DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM & MARKING SCHEME

M.Sc. MATHEMATICS
Semester - IV
SESSION : 2024-25

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A⁺, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

DEPARTMENT OF MATHEMATICS

GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE DURG (C.G.)

Approved syllabus for M.Sc. Mathematics by the members of Board of Studies for the
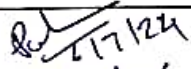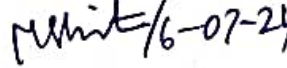
Sessions 2024 - 25

The Syllabus with the paper combinations is as under

Semester IV

I: MMT 401 - Functional Analysis (II)	II: MMT 402 - Mechanics
III: MMT 403 - Programming in C (with ANSI features) (II)	IV: MMT 404 - Operations Research (II)
V: MMT 405 (A) - Fuzzy Sets and Their Applications (II) MMT 405 (B) - Graph Theory (II)	Lab Course/Practical : (A) Programming in C

The Syllabus for M.Sc. Mathematics is hereby approved for the sessions 2024 – 25.

Name and Signatures

Chairperson / H.O.D - Dr. Padmavati	Faculty members:
Subject Expert - Dr. Madhu Shrivastava	
Subject Expert - Dr. Shabnam Khan	Dr. M.A. Siddiqui –
Subject Expert - Dr. S. K. Bhatt	Dr. Rakesh Tiwari –
Representative Members 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami -	Dr. (Smt.) Prachi Singh –

GENERAL INSTRUCTIONS FOR STUDENTS

1. The candidate has to obtain minimum 20% marks in each theory paper and internal assessment separately.

2. The candidate has to secure minimum 36% marks as an aggregate in order to pass that semester examination.

3. The internal assessment shall include class test, home assignment and seminar presentation.

4. Internal Assessment Examination will be as follows :
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

5. There shall be one seminar in each semester. In each semester, the paper in which seminar has to be presented will be allotted randomly .The marking of seminar shall be in terms of hard copy submission (10 marks) and presentation and open discussion 10 marks. In seminar the marks taken in to consideration will be the average marks given by two examiners.

Chairperson / H.O.D - Dr. Padmavati	Faculty members:
Subject Expert - Dr. Madhu Shrivastava	Dr. M.A. Siddiqui –
Subject Expert - Dr. Shabnam Khan	
Subject Expert - Dr. S. K. Bhatt	Dr. Rakesh Tiwari –
Representative Members	
1. Dr. Anil Kashyap -	Dr. (Smt.) Prachi Singh –
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami -	

DIRECTIVES FOR STUDENTS, FACULTY AND EXAMINERS

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Very short answer type question (Answer in one or two sentences)	**(02 Marks)**
Very short answer type question (Answer in one or two sentences)	**(02 Marks)**
Short answer type question	**(04 Marks)**
Long answer type questions	**(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question)	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question)	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

3

Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus / syllabi.

4. The students are required to study the content mentioned in the curriculum exhaustively.

CREDIT ALLOTMENTS

Theory 80 marks = 04 Credits

Internal Assessment 20 marks = 01 credit

Theory Paper + Practical = 05 credits (04+01)

Chairperson / H.O.D - Dr. Padmavati	**Faculty members:**
Subject Expert - Dr. Madhu Shrivastava	
Subject Expert - Dr. Shabnam Khan	Dr. M.A. Siddiqui –
Subject Expert - Dr. S. K. Bhatt	Dr. Rakesh Tiwari –
Representative Members	
1. Dr. Anil Kashyap -	Dr. (Smt.) Prachi Singh –
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami -	

4

Syllabus and Marking Scheme for M. Sc. Mathematics Fourth Semester Session 2024-25

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	Integration theory and Functional analysis	80	16	20	04	05
II	Mechanics	80	16	20	04	05
III	Programming in C (withANSI features) (II)	80	16	20	04	05
IV	Operations Research (II)	80	16	20	04	05
V	Fuzzy Sets and Their Applications (II)	80	16	20	04	05
IV	Practical in Paper III	50	18			02
	Total	450		100		27

05 Theory papers - 400 ; 01 Practical - 50 ; 05 Internal Assessments - 100
Total Marks - 550

Note: 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in Practical.

Chairperson / H.O.D - Dr. Padmavati

Subject Expert - Dr. Madhu Shrivastava

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

Representative Members
1. Dr. Anil Kashyap -
2. Shri A. K. Pandey -
3. Dr. Mayur Puri Goswami -

Faculty members:

Dr. M.A. Siddiqui -

Dr. Rakesh Tiwari –

Dr. (Smt.) Prachi Singh –

PG Department of Mathematics

PO No.	Program outcomes upon completion of the M. Sc. Degree program, the student will be able to
PO No. - 1	Pursue higher studies in mathematics in reputed institute of our country and clear Competitive exams like SET / NET / TET etc.
PO No. - 2	Read and identify mathematical and computational methods in order to solve comprehensive problems in several competitive examinations.
PO No. - 3	Well prepared to take jobs in schools and colleges as Mathematic Teachers and Professors, Software Industries, Research and Development Organizations.
PO No.- 4	Learn and apply Mathematics in real life situations aiming at service to the society.

Program Specific Outcomes:

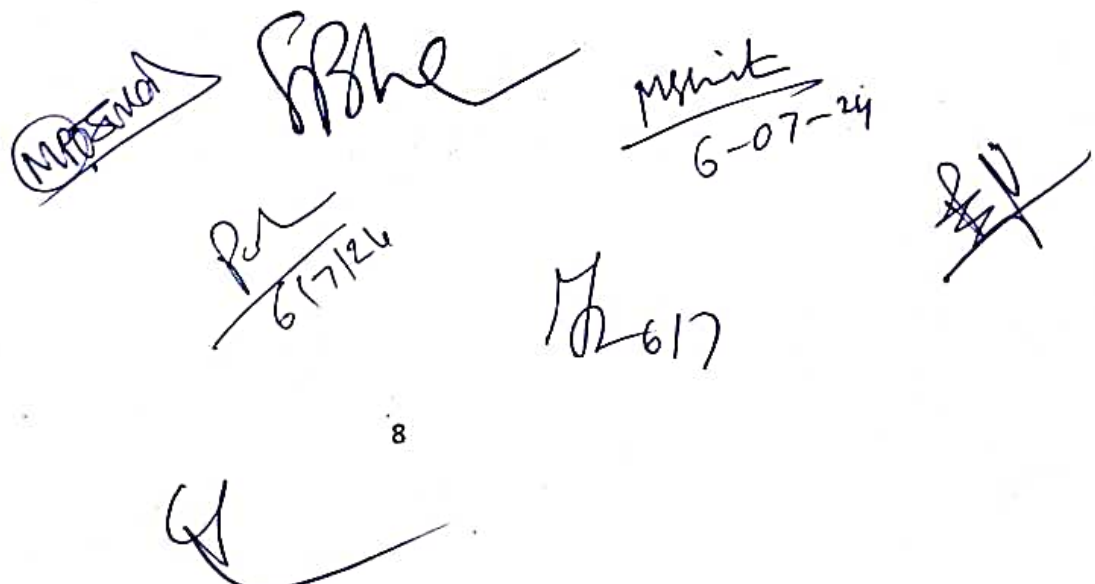| PSO No.	Program specific outcomes : upon completion of the M. Sc. Degree program, the student will be able to
PSO - 1	Understand the fundamental axioms in mathematics and capable to develop ideas based on them.
PSO - 2	Inculcate mathematical reasoning and develop own learning capacity.
PSO - 3	Explain the core ideas and the techniques of mathematics and developabstract mathematical thinking.
PSO - 4	Assimilate the logical approach to take decision in complicated situations.
PSO - 5	Prepare and motivate for research studies in mathematics and relatedfields.

Learning outcomes :

Students able to understand specially natural events, forces, gravitational and attraction forces to bodies .

Course Title	M. Sc. Final, Mechanics
CO No.	Course Outcomes This course will enable the student to :
CO No. – 1	Remember Generalized coordinates langranges equation of first kind cyclic coordinates.
CO No. – 2	Understand Poisson's bracket hamilton's principle, principle of least action Poincare cardan integral invariant.
CO No.– 3	Apply Whittaker equations hamillton Jacobi equation invariation of lagrange bracket under canonical transformation.
CO No – 4	Evaluate the attraction for different types of objects.

Learning outcomes :

Application of computers using 'C'- Language and different fields of mathematical problem.

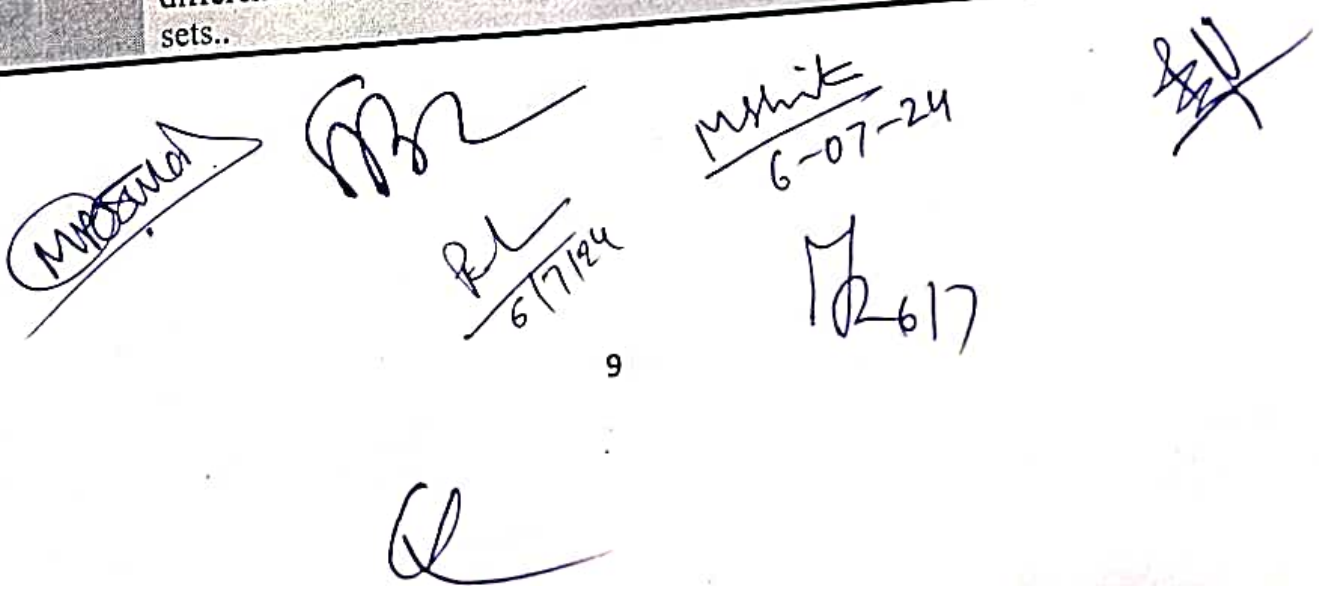| Course Title	M. Sc. Final, Programming in "C" (with ANSCI features)
CO No.	Course Outcomes This course will enable the student to :
CO No. – 1	Remember over view of programming, Anatomy of C-functions, variables and constants.
CO No. – 2	Evaluate Different types of data.
CO No.– 3	Analyze the main function Complex declaration, Conditional Compilation, Line Control, Input and output streams, Buffering, closing and opening files. The slandered library for input \ output etc.
CO No – 4	Apply an objects and pointers, Control flow conditional branching various types of loop.

8

Learning outcomes:

Application of Marketing field using this (Operation Research) and different fields of mathematical problems.

Course Title	M. Sc. Final, Operations Research
CO No.	Course Outcomes This course will enable the student to :
CO No. – 1	Remember the scope of operation research.
CO No. – 2	Evaluate real world problems to linear programming problems. Solve this problem with various methods, acquired with various algorithm and techniques of above used methods.
CO No.- 3	Understand mathematical formulation and solution of assignment problems and transportation problems.
CO No – 4	Apply the use of dynamic programming in various fields, Game theory, theory of queveing system and Inventory control to particle problems.

Learning outcomes:

After the study of this paper, students are familiar with the new branch of which is nearer to the real world.

Course Title	M. Sc. Final, (A) Fuzzy Sets and their Logics
CO No.	Course Outcomes This course will enable the student to :
CO No. – 1	Apply mathematical logic with real life. In this unit some models are explained.
CO No. – 2	Create an expert system, this unit gives basic propositional rules.
CO No.- 3	Remember the application of fuzzy set theory in the topic decision making, which is somewhat vague in nature?
CO No – 4	Understand Introduction and operation between fuzzy sets and fuzzy numbers, the difference between probability and possibility theory is explained through fuzzy sets..

6-07-24

6|7|24

6|7

Learning outcomes:

After the study of this paper, students are familiar with the new branch of which is nearer to the real world as well as graphics.

Course Title	M. Sc. Final, (B) Graph Theory
CO No.	Course Outcomes This course will enable the student to :
CO No. – 1	Apply mathematical logic with real life. In this unit some models are explained.
CO No. – 2	Create Polynomials and Graph Enumeration: The colour polynomials, The chromatic polynomial, bivariate coloring polynomials.
CO No.- 3	Remember the concept of Perfectness-preserving operations, Forbidden Subgraph orientations, Ramsey numbers and Ramsey graphs.
CO No - 4	Understand the spectrum, Spectrum properties, Coloring packing and covering i. e. colorable graphs, edge-colorings, Face colorings..

M.Sc. Mathematics (Fourth Semester)
2024 – 2025

PAPER –I
Code- MMT 401
Functional Analysis (II)

Max. Marks. 80

Unit-I Uniform boundedness theorem and some of its consequences. Open mapping and closed graph theorems. Hahn-Banach theorem for real linear spaces, complex linear spaces andnormed linear spaces.

Unit-II 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.

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

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

Recommended Books:

B.Choudhary and Sudarsan Nanda, Functional Analysis with Applications Wiley Eastern Ltd., 1989.

References:
1. S.K. Berberian, Measure and integration, Chelsea Publishing Company, New York, 1965.
2. G. de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
3. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Limited, New Delhi, 2000.
4. Richard L. Wheeden and Antoni Zygmund, Measure and Integral : An Introduction to Real Analysis, Marcel Dekker Inc. 1977.
5. J.H. Williamson, Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962.
6. P.R. Halmos, Measure Theory, Van Nostrand, Princeton, 1950.
7. T.G. Hawkins, Lebesgue's Theory of Integration: Its Origins and Development, Chelsea, New York, 1979.
8. K.R. Parthasarathy, Introduction to Probability and Measure, Macmillan Company of India Ltd., Delhi, 1977.
9. R.G. Bartle, The Elements of Integration, John Wiley & Sons, Inc. New York, 1966. .

11

10. Inder K. Rana, An Introduction to Measure and Integration, Narosa Publ. House, Delhi, 1997.
11. Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing.
12. Edwin Hewitt and Korl Stromberg, Real and Abstract Analysis, Springer-Verlag, New York.
13. Edwin Hewitt and K. A. Ross, Abstract Harmonic Analysis, Vol. 1, Springer-Verlag, 1993.
14. G. Bachman and L. Narici, Functional Analysis, Academic Press, 1966.
15. N. Dunford and J.T. Schwartz, Linear Operators, Part I, Interscience, New York, 1958.
16. R.E. Edwards, Functional Analysis, Holt Rinehart and Winston, New York, 1965.
17. .C. Goffman and G. Pedrick, First Course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.
18. P.K. Jain, O.P. Ahuja and Khalil Ahmad, Functional Analysis, New Age International (P) Ltd. & Wiley Eastern Ltd., New Delhi, 1997.
19. R.B. Holmes, Geometric Functional Analysis and its Applications, Springer-Verlag, 1975.
20. K.K. Jha, Functional Analysis, Students' Friends, 1986.
21. L.V. Kantorovich and G.P. Akilov, Functional Analysis, Pergamon Press, 1982.
22. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978.
23. B.K. Lahiri, Elements of Functional Analysis, The World Press Pvt. Ltd., Calcutta, 1994.

Chairperson / H.O.D - Dr. Padmavati	**Faculty members:**
Subject Expert - Dr. Madhu Shrivastava	
Subject Expert - Dr. Shabnam Khan	Dr. M.A. Siddiqui –
Subject Expert - Dr. S. K. Bhatt	Dr. Rakesh Tiwari –
Representative Members	
1. Dr. Anil Kashyap -	Dr. (Smt.) Prachi Singh –
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami -	

PAPER -II
Code- MMT 402
Mechanics

Max.Marks. 80

Analytical Dynamics:

Unit-I 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-II 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. Hamilton's Principle. Principle of least action. Poincare Cartan Integral invariant.

Unit-III Whittaker's equations. Jacobi's equations. Statement of Lee Hwa Chung's theorem. 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.

Gravitational :

Unit-IV Attraction of rod, disc, spherical shells and sphere. Surface integral of normal attraction (application & Gauss' theorem). Potential of rod, disc, spherical shells and sphere. Laplace and Poisson equations. Work done by self attracting systems. Distributions for a given potential. Equipotential surfaces. Surface and solid harmonics. Surface density in terms of surface harmonics.

13

References:

1. R. N. Tiwari and B. S. Thakur, Classical Mechanics, Analytical Dynamics, published by Prentice-Hall of India in 2007, ISBN No. 978-81-203-3126-6.
2. A.S. Ramsey, Dynamics Part II, The English Language Book Society and Cambridge University Press, 1972.
3. F. Gantmacher, Lectures in Analytic Mechanics, MIR Publishers, Moscow, 1975.
4. H. Goldstein, Classical Mechanics (2nd edition), Narosa Publishing House, New Delhi.
5. I.M. Gelfand and S.V. Fomin, Calculus of Variations, Prentice Hall.
6. S.L. Loney, An Elementary Treatise on Statics, Kalyani Publishers, New Delhi, 1979.
7. A.S. Ramsey, Newtonian Gravitation, The English Language Book Society and the Cambridge University Press.
8. Narayan Chandra Rana & Pramod Sharad Chandra Joag, Classical Mechanics, Tata McGraw Hill, 1991.
9. Louis N. Hand and Janet D. Finch., Analytical Mechanics, Cambridge University Press, 1998.

Chairperson / H.O.D - Dr. Padmavati 6/7/24 Subject Expert - Dr. Madhu Shrivastava MMit/6-07-24 Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt **Representative Members** 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami -	**Faculty members:** Dr. M.A. Siddiqui – Dr. Rakesh Tiwari – Dr. (Smt.) Prachi Singh –

M. Sc. Mathematics (Fourth Semester)
2024 – 2025

PAPER-III (A)
Code- MMT 403 (A)
Programming in C (with ANSI features) Theory and Practical (II)

Max. Marks. 80
(Theory-50 + Practical-30)

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. Dynamic Memory Allocation

Unit-II 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.

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.Linked Lists. Unions, enum Declarations. 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.

References:

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.

15

3. Brian W. Kernighan & Dennis M. Ritohie, The C Programme Language, 2nd Edition (ANSI Features), Prentice Hall 1989.

4. Yashwant Kanetkar, Let Us C, 8th Edison, B P B Publications 2007.

5. E. Balagurusamy, Programming in C (ANSI), 4th Edison, Tata Mac Graw Hill.

List of C programming for 4th sem. Mathematics

1. WAP to input any number and compute sum of its digits using
2. WAP to compute factorial of any number using recursive function.
3. WAP to perform different arithmetic operations using pointers.
4. WAP to print the element of an array using pointers.
5. WAP to calculate the sum of all elements stored in an array using pointer.
6. WAP to exchange two values using call by reference.
7. WAP to print the reverse of an integer number entered by user using recursion.
8. WAP for multi dimensional arrays.
9. WAP to short an integer array using sorting algorithm.
10. WAP for creating and storing of book record using following structure
    a. Book Acc No.   b. Name c. Title   d. Author   e. Publication.
11. WAP to add n numbers which will be entered by the user.
12. WAP to multiply two matrices.
13. WAP to calculate the length of the string using pointer.
14. WAP to find maximum element in array.
15. WAP to swap strings.

Chairperson / H.O.D - Dr. Padmavati	**Faculty members:**
Subject Expert - Dr. Madhu Shrivastava	
Subject Expert - Dr. Shabnam Khan	Dr. M.A. Siddiqui –
Subject Expert - Dr. S. K. Bhatt	Dr. Rakesh Tiwari –
Representative Members	
1. Dr. Anil Kashyap -	
2. Shri A. K. Pandey -	Dr. (Smt.) Prachi Singh –
3. Dr. Mayur Puri Goswami -	

M. Sc. Mathematics (Fourth Semester)
2024 – 2025

Paper- III
Code- MMT 403 (B)

WAVELETS (II)

Max.marks.80

UNIT -I Orthonormal bases of piecewise linear continuous function for $L^2(T)$. Orthonormal bases of periodi splines. Periodization of wavelets defined on the real line.

UNIT -II Characterizations in the theory of wavelets-The basic equation and some of its application. The characterization of MRA wavelets .

UNIT -III A characterization of Low-pass filters and scaling function. Non-existence of smooth wavelets in $H^2(R)$.

UNIT –IV Frames - The reconstruction formula and the Balian - Low theorem for frames. Frames from translations and dilations. Smooth frames for $H^2(R)$. Discrete Transforms and algorithms -The discrete and the fast Fourier transforms. The discrete and the fast cosine transforms. The discrete version of the local sine and cosine bases. and reconstruction algorithm for wavelets.

Recommended Books :

1. Eugenio Hernandez and Guido Weiss . A First course on Wavelets , CRC Press, New York , 1996.

References:

1. C. K . Chui, An Introduction to Wavelets , Academic Press,1992.

2. I. Daubechies , Ten Lectures on Wavelets , CBS-NSF Regional Conferences in

17

Applied Mahtematics , 61 ,SIAM , 1992.

3. Y. Meyer , Wavelets , Algorithms and applications (Translated by R. Rayan), SIAM , 1993.

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

Chairperson / H.O.D - Dr. Padmavati	**Faculty members:**
Subject Expert - Dr. Madhu Shrivastava	Dr. M.A. Siddiqui –
Subject Expert - Dr. Shabnam Khan	
Subject Expert - Dr. S. K. Bhatt	Dr. Rakesh Tiwari –
Representative Members	
1. Dr. Anil Kashyap -	Dr. (Smt.) Prachi Singh –
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami -	

M. Sc. Mathematics (Fourth Semester)

2024 – 2025

PAPER –IV

Code- MMT 404
Operations Research (II)

Max. Marks. 80

Unit-I   Dynamic Programming-Deterministic and Probabilistic Dynamic programming. Integer Programming Branch and Bound Technique.

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

Unit-III   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.

Unit-IV   Nonlinear Programming-One and Multi-Variable Unconstrained Optimization. Kuhn-Tucker \ Conditions for Constrained Optimization. Quadratic Programming.

References:
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. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network flows, John Wiley & Sons, New York, 1990.
5. H.A. Taha, Operations Researc~-An introduction, Macmillan Publishing Co., Inc., New Yark.

19

6-07-24

6. K. Swarup, P.K. Gupta and Man Mohan, Operations Research, S. Chand & Sons, N.Delhi.

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

8. P. K. Gupta and D.S. Hira, O. R.- An Introduction. S. Chand & Co.y Ltd., N.Delhi.

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

Chairperson / H.O.D - Dr. Padmavati 6|7|24	Faculty members:
Subject Expert - Dr. Madhu Shrivastava /6-07-24	
Subject Expert - Dr. Shabnam Khan	Dr. M.A. Siddiqui –
Subject Expert - Dr. S. K. Bhatt	Dr. Rakesh Tiwari –
Representative Members	
1. Dr. Anil Kashyap -	Dr. (Smt.) Prachi Singh –
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami -	

M. Sc. Mathematics (Fourth Semester)

2024 - 2025

Paper- V (A)
Code – MMT 405 (A)

Fuzzy Set and their Applications (II)

Max.marks.80

Unit-I Fuzzy Logic - An overview of classical logic. Multivalued logics. Fuzzy propositions. Fuzzy Quantifiers. Linguistic variable and hedges. Inference from conditional fuzzy proposition. The compositional rule of inference.

Unit-II Approximate Reasoning. An overview of fuzzy expert system. Fuzzy implications andtheir 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. Defuzzification and various defuzzification method.

Unit-IV 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. Sets and fuzzy logic by G.J. Klir and B. Yuan, Prentice-Hall of, New Delhi, 1995.
2. Fuzzy set theory and its Applictions , By H.J.Zimmermann , Allied Publishers Ltd., New Delhi, 1991.

Chairperson / H.O.D - Dr. Padmavati		**Faculty members:**
Subject Expert - Dr. Madhu Shrivastava	6-07-24	Dr. M.A. Siddiqui
Subject Expert - Dr. Shabnam Khan		
Subject Expert - Dr. S. K. Bhatt		Dr. Rakesh Tiwari –
Representative Members		
1. Dr. Anil Kashyap -		Dr. (Smt.) Prachi Singh –
2. Shri A. K. Pandey -		
3. Dr. Mayur Puri Goswami -		

M. Sc. Mathematics (Fourth Semester)
2024 – 2025

Paper- V (B)
Code – MMT 405 (B)
Graph theory-II

Max. Marks - 80

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

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

Unit-III: Polynomials and Graph Enumeration: The colour polynomials, The chromaticpolynomial, The bivariate colouring polynomials.

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

Unit-V: Digraphs & Networks: Digraphs, Types of connectedness, Flows in Networks, Menger's and Konig's Theorem, Degree sequences.

REFERENCES:
1. K. R. Parthasarathy, Basic graph theory, Tata Mc graw Hill publishing company limited, 1994.
2. R. J. Wilson, Introduction to graph theory, Longman Harlow, 1985.
3. John Clark, Derek Allon Holton, A first look at graph Theory, World Scientific Singapore, 1991.
4. Frank Hararary, Graph Theory Narosa, New Delhi, 1995.
5. Ronald Gould and Benjamin Cummins, Graph Theory, California.
6. Narsingh Deo, Graph Theory with applications to Engineering and Computer Science, Prentice-Hall of India Private Limited, New Delhi, 2002.
7. J. A. Bondy and U. S. R. Murthy, Graph Theory with applications, North Holland.
8. Gary Chartrend and Ping Zhang, Introduction to graph theory, Mc Graw Hill publishing, reference book.

Chairperson / H.O.D - Dr. Padmavati	Faculty members:
Subject Expert - Dr. Madhu Shrivastava	Dr. M.A. Siddiqui –
Subject Expert - Dr. Shabnam Khan	
Subject Expert - Dr. S. K. Bhatt	Dr. Rakesh Tiwari –
Representative Members	
1. Dr. Anil Kashyap -	Dr. (Smt.) Prachi Singh –
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami -	