler's theorem.

Unit-II Analytic Continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation Schwarz Reflection Principle. Monodromy theorem and its consequences.

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

Unit-IV Canonical products. Jensen's formula. Poisson-Jensen 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 Caratheodory and the Great picard theorem. Univalent functions. Bieberbach's conjecture (Statement only) and the "1/4-theorem.

Recommended Books:

1. L.V. Ahlfors, Complex Analysis, MCGraw - Hill, 1979.
2. D. Sarason, Complex Function Theory, Hindustan Book Agency, Delhi, 1994.
3. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student-Edition, Narosa Publishing House,1980.

References

1. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990.
2. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996.
3. S. Lang, Complex Analysis, Addison Wesley, 1977.

4. Mark J.Ablowitz and A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University press, South Asian Edition, 1998.
5. E. Hille, Analytic Function Theory (2 Vols.) Gonn & Co., 1959.
6. W.H.J. Fuchs, Topics in the Theory of Functions of one Complex Variable, D.Van Nostrand Co., 1967.
7. C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964.
8. M.Heins, Complex Function Theory, Academic Press, 1968.
9. Walter Rudin, Real and Complex Analysis, McGraw-Hill Book Co., 1966.
10. S.Saks and A.Zygmund, Analytic Functions, Monografic Matematyczne, 1952.
11. E.C Titchmarsh, The Theory of Functions, Oxford University Press, London.
12. W.A. Veech, A Second Course in Complex Analysis, W.A. Benjamin, 1967.
13. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

M.Sc./M.A. Course (Second Semester)
PAPER-V

Advanced Discrete Mathematics (II)

Max. Marks. 80

Unit-I Graph Theory-Definition of (Undirected) Graphs, Paths, Circuits, Cycles & Subgraphs. Induced Subgraphs. Degree of a vertex. Connectivity. Planar Graphs and their properties. Trees. Euler's Formula for connected planar Graphs. Complete & Complete Bipartite Graphs. Kuratowski's Theorem (statement only) and its use.

Unit-II Spanning Trees, Cut-sets, Fundamental Cut -sets, and Cycle. Minimal Spanning Trees and Kruskal's Algorithm. Matrix Representations of Graphs. Euler's Theorem on the Existence of Eulerian Paths and Circuits. Directed

Unit-III Graphs. In degree and Out degree of a Vertex. Weighted undirected Graphs. Dijkstra's Algorithm.. strong Connectivity & Warshall's Algorithm. Directed Trees. Search Trees. Tree Traversals.

Unit-IV Introductory Computability Theory-Finite State Machines and their Transition Table Diagrams. Equivalence of finite State Machines. Reduced Machines. Homomorphism.

Unit-V Finite Automata. Acceptors. Non-deterministic Finite Automata and equivalence of its power to that of Deterministic Finite Automata. Moore and mealy Machines. Turing Machine and Partial Recursive Functions.

Recommended Books:

1. Elements of Discrete Mathematics By C.L.Liu
2. Graph Theory and its application By N.Deo
3. Theory of Computer Science By K.L.P.Mishra and N.Chandrashekaran

References

1. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.
2. J.L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.

3. Seymour Lepschutz, Finite Mathematics (International) edition 1983), McGraw-Hill Book Company, New York.
4. S.Wiitala, Discrete Mathematics-A Unified Approach, McGraw-Hill Book Co.
5. J.E. Hopcroft and J.D Ullman, Introduction to Automata Theory, Languages & Computation, Narosa Publishing House.
6. C.L Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co.
7. N. Deo. Graph Theory with Application to Engineering and Computer Sciences. Prentice Hall of India.

M.Sc./M.A. Course (Third Semester)

PAPER -I

Integration Theory and Functional Analysis (I)

M.M. 80

Integration Theory:

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

Unit-II Lebesgue-Stieltjes integral, product measures, Fubini's theorem. Differentiation and Integration. Decomposition into absolutely continuous and singular parts.

Unit-III Baire sets. Baire measure, continuous functions with compact support. Regularity of measures on locally compact spaces. Integration of continuous functions with compact support, Riesz-Markoff theorem.

Functional Analysis :

Unit-IV 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-V Weak convergence and bounded linear transformations, normed linear spaces of bounded linear transformations, dual spaces with examples.

Books Recommended :

1. P.R. Halmos, Measure Theory, Van Nostrand, Princeton, 1950.
2. B.Choudhary and S.Nanda, Functional Analysis with Applications. Wiley Eastern Ltd. 1989.
3. H.L. Royden, Real Analysis, Macmillan Publishing Co. Inc., New York, 4'h Edition, 1993.
4. S.K. Berberian, Measure and integration, Chelsea Publishing Company, York, 1965.

References

1. G. de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
2. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Limited, New Delhi, 2000.
3. Richard L. Wheeden and Antoni Zygmund, Measure and Integral : An Introduction to Real Analysis, Marcel Dekker Inc. 1977.
4. J.H. Williamson, Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962.
5. T.G. Hawkins, Lebesgue's Theory of Integration: Its Origins and Development, Chelsea, New York, 1979.
6. K.R. Parthasarathy, Introduction to Probability and Measure, Macmillan Company of India Ltd., Delhi, 1977.
7. R.G. Bartle, The Elements of Integration, John Wiley & Sons, Inc. New York, 1966.
8. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1967.
9. Inder K. Rana, An Introduction to Measure and Integration, Narosa Publishing House, Delhi, 1997.
10. Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing.
11. Edwin Hewitt and Korl Stromberg, Real and Abstract Analysis, Springer-Verlag, New York.
12. Edwin Hewitt and Kenneth A. Ross, Abstract Harmonic Analysis, Vol. 1, Springer-Verlag, 1993.

13. G. Bachman and L. Narici, Functional Analysis, Academic Press, 1966.
14. N. Dunford and J.T. Schwartz, Linear Operators, Part I, Interscience, New York, 1958.
15. R.E. Edwards, Functional Analysis, Holt Rinehart and Winston, New York, 1965.
16. C. Goffman and G. Pedrick, First Course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.
17. P.K. Jain, O.P. Ahuja and Khalil Ahmad, Functional Analysis, New Age International (P) Ltd. & Wiley Eastern Ltd., New Delhi, 1997.
18. R.B. Holmes, Geometric Functional Analysis and its Applications, Springer-Verlag, 1975.
19. K.K. Jha, Functional Analysis, Students' Friends, 1986.
20. L.V. Kantorovich and G.P. Akilov, Functional Analysis, Pergamon Press, 1982.
21. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978.
22. B.K. Lahiri, Elements of Functional Analysis, The World Press Pvt. Ltd., Calcutta, 1994.
23. A.H.Siddiqui, Functional Analysis with Applications, Tata McGraw-Hill Publishing Company Ltd. New Delhi
24. B.V. Limaye, Functional Analysis, Wiley Eastern Ltd.
25. L.A. Lustenik and V.J. Sobolev, Elements of Functional Analysis, Hindustan Publishing Corporation, New Delhi, 1971.
26. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, New York, 1963.
27. A.E. Taylor, Introduction to Functional Analysis, John Wiley and Sons, New York, 1958.
28. K.Yosida, Functional Analysis, 3"' edition Springer-Verlag, New York, 1971.
29. J.B. Conway, A Course in Functional Analysis, Springer-Verlag, New York, 1990.
30. Walter Rudin, Functional Analysis, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1973.
31. A. Wilansky, Functional Analysis, Blaisdell Publishing Co., 1964.
32. J. Tinsley Oden & Leszek F. Dernkowicz, Applied Functional Analysis, CRC Press Inc., 1996.

M.Sc./M.A. Course (Third Semester)
PAPER -II
Partial Differential Equations and Mechanics (I)

M.M. 80

Partial Differential Equations

Unit-I Examples of PDE. Classification.Transport Equation-Initial value Problem. Non-homogeneous Equation. Laplace's Equation-Fundamental Solution, Mean Value Formulas, Properties of Harmonic Functions, Green's Function, Energy Methods.

Unit-II Heat Equation-Fundamental Solution, Mean Value Formula, Properties of Solutions, Energy Methods. Wave Equation-Solution by Spherical Means, Non-homogeneous Equations, Energy Methods.

Unit-III Nonlinear First Order PDE-Complete Integrals, Envelopes, Characteristics, HamiltonJacobi Equations (Calculus of Variations, Hamilton's ODE, Legendre Transform, Hopf-Lax Formula, Weak Solutions, Uniqueness), Conservation Laws (Shocks, Entropy Condtion, LaxOleinik formula, Weak Solutions, Uniqueness, Riemann's Problem, Long Time Behaviour)

Gravitation:

Unit-IV Attraction and potential of a thin uniform rod, circular plate, disc, spherical shells and sphere.

Unit-V Surface integral of normal attraction (application & Gauss' theorem). Laplace and Poisson equations. Work done by selfattracting systems. Distributions for a given potential. Equipotential surfaces. Surface and solid harmonics. Surface density in terms of surface harmonics.

Books Recommended :

1. L.C. Evans, Partial Differential Equations, Graduate Studies in Mathematics, Volume 19, AMS, 1998.
2. S.L. Loney, An Elementary Treatise on Statics, Kalyani Publishers, New Delhi, 1979.

M.Sc./M.A. Course (Third Semester)
PAPER-III (1)

Fundamentals of Computer Science-Theory and Practical
(Object Oriented Programming and Data Structure)

Max. Marks. 80

Unit-I Object Oriented Programming-Classes and Scope, nested classes, pointer class members; Class initialization, assignment and destruction.

Unit-II Overloaded functions and operators; Templates including class templates; class inheritance and virtual functions.

Unit-III Data Structures-Analysis of algorithms, q, W, 0, o, w notations ; Sequential and linked representations, Lists, Stacks, and queues;

Unit-IV Trees: Binary tree- search tree implementation, B-tree (concept only);

Unit-V Sorting: Insertion sort, shell sort, quick-sort, heap sort and their analysis; Hashing-open and closed.

Books Recommended :

1. S.B. Lipman, J. Lajoi: C++ Primer, Addison Wesley.
2. B. Stroustrup; The C++ Programming Language, Addison Wesley.
3. C.J. Date : Introduction to Database Systems, Addison Wesley.
4. C. Ritehie: Operating Systems-Incorporating UNIX and Windows, BPB Publications.
5. M.A. Weiss, Data Structures and Algorithm Analysis in C++, Addison Wesley.

Practical Examination Scheme

Max. Marks – 30	Time Duration – 3 Hrs.
Practical (two)	20 Marks(10 marks each)
Viva	05 Marks
Sessional	05 Marks

M.SC./M.A. COURSE (THIRD SEMESTER)
PAPER-III (2)
FUZZY SETS AND ITS APPLICATIONS (I)

MAX MARKS 80

UNIT-I **Fuzz**y sets Basic definitions, a -level sets. Convex Fuzzy sets. Basic operations on fuzzy sets. Types of fuzzy sets. Cartesian Products, Algebraic products. Bounded sum and difference, t-norms and t-conorms.

UNIT-II The extention principle- The Zadeh's extension principle. Image and inverse image of Fuzzy sets.Fuzzy numbers. Elements of Fuzzy arithmetic.

UNIT III Fuzzy relations on Fuzzy sets, composition of Fuzzy relations .Min-max composition and its properties.

UNIT IV Fuzzy equivalence relations.Fuzzy compatibility relations. Fuzzy relation equations. Fuzzy graphs, similarity relation.

UNIT V Possibility theory-Fuzzy measures. Evidence theory. Necessity measure. Possibility measure . Possibility distribution. Possibility theory and fuzzy sets. Possibility theory versus probability theory.

REFERENCES :

1. H.J. Zmmemann, Fuzzy set theory and its applications ,Allied publishers Ltd New Delhi,1991.

2. 2 .G.J. Klir and B. Yuan-Fuzzy sets and fuzzy logic, PHI, New Delhi 1995.

M.SC./M.A. COURSE (THIRD SEMESTER)
PAPER III (3)
Difference Equations-(I)

MAX MARKS-80

UNIT-I Introduction, difference Calculus-The Difference operator, Summation Generating functions and approximate summation.

UNIT-II Linear difference equations- **First order equations**. General results for Linear Equations with constant coefficients, Applications.

UNIT-III Equations with Variable coefficients. Non-linear equation s that can be linearized. The z-transform. Stability theory-initial value problems for linear systems.

UNIT-IV Asymptotic methods-Introduction .Asymptotic analysis of sums. Linear & non-linear equations

UNIT-V The self adjoint second order linear equation, introduction to Sturmian theory. Green's function, Disconnjugacy.The Riccati Equations . Oscillation

Recommended Text

Walter G. Kelley and Allan C. Peterson.Difference Equations.An introduction with Applications.Academic press Inc. Harcourt Brace Joranovich Publishers, 1991

REFERENCES:

Calvin Ahlbrandt and Allan C. Peterson. Discrete Hamiltonian systems, difference equations, continued fractions and Riccati equations, Kluwer, Boston, 1996

M.SC./M.A. COURSE (THIRD SEMESTER)
PAPER-III (4)
GRAPH THEORY--(I)

MAX MARKS-80

UNIT-I Operations on graphs, matrices and vector spaces, Topological operations, Homeomerphism homomorphism, contractions, derived graphs ,Binary operations.

UNIT-II Matrices and vector spaces: matrices and vector spaces :The adjacency matrix, The determinant and the spectrum, Spectrum properties, The incident matrix, cycle space and bond space, Cycle bases and cycle graphs.

UNIT III Colouring packing and covering: vertex covering ,critical graphs, Girth and chromatic number, uniquely colourable graphs, edge colourings, Face colouring and Beyond ,The achromatic and the the Adjoint Numbers.

UNIT IV Combinational formulations: setting up of combinational formulations ,the classical pair of duals .Gallai, Norman-Robin theorems ,Clique parameters ,The Rosenfeld Numbers.

UNIT V Perfect Graphs; Introduction to the "SPGC", Triagulated (Chordal) graphs ,comparability graphs, Interval graphs ,permutation graphs ,circular arc graphs, split graphs ,weakly triangulated graphs.

REFERENCES:

1. K.R. Parthasarthy, Basic graph theory, Tata McGraw Hill publishing company Ltd 1994.
2 .R.J. Wilson ,Introduction to graph theory ,Longman Horlow,1985
3. John Clark, Derek Allon Holton ,A first book at graph Theory ,World Scientific Singapore,1991.
4. Franf Hararary,Graph Theory Narosa , New Delhi,1995.
5. Ronald Gould and Benjamin Commins ,Graph Theory, California.
6. Narsingh Deo, Graph Theory with applications to Engineering and Computer Science, PHI Private Ltd. New Delhi.2002.

M.SC./M.A. COURSE (THIRD SEMESTER)
PAPER-III (5)
WAVELETS-(I)

MAX MARKS-80

UNIT-I Preliminaries different ways of constructing wavelets-Orthonormal bases generated by a single function: the Balian- Low theorem. Smooth projection on $L^2(R)$

UNIT-II Local sine and cosine bases and the construction of some wavelets. The unitary folding operators and the smooth projections.

UNIT-III Multiresolution analysis and construction of wavelets. Construction of some compactly supported wavetets and estimates for its smoothness .

UNIT-IV Band limited wavelets. Orthonormality. Completeness. Characterization of Lamarie-Meyer wavelets and some other characterizations.

UNIT-V Franklin wavelets and Spline wavelets on the real line.Orthonormal bases of piecewise linear continuous functions for $L^2(T)$. Orthonormal bases of periodic splines. Periodization of wavelets defined on the real line.

REFERENCES:

1.Eugenic HernBndez and Guido Weiss, A First Course on Wavelets, CRC press New York, 1996.

2.C.K. Chui, An introduction to Wavelets, Academic press 1992.

3. I.Daubechies, Ten lectures on Wavelets, CBS-NSF Regional conference in applied Mathematics,61,SIAM, 1992.

4.Y.Meyer Wavelets, algorithms and applications (Traslated by R.D. Rayan,SIAM,1993)

5.M.V. Wickerhauser, Adapted wavelet analysis from theory to software, Wellesley, MA, A.K. Peters 1994.

M.Sc./M.A. Course (Third Semester)
PAPER -IV

Operations Research (I)

M.M. 80

Unit-I Operations Research and its Scope. Necessity of Operations Research in Industry. Linear Programming-Simplex Method. Theory of the Simplex Method. Duality and Sensitivity Analysis.

Unit-II Other Algorithms for Linear Programmrng-Dual Simplex Method.

Unit-III Parametric Linear Programming. Upper Bound Technique. Interior Point Algorithm. Linear Goal Programming.

Unit-IV Transportation and Assignment Problems.

Unit-V 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.

Books Recommended :

1. F.S. Hillier and G.J. Ueberman. Introduction to Operations ResBareft (Sixth Edition), McGraw Hill International Edition, Industrial Engineering Series, 1995. (This book comes with a CD containing tutorial software).
2. G. Hadley, Linear Programming, Narosa Publishing House, 1995.
3. G. Hadly, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
4. H.A. Taha, Operations Research -An introduction, Macmillan Publishing Co., Inc., New Yark.
5. Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, Sultan Chand & Sons, New Delhi
6. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network flows, John Wiley & Sons, New York, 1990.

References

1. S.S. Rao, Optimization Theory and Applications, Wiley Eastern Ltd., New Delhi.

2 Prem Kumar Gupla and D.S. Hira, Operations Research-An Introduction. S. Cliand & Company Ltd., New Delhi.

3. N.S. Kambo, Mathematical Programming Techniques, Affiliated East-West Press Pvt. Ltd., New Delhi, Madras

4 R.K. Rathy, An Introduction to Fluid Dynamics, Oxford and IBH Publishing Company, New Delhi, 1976.

5. A.D. Young, Boundary Layers, AIAA Education Series, Washington DC, 1989.

6. S.W. Yuan, Foundations of Fluid Mechanics, Prentice Hall of India Private Limited, New Delhi, 1976.

7. UNDO Systems Products (Visit webs httl://www.Hndo.com/productsf.html)

(i) UNDO (the linear programming solver)

(ii) UNDO Callable Library (the premier optimisation engine)

(iii) LINGO (the linear, non-linear, and integer programming solver with mathematical modelling language)

(iv) What's Best I (the spreads sheet add-in that solves linear, non-linear, and integer problems).

All the above four products are bundled into one package to form the Solver Suite. For more details about any of the four products one has to click on its name.

(i) Optimisation Modelling with UNDO (8" edition) by Linus Schrage.

(ii) Optimisation Modelling with LINGO by Unus Schrage.

More details available on the Related Books page York, 1979.

M.Sc./M.A. Course (Third Semester)

PAPER -V

Programming in C (with ANSI features) Theory and Practical

Max. Marks. 56

Unit-I An overview of programming. Programming language its Classification. C Essentials-Program Development. Functions. Anatomy of a C Function. Variables and Constants. Expressions. Assignment Statements. Formatting Source Files. Continuation Character. An introduction of Preprocessor.

Unit-II 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. An introduction of Pointers.

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

Unit-IV 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. Cast Operator. Size of Operators. Conditional Operator. Memory Operators.

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

Books Recommended :

1. Peter A. Darnell and Philip E. Margolis, C: A Software Engineering Approach, Narosa Publishing House (Springer International Student Edition) 1993.
2. Samuel P. Harkison and Gly L. Steele Jr., C : A Reference Manual, 2nd Edition, Prentice Hall, 1984.
3. Brian W. Kernighan & Dennis M. Ritohie, The C Programme Language, 2nd Edition (ANSI Features), Prentice Hall 1989.

Practical Examination Scheme

Max. Marks – 30	**Time Duration – 3 Hrs.**
Practical (two)	**20 Marks(10 marks each)**
Viva	**05 Marks**
Sessional	**05 Marks**

M.Sc./M.A. Course (Fourth Semester)
PAPER -I
Functional Analysis (II)

M.M. 80

Unit-I Uniform boundedness theorem and some of its consequences. Open mapping and closed graph theorems.

Unit-II 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. The closed Range Theorem.

Unit-III Inner product spaces. Hilbert spaces. Orthonormal Sets. Bessel's inequality. Complete orthonormal sets and Parseval's identity.

Unit-IV Structure of Hilbert spaces. Projection theorem. Riesz representation theorem. Adjoint of an operator on a Hilbert space. Reflexivity of Hilbert spaces.

Unit-V Self-adjoint operators, Positive, projection, normal and unitary operators. Abstract variational boundary-value problem. The generalized Lax-Milgram theorem.

Books Recommended :

5. B.Choudhary and S.Nanda, Functional Analysis with Applications. Wiley Eastern Ltd. 1989.
6. H.L. Royden, Real Analysis, Macmillan Publishing Co. Inc., New York, 4'h Edition, 1993.

References

33. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1967.
34. Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing.
35. Edwin Hewitt and Korl Stromberg, Real and Abstract Analysis, Springer-Verlag, New York.

36. Edwin Hewitt and Kenneth A. Ross, Abstract Harmonic Analysis, Vol. 1, Springer-Verlag, 1993.
37. G. Bachman and L. Narici, Functional Analysis, Academic Press, 1966.
38. N. Dunford and J.T. Schwartz, Linear Operators, Part I, Interscience, New York, 1958.
39. R.E. Edwards, Functional Analysis, Holt Rinehart and Winston, New York, 1965.
40. C. Goffman and G. Pedrick, First Course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.
41. P.K. Jain, O.P. Ahuja and Khalil Ahmad, Functional Analysis, New Age International (P) Ltd. & Wiley Eastern Ltd., New Delhi, 1997.
42. R.B. Holmes, Geometric Functional Analysis and its Applications, Springer-Verlag, 1975.
43. K.K. Jha, Functional Analysis, Students' Friends, 1986.
44. L.V. Kantorovich and G.P. Akilov, Functional Analysis, Pergamon Press, 1982.
45. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978.
46. B.K. Lahiri, Elements of Functional Analysis, The World Press Pvt. Ltd., Calcutta, 1994.
47. A.H.Siddiqui, Functional Analysis with Applications, Tata McGraw-Hill Publishing Company Ltd. New Delhi
48. B.V. Limaye, Functional Analysis, Wiley Eastern Ltd.
49. L.A. Lustenik and V.J. Sobolev, Elements of Functional Analysis, Hindustan Publishing Corporation, New Delhi, 1971.
50. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, New York, 1963.
51. A.E. Taylor, Introduction to Functional Analysis, John Wiley and Sons, New York, 1958.
52. K.Yosida, Functional Analysis, 3'" edition Springer-Verlag, New York, 1971.
53. J.B. Conway, A Course in Functional Analysis, Springer-Verlag, New York, 1990.
54. Walter Rudin, Functional Analysis, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1973.
55. A. Wilansky, Functional Analysis, Blaisdell Publishing Co., 1964.

56. J. Tinsley Oden & Leszek F. Dernkowicz, Applied Functional Analysis, CRC Press Inc., 1996.

M.Sc./M.A. Course (Fourth Semester)
PAPER -II

Partial Differential Equations and Mechanics (II)

M.M. 80

Partial Differential Equations:

Unit-I Representation of Solutions-Separation of Variables, Similarity Solutions (Plane and Travelling Waves, Solitons, Similarity under Scaling), Fourier and Laplace Transform, Hopf-Cole Transform, Hodograph and Legendre Transforms, Potential Functions.

Asymptotics (Singular Perturbations, Laplace's Method, Geometric Optics, Stationary Phase, Homogenization), Power Series (Non-characteristic Surfaces, Real Analytic Functions, Cauchy-Kovalevskaya Theorem).

Analytical Dynamics:

Unit-II Generalized coordinates. Holonomic and Non-holonomic systems. Scleronomic and Rheonomic sytems. Generalized potential. Lagrange's equations of first kind. Lagrange's equations of second kind. Uniqueness of solution. Energy equation for conservative fields. Hamilton's variables. Donkin's theorem. Hamilton canonical equations. Cyclic coordinates. Routh's equations.

Unit-III 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. Fundamental lemma of calculus of variations. Euler's equation for one dependent function and its generalization to (1) 'n' dependent functions, (ii) higher order derivatives. Conditional extremum under geometric constraints and under integral constraints.

Unit-IV Hamilton's Principle. Principle of least action. Poincare Cartan Integral invariant. Whittaker's equations. Jacobi's equations. Lee Hwa Chung's theorem, canonical transformations and properties of generating functions.

Unit-V 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 transformations.

Books Recommended :

3. L.C. Evans, Partial Differential Equations, Graduate Studies in Mathematics, Volume 19, AMS, 1998.
4. F. Gantmacher, Lectures in Analytic Mechanics, MIR Publishers, Moscow, 1975.
5. R.C.Mondal, Classical Mechanics, Prentice Hall of India

References

1. Books on Partial differential equation by 1.N. Sneddon, F. John, P. Prasad and R. Ravindran, Amarnath etc.
2. A.S. Ramsey, Dynamics Part II, The English Language Book Society and Cambridge University Press, 1972.
3. H. Goldstein, Classical Mechanics (2nd edition), Narosa Publishing House, New Delhi.
4. I.M. Gelfand and S.V. Fomin, Calculus of Variations, Prentice Hall.
5. Narayan Chandra Rana & Pramod Sharad Chandra Joag, Classical Mechanics, Tata McGraw Hill, 1991.
6. Louis N. Hand and Janet D. Finch, Analytical Mechanics, Cambridge University Press, 1998.

M.Sc./M.A. Course (Fourth Semester)
PAPER-III (1)

Operating System and Database Management System(II) -Theory and Practical

Max. Marks.56

Unit-I **Database Systems**- Role of database systems, database system architecture and data modeling.

Unit-II Introduction to relational algebra and relational calculus.

Unit-III **Intoduction to SQL-** Basic features including views; Integrity constraints; Database design-normalization up to BCNF.

Unit-IV **Operating Systems**- Overview of operating system, user interface, processor management, memory management.

Unit-V I/O management, concurrency and Security, network and distributed systems.

Books Recommended :

6. S.B. Lipman, J. Lajoi: C++ Primer, Addison Wesley.
7. B. Stroustrup; The C++ Programming Language, Addison Wesley.
8. C.J. Date : Introduction to Database Systems, Addison Wesley.
9. C. Ritehie: Operating Systems-Incorporating UNIX and Windows, BPB Publications.
10. M.A. Weiss, Data Structures and Algorithm Analysis in C++, Addison Wesley.

Practical Examination Scheme

Max. Marks – 30	Time Duration – 3 Hrs.
Practical (two)	20 Marks(10 marks each)
Viva	05 Marks
Sessional	05 Marks

M.SC./M.A. COURSE (FOURTH SEMESTER)
PAPER-III (2)
FUZZY SETS AND ITS APPLICATIONS (II)

MAX MARKS-80

UNIT-I Fuzzy Logic- An overview of classical logic, Multivalued logics, Fuzzy propositions.Fuzzy quantifiers .Linguistic variables and hedges. Inferences from conditional Fuzzy propositions, the compositional rule of inference.

UNIT-II Approximate Reasoning –An overview of Fuzzy expert system.Fuzzy implication and their selection. Multiconditional approximate reasoning. The role of Fuzzy relation equation.

UNIT III An introduction to Fuzzy control, Fuzzy controllers. Fuzzy rule base. Fuzzy inference engine.Fuzzification.

UNIT IV Defuzzification and the various defuzzification methods (the center of area,the center of maxima, and the mean of maxima methods)

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

REFERENCES:

1 .H.J. Zmmemann, Fuzzy set theory and its Applications, Allied Publishers Ltd. New Delhi, 1991.

2. G.J. Klir and B Yuan-Fuzzy sets and Fuzzy logic, PHI New Delhi,1995

M.SC. /M.A. COURSE (FOURTH SEMESTER)
PAPER-III (4)
GRAPH THEORY--(II)

MAX MARKS-80

UNIT-I Ramsey Theory: Perpectness-preserving operations, Forbidden Subgraph orientations,Ramsey numbers and Ramsey graphs.

UNIT-II Groups: Permution groups, the automorphism group, graphs with given groups, symmetry concepts, pseudo similarity and stability, spectral studies of Automorphism groups.

UNIT III Polynomial and Graph Enumeration: The colour polynomial. The chromatic polynomial,The bivariate colouring polynomials.

UNIT IV Graph Enumeration Co-chromatic(co-dichromatic) graphs and chromatically unique graphs, Graph Enumeration.

UNIT V Digraphs and Networks: Digraphs, Types of connectedness, Flow in networks, Menger's and Konig's Theorem, Degree sequences

REFERENCES:

1.K.R.Pathasarthy,Basic graph theory,TMH publishing com. Ltd 1994.

2. R.J. Wilson,Introduction to graph theory,Longman Harlow,1985.

3. John Clark,Derek Allon Holton, A FIRST LOOK AT GRAPH THEORY,WSS 1991.

4 .Franf Hararary,Graph Theory Narosa, New Delhi,1995.

5.Ronald Gould and Benjamin Commins,Graph Theory, California.

6.Narsingh Deo, Graph Theory with applications to Engineering and Computer Science, PHI,New Delhi.2002.

M.SC./M.A. COURSE (FOURTH SEMESTER)

PAPER III (3)
Difference Equations-(II)

MAX MARKS-80

UNIT-I The Sturm-Liouville problem-Introduction, Finite Fourier analysis. A non homogeneous problem.

UNIT-II Discrete Calculus of variation-Introdution. Necesssary conditions. Sufficient condition and Disconjugacy.

UNIT-III Boundary Value Problems for Non-linear equations-Introduction. The Lipschitz case .Existence of solutions. Boundary value problems for Differential Equations

UNIT-IV Partial Differential Equations

UNIT-V Discretization of Partial Differential Equation.Solution of Partial Differential Equation**s.**

Recommended Text

Walter G. Kelley and Allan C. Peterson.Difference Equations.An introduction with Applications.Academic press Inc. Harcourt Brace Joranovich Publishers, 1991

REFERENCES:

. Calvin Ahlbrandt and Allan C. Peterson. Discrete Hamiltonian systems, difference equations, continued fractions and Riccati equations, Kluwer, Boston, 1996

M.SC./M.A. COURSE (FOURTH SEMESTER)
PAPER-III (5)
WAVELETS-(II)

MAX MARKS-80

UNIT-I Characterization in the theory of wavelets-The basic equation and some of its applications.

UNIT-II Characterization of MRA wavelets ,low pass filter and scaling functions .Non-existence of smooth wavelets in $H^2(R.)$

UNIT-III Frames-The reconstruction formula and the Batian- Low theorem for frames. Frames from translations and dialations .Smoooth frames for $H^2(R.)$

UNIT-IV Discrete transforms and algorithms-The discrete and fast Fourier transforms .The discrete and fast cosine transforms .

UNIT-V The discrete version Of the local sine and cosine bases.Decomposion and reconstruction of algorithms for wavelets.

REFERENCES:

1.Eugenic HernBndez and Guido Weiss, A first course on Wavelets, CRC press New York, 1996.

2.C.K. Chui,An introduction to Wavelets,Academic press 1992.

3. I.Daubechies, Ten lectures on Wavelets, CBS-NSF Regional Conference in applied mathematics,61,SIAM, 1992.

4.Y.Meyer Wavelets, Algorithms and applications (Traslated by R.D. Rayan,SIAM,1993)

5.M.V. Wickerhauser, Adapted wavelet analysis from theory to software, Wellesley, MA, A.K. Peters 1994.

M.Sc./M.A. Course (Fourth Semester)
PAPER -IV

Operations Research (II)

M.M. 80

Unit-I Dynamic Programming-Deterministic and Probabilistic Dynamic programming.

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

Unit-III Integer Programming-Branch and Bound Technique.

Unit-IV Applications to Industrial Problems-Optimal product mix and activity levels. Petroleumi. refinery operations. Blending problems. Economic interpretation of dual linear programming. problems. Input-output analysis. Leontief system. Indecomposable and Decomposable economies.

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

Books Recommended :

8. F.S. Hillier and G.J. Ueberman. Introduction to Operations ResBareft (Sixth Edition), McGraw Hill International Edition, Industrial Engineering Series, 1995. (This book comes with a CD containing tutorial software).
9. G. Hadley, Linear Programming, Narosa Publishing House, 1995.
10. G. Hadly, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
11. H.A. Taha, Operations Research -An introduction, Macmillan Publishing Co., Inc., New Yark.
12. Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, Sultan Chand & Sons, New Delhi

13. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network flows, John Wiley & Sons, New York, 1990.

References

2. S.S. Rao, Optimization Theory and Applications, Wiley Eastern Ltd., New Delhi.

2 Prem Kumar Gupla and D.S. Hira, Operations Research-An Introduction.
S. Cliand & Company Ltd., New Delhi.

3. N.S. Kambo, Mathematical Programming Techniques, Affiliated East-West Press Pvt. Ltd., New Delhi, Madras

5 R.K. Rathy, An Introduction to Fluid Dynamics, Oxford and IBH Publishing Company, New Delhi, 1976.

5. A.D. Young, Boundary Layers, AIAA Education Series, Washington DC, 1989.

6. S.W. Yuan, Foundations of Fluid Mechanics, Prentice Hall of India Private Limited, New Delhi, 1976.

14. UNDO Systems Products (Visit webs httl://www.Hndo.com/productsf.html)

(i) UNDO (the linear programming solver)

(ii) UNDO Callable Library (the premier optimisation engine)

(iii) LINGO (the linear, non-linear, and integer programming solver with mathematical modelling language)

(iv) What's Best I (the spreads sheet add-in that solves linear, non-linear, and integer problems).

All the above four products are bundled into one package to form the Solver Suite. For more details about any of the four products one has to click on its name.

(i) Optimisation Modelling with UNDO (8" edition) by Linus Schrage.

(ii) Optimisation Modelling with LINGO by Unus Schrage.

More details available on the Related Books page York, 1979.

M.Sc./M.A. Course (Fourth Semester)
PAPER-V

Programming in C (with ANSI features) Theory and Practical (II)

Max. Marks. 56

Unit-I **Storage Classes**-Fixed vs. Automatic Duration. Scope. Global variables. The register Specifier. ANSI rules for the syntax and Semantics of the storage-class keywords.

Unit-II 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.

Unit-III **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.

Unit-IV **Structures and Unions**- Structures. Dynamic Memory Allocation. Linked Lists. Unions. Enum Declarations.

Unit-V **Input and Output**- Streams, Buffering. The <Stdio.h> Header File. Error Handling. Opening and Closing a File. Reading and Writing Data. Selecting an I/O Method. Unbuffered I/O Random Access. The standard library for Input/Output.

Books Recommended :

1. Peter A. Darnell and Philip E. Margolis, C: A Software Engineering Approach, Narosa Publishing House (Springer International Student Edition) 1993.
2. Samuel P. Harkison and Gly L. Steele Jr., C : A Reference Manual, 2nd Edition, Prentice Hall, 1984.
3. Brian W. Kernighan & Dennis M. Ritohie, The C Programme Language, 2nd Edition (ANSI Features), Prentice Hall 1989.

Practical Examination Scheme

Max. Marks – 30	Time Duration – 3 Hrs.
Practical (two)	20 Marks(10 marks each)
Viva	05 Marks
Sessional	05 Marks