M.Phil. MATHEMATICS

SEM	COURSE CODE	COURSE	COURSE TITLE	NO. OF HOURS	CREDIT	CIA MARKS	SE MARKS	TOTAL MARKS
I	14MPMA1C1	CORE - I	Research Methodology	4*	4	40	60	100
	14MPMA1C2	CORE - II	Analysis and Applied Mathematics	4*	4	40	60	100
	14MPMA1C3	CORE - III	Research Topics in Mathematics	4*	4	40	60	100
	14MPMA1C4	CORE - IV	Teaching and Learning Methodology	4*	4	40	60	100
*** One hour Library for each course**								
TOTAL				**16**	**16**	**160**	**240**	**400**
II	14MPMA2PW	Project Work	Dissertation**	--	8	--	--	200
GRAND TOTAL				**--**	**24**	**--**	**--**	**600**

** (Evaluation of the Dissertation shall be made jointly by the Research Supervisor and the External Examiner)

Project (M.Phil)

Maximum Marks: 200

I review	20 Marks
II review	20 Marks
Evaluation of project	120 Marks
Viva voce	40 Marks

SEMESTER I: CORE – I
RESEARCH METHODOLOGY

Course Code : 14MPMA1C1 **Max. Marks : 100**
Hours/Week: 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective:

To have the knowledge to expand recent theories in various topics of mathematics.

UNIT I **12 hours**

Research Methodology: An introduction – #Defining the research problem# – Research design.

UNIT II **12 hours**

Noetherian modules – Primary decomposition – Artinian modules

UNIT III **12 hours**

Real Analysis: Vector spaces – Integration as a linear functional - Topological preliminaries – #Regularity properties of Borel measures#.

UNIT IV **12 hours**

Complex Measures: Total variation – Absolute – Continuity - Consequences of the Random Nikodym theorem - #Bounded linear functional of L^p#- Riesz representation Theorem.

UNIT V **12 hours**

Homotopy of paths – #The Fundamental group# – Covering spaces

 # # Self-study portion.

Text Books:

T.B-1: C.R. Kothari, Research Methodology, New Age International Publishers, Second Revised Edition Reprint (2009).
T.B-2: N. S. Gopalakrishnan, Commutative Algebra, Oxonian Press Private Ltd, NewDelhi, Second Edition (1988).
T.B-3: Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing Company Limited, Third Edition (2006).
T.B-4: James R. Munkres, Topology a First Course, Prentice Hall of India Learning Private Ltd. (2009).

UNIT I	Chapter I, II & III Page No. 1 –54	**T.B-1**
UNIT II	Sections 3.1 – 3.3	**T.B-2**
UNIT III	Chapter 2 Sections 2.1 - 2.13, 2.15-2.18	**T.B-3**
UNIT IV	Chapter 6 Sections 6.1 - 6.19 (Page No.124-142)	**T.B-3**
UNIT V	Chapter 9 Sections 51, 52, 53	**T.B-4**

Books for Reference:

1. David S. Dummit and Richard M. Foote, Abstract Algebra, Wiley-Student Edition, India, Second Edition (2009).
2. G. De .Barra, Measure Theory and Integration, New Age International (P) Ltd., New Delhi, Reprint(2009).
3. P. R. Halmos, Measure Theory, D. Van Nostrand Company Inc, Princeton N.J. (1950).
4. Serge Lang, Algebra, Addition - Wesley Publishing Company, Sydney, London, Second Edition (1970).
5. Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, Second Edition (2002).

SEMESTER I: CORE – II
ANALYSIS AND APPLIED MATHEMATICS

Course Code :	**14MPMA1C2**	**Max .Marks :**	**100**
Hours/Week:	**4**	**Internal Marks:**	**40**
Credit :	**4**	**External Marks:**	**60**

Objective:

To make the students understand and apply concepts of pure and applied mathematics.

UNIT I **12 hours**

Functional Analysis: General preliminaries on Banach Algebras: The definition and some examples – Regular and singular elements – Topological divisors of zero. The Spectrum – The formula for the spectral radius – the radial and semi – simplicity. The structure of commutative Banach Algebra: The Gelfand mapping – #Application of the formula r(x) = lim || x ||# - Involution in Banach Algebra. The Gelfand – Neumark theorem

UNIT II **12 hours**

Differential Equation (Linear and Non-Linear systems): Uncoupled linear systems – Diagonalization – Exponential of operators – The fundamental theorem for linear systems – linear system in R^2 – #Complex Eigen values# - Multiple Eigen Values - Some preliminary concepts and definitions – The fundamental existence – Uniqueness theorem.

UNIT III **12 hours**

Domination: The domination number of graph - #Exploration – Stratification#

UNIT IV **12 hours**

Advanced optimization techniques: Network Optimization Problem (NOP) – Various classes of NOP - Various classes of Shortest Path Problem – Terminology – #Mathematical formulation of an MOSPP as an MOLPP# – Classification of algorithmic approach of SOSPP and MOSPP – Basics of complexity of algorithm – Algorithm to compute Pareto optimal vectors - Maximum number of Pareto Optimal Paths – Detection of Negative cycle of an MOSPP - Generalization of Modified Dijkstra's Algorithm - Computational Complexity.

UNIT V **12 hours**

Fuzzy Graph: Paths and Connectedness - Fuzzy Bridges and #Fuzzy Cut nodes# - Fuzzy Forests and Fuzzy Trees.

 # # Self-study portion.

Text Books:

T.B-1: G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill International Edition, Fifteenth Reprint (2011).

T.B-2: L.Perko, Differential Equations and Dynamical Systems, Springer International Edition, Third Edition (2009).

T.B-3: Gary Chartrand and PingZhang, Introduction to Graph Theory, McGraw Hill, International Edition (2005).

T.B-4: Ismail Mohideen .S, A text Book of Network Optimization Problems, Golden Publishers, First Edition (2011).

T.B-5: A. Nagoor Gani and V. T. Chandrasekaran, A first look at Fuzzy Graph Theory, Allied Publishers Pvt. Ltd. Chennai, First Edition (2010).

UNIT I	Chapter 12 Sections 64 - 69 (Page No. 301 to 317)	
	Chapter 13 Sections 70 - 73 (Page No. 318 to 326)	**T.B-1**
UNIT II	Chapter 1 Sections 1.1 - 1.7	
	Chapter 2 Sections 2.1 - 2.2	**T.B-2**
UNIT III	Chapter 13 Sections 13.1 and 13.2	**T.B-3**
UNIT IV	Chapters 2, 3 and 4	**T.B-4**
UNIT V	Chapter 3 Sections 3.1 – 3.3	**T.B-5**

Books for Reference:

1. Balmohan V Limaye, Functional Analysis, New Age International (P) Ltd.NewDelhi, Second Edition (2009).
2. M. Murugan, Topics in Graph Theory and Algorithms, Muthali Publishing House, Annanagar, Chennai, First Edition (2003).
3. V. N. Sastry, and S. Ismail Mohideen., Modified Algorithm to Compute Pareto –Optimal Vectors, Journal of Optimization Theory and Applications, Vol. 103, No. 1, PP. 241 – 244,(1999).
4. V.N. Sastry , T.N. Janakiraman, and S. Ismail Mohideen , New Algorithms for Multi Objective Shortest Path Problem, OPSEARCH, Vol. 40, No. 4, PP. 278 – 298, (2003).

SEMESTER I: CORE – III
RESEARCH TOPICS IN MATHEMATICS

Course Code	**: 14MPMA1C3**	**Max. Marks:**	**100**
Hours/Week	**: 4**	**Internal Marks:**	**40**
Credit	**: 4**	**External Marks:**	**60**

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

Text Books:

Books for Reference:

SEMESTER I: CORE – IV
TEACHING AND LEARNING METHODOLOGY

Course Code : 14MPMA1C4 **Max. Marks : 100**
Hours/Week: 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective:

To enable the students to be familiar with conceptual and empirical tools of teaching and learning methodology.

UNIT I **12 hours**

Learning in higher education: What is Learning? - Learning Hierarchy – Information Processing – Learning Events – Learning Outcomes – Motivation. Teaching technology –Designs: Technology – Teaching Technology – Instructional Technology and Education Technology – Instructional Designs – #Combination of Teaching Strategies and Instructional Designs#.

UNIT II **12 hours**

Teaching technology Large groups: Psycho – Dynamics of Group Learning – Lecture Method – Modified Forms of Lecture – Seminar – Symposium – Panel Discussion – #Team Teaching – Project Approach# – Workshop. Teaching in small groups: Small Group Instruction – Group Discussions – Simulation Approach – Role Playing - Buzz Group Technique – Brainstorming – Case Discussions – Assignment.

UNIT III **12 hours**

Class room management: Teacher and Class Room Management – Class Room Management: A Conceptual Analysis – Discipline – A component of Class Room Management – Strategies for Class Room Management – Behavior Problems of Students in Colleges – Human Relations in Educational Institutions. #Professional Growth: Need and Importance of Professional Growth – Professional Ethics#.

UNIT IV **12 hours**

Communication skills: Introduction to life skills – Communication – Emotional – Functional – Personality skills. Public speaking – Welcome speech- Introducing guests – Vote of Thanks – Speech on current topics like use of cell phones, beauty contests, pollution etc., Personality Development Soft skills – Body language – Goal setting – #Positive attitude# – Emotional intelligence, leadership qualities – Problem solving Conversation in selected context – Introduction, permission, request, offer, greetings, sympathy, apology, suggestion, permission, telephonic conversation, compliant, warning, gratitude. Communication for career – Preparation – Resume- Group Discussion - Interview – standard, Panel, walk-in, group, stress, mock interview (practice)

UNIT V **12 hours**

MATLAB: Introduction - What is MATLAB? – Does MATLAB do symbolic calculations? – Will MATLAB Run on My Computer? – Where do I get MATLAB? – Basis of MATLAB: MATLAB windows – Online help – Input output, File types. #Tutorial Lessons: A minimum MATLAB session – creating and working with arrays of numbers# – creating and printing simple plots – creating, saving and executing a script file. Applications: Linear Algebra – curve fitting interpolation – Numerical Integration – Ordinary differential equation.

 # # Self-study portion.

Text Books:

T.B-1: E .C. Vedanayagam, Teaching Technology For College Teachers, Striling Publishers Private Limited (1988).
T.B-2: K. Alex, Soft Skills, S. Chand & company Ltd., New Delhi, First Edition (2009).
T.B-3: Rudra Pratap, Getting Started with MATLAB 7, Oxford University Press (2006).

UNIT I	Chapter 2 and 3		**T.B – 1**
UNIT II	Chapter 4 and 5		**T.B – 1**
UNIT III	Chapter 8 and 12		**T.B – 1**
UNIT IV			**T.B – 2**
UNIT V	Chapter 1	Sections 1.1 - 1.4 and 1.6 - 1.6.5	
	Chapter 2	Sections 2.1 - 2.4	
	Chapter 3	Sections 5.1 - 5.5	**T.B – 3**

Books for Reference:

1. Brian R. Hunt, Ronald L. Lipsman, Jonathan. M. Rosenberg, A Guide to MATLAB for Beginners and Experienced Users, Cambridge University Press, Reprint (2008).
2. Cheryl Hamilton, Communicating for results, Wads Worth cenage learning, Ninth Edition, USA (2005).
3. Leena Sen, Verbal and non-verbal communication, Eastern Economy Editions, Prentice Hall of India Learning, Second Edition (2011).
4. S.A.W.Bukari, Soft Skills Competencies for Success, Sanjee Book House, Trichy (2009).

SEMESTER I: CORE – III
CODES AND CRYPTOGRAPHY

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours/ Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Introduction –Entropy –Coding -Efficient codes -Compression

UNIT II **12 hours**

Information capacity -Fano's inequality- Shannons's noisy coding theorem

UNIT III **12 hours**

Linear codes -Cyclic codes -BCH codes -Linear feedback shift Registers

UNIT IV **12 hours**

Cryptography -Symmetric and Asymmetric Ciphers –Complexity -Public Key Ciphers

UNIT V **12 hours**

Discrete Logarithm Ciphers –Signatures -Bit Commitment -Quantum Cryptography

Text Book:

T.K.Carne., "Codes & Cryptography" *,Applications & Algorithms,* Department Of Mathematics., University of Cambridge**,** Notes Michaelmas (2007).

UNIT I Chapter 1 to 5
UNIT II Chapter 8 to 10
UNIT III Chapter 11 to 14
UNIT IV Chapter 15 to 18
UNIT V Chapter 19 to 22

Books for Reference:

1. W.W. Adams and L.J. Goldstein, "*Introduction to Number Theory",* Englewood Cliffs, N.J.Prentice-Hall of India (1976).
2. S.G.AKL, "On the security of Compressed Encoding,''Advance in Cryptology: Proceedings of Cryptology: Proceedings of Crypto 83, Plenum Press (1984).
3. Bruce Schneier, "Applied Cryptography", Second Edition, John Wiley & Sons, Inc (2001).
4. Johannes. A. Buchmann,"Introduction to Cryptography", Springer, Second Edition (2004).

SEMESTER I: CORE– III

NETWORK OPTIMIZATION & GENETIC ALGORITHMS

Course Cod : 14MPMA1C3 **Max. Marks : 100**
Hours/Week: 4 **Internal Marks : 40**
Credit : 4 **External Marks: 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Various classes of network optimization problems-Various classes of shortest path problems-Notations-Terminology-Generalization of modified Yen's algorithm- New MOSPP Algorithm.

UNIT II **12 hours**

Polynomial time algorithms for an MOSPP using various mean concepts- Arithmetic mean concept-Solving an MOSPP in a network by Dijkstra's algorithm using non-dominated arithmetic mean vector concept - Solving an MOSPP in a network by Yen's algorithm using non-dominated arithmetic mean vector concept - Solving an MOSPP by single objective version of new MOSPP algorithm using non-dominated arithmetic mean vector concept-Numerical illustrations.

UNIT III **12 hours**

Non-linear mean concepts-Introduction- Best compromise vector based on non-linear means- Best compromise vector based on centroidal mean- Best compromise vector based on contra harmonic mean-Theorem - Principle of optimality- Numerical illustrations.

UNIT IV **12 hours**

Genetic algorithms: History- Basic concepts- Creation of Off springs- Working principle- Encoding-Fitness function- Reproduction.

UNIT V **12 hours**

Inheritance operators - Cross over - Inversion and deletion- Mutation operator - Bit-wise operators-Bit-wise operators used in GA- Generational cycle- Convergence of genetic algorithm- Applications- Multi-level optimization- Real life problem- Differences and similarities between GA and other traditional methods- Advances in GA.

Text Books:

T.B-1: S. Ismail Mohideen, A Text Book Of Network Optimization Problems, First Edition (2011).
T.B-2: S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, Prentice-Hall of India Pvt Ltd (2007).

UNIT I	Chapter 2	Sections 2.1 - 2.4	**T.B-1**
	Chapter 5	Sections 5.1 - 5.8 and 6.1 - 6.9	**T.B-1**
UNIT II	Chapter 7	Sections 7.1 - 7.6	**T.B-1**
UNIT III	Chapter 8	Sections 8.1 - 8.8	**T.B-1**
UNIT IV	Chapter 8	Sections 8.1 - 8.7	**T.B-2**
UNIT V	Chapter 9	Sections 9.1 - 9.13	**T.B-2**

SEMESTER I: CORE – III

NUMERICAL SOLUTION OF BOUNDARY VALUE PROBLEMS

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours/Week : 4 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Ritz finite element method –Least square finite element method -Galerkin finite element method-Convergence analysis

UNIT II **12 hours**

First order initial value problems -Second order initial value problems

UNIT III **12 hours**

Parabolic equation - First order hyperbolic equation-second order hyperbolic equation-Bibliographical note -Problems

UNIT IV **12 hours**

Assembly of element equations - Mixed boundary conditions - Galerkin method

UNIT V **12 hours**

Assembly of element equations -Mixed boundary conditions-Boundary points -Galerkin method

Text Book:

Numerical Solution of Differential Equations, Second Edition, M.K. Jain - Wiley Eastern Limited, New Delhi.

UNIT I Chapter 8 Section 8.5
UNIT II Chapter 8 Section 8.9
UNIT III Chapter 8 Section 8.10
UNIT IV Chapter 8 Section 8.6
UNIT V Chapter 8 Section 8.7

Books for Reference:

1. G.Evans , J.Black leeger and P. Yardley, Numerical Methods for Partial Differential Equation, Springer International Edition (2010).

2. Curtis. F. Gerald, Applied Numerical Analysis, Addison -Wesley Publishing Company, Second Edition (1970).

SEMESTER I: CORE – III
STOCHASTIC PROCESSES

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours/Week: 4 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

General theory of continuous process – Kolmogorov's Forward and Backward Equation – Fokker – Plank equation – An alternative approach to the diffusion equation – Wierner levey process – Uhlenbeck – Ornstein stochastic process – Diffusion processes in n dimensions – Wiener process as a continuous approximation to simple random walk – First passage problems in diffusion process- Purely Discontinuous Markov processes.

UNIT II **12 hours**

Definitions – Examples – Stationary and orderliness – Distribution of Forward and Backward Recurrence Times – Palm – Khintchine Functions – Khintchine's Limit Theorem – Palm's Theorem – Point processes on the real line: Intensity Functions, Moments and correlation – Doubly stochastic poisson Processes.

UNIT III **12 hours**

Covariance Function – continuity, Differentiability, Integrals of Second Order Processes in the mean square sense- Stationary processes – Herglotz theorem- Bochner's theorem – Spectral Representation of a wide sense stationary process – Spectral Representation Theorem – Karhunen – Loeve expansion of a second order process.

UNIT IV **12 hours**

Wiener process and wiener integrals –Ito Integral – Ito equation – Mc Shane Integrals and Models –Examples.

UNIT V **12 hours**

Definition – Examples –Discrete Branching Process- Generating Function of the Process –The probability of extinction – Fundamental theorem of Branching processes –Total population size – Cumulant Generating function – Continuous Parameter Branching process (Markov Branching Process) –Age dependent branching process.

Text book:

S.K. Srinivasan and Mehata , Stochastic Processes, Tata McGraw Hill Ltd., Second Edition.

UNIT I	Chapter 5	Sec 5.1 - 5.6
UNIT II	Chapter 6	Sec 6.2 - 6.5
UNIT III	Chapter 7	Sec 7.1 - 7.6
UNIT IV	Chapter 8	Sec 8.1 - 8.5
UNIT V	Chapter 9	Sec 9.1 - 9.4

Books for Reference:

1. N.V.Prabhu, Macmilan, Stochastic Processes (NEW YORK).
2. Somuel Korlin, Howard, M.Taylor, A first course in stochastic processes Second Edition.
3. Narayan Bhat, Elements of Applied Stochastic processes.
4. Stochastic Processes J.Medhi –Wiley eastern Ltd., Second Edition.
5. Stochastic Processes in information and Dynamical system, Mc Graw Hill, New York, E.Wong.

SEMESTER I: CORE – III
ADVANCED GRAPH THEORY

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours/ Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Digraphs- Types of diagraphs - Directed paths and connected diagraph - Incidence matrix of a diagraph - Cycle matrix of a digraph.

UNIT II **12 hours**

Types of Enumeration - Counting Labeled trees – Counting unlabeled trees - Generating functions - Partitions – Rooted unlabeled trees – Centroid – free unlabeled trees.

UNIT III **12 hours**

Independent domination number – total domination number – Connected domination number - connected total domination number – clique domination number

UNIT IV **12 hours**

Paired domination number - Induced paired domination number – Global domination number - Total global domination number – Connected global domination number – Multiple domination number

UNIT V **12 hours**

Edge domination number – Total edge domination number –Connected edge domination number - Entire domination number and other related parameters.

Text books:

T.B.1: V.R.KULLI, College graph theory, first edition, vishwa international publications (2012).

T.B.2: Narasingh Deo, Graph theory with application to Engineering and computer science, Prentice Hall of India Pvt.Ltd (2008).

T.B.3: V.R.KULLI, Theory of Domination in Graphs, first edition, Vishwa international publications (2010).

UNIT I	Chapter 9	Sections 9.2 to 9.6	**T.B.1**
UNIT II	Chapter 10	Sections 10.1to10.3	**T.B.2**
UNIT III	Chapter 3	Sections 3.2to3.6	**T.B.3**
UNIT IV	Chapter 3	Sections 3.7to3.12	**T.B.3**
UNIT V	Chapter 4	Sections 4.1to4.4	**T.B.3**

Books for Reference:

1. Douglas B.West Introduction to graph theory, Prentice Hall of India Pvt.Ltd, Second edition (2009).
2. Frank harary – Egdes palmer, Graphical enumeration, Academic Press (1973).

SEMESTER I: CORE– III
TOPOLOGICAL VECTOR SPACES

Course Code: 14MPMA1C3 **Max. Marks : 100**
Hours/Week: 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Introduction-Separation-properties-Linear mapping-Finite dimensional spaces.

UNIT II **12 hours**

Metrization-Boundedness and continuity-Seminorms and local convexity-Quotient spaces and examples.

UNIT III **12 hours**

Baire category- The Banach-Steinhaus theorem-The open mapping theorem- The closed graph theorem-Bilinear mappings.

UNIT IV **12 hours**

The Hahn-Banach theorems-Weak topologies-Compact convex sets-Vector-valued integration-Holomorphic functions.

UNIT V **12 hours**

The normed dual of a normed space-Adjoints-Compact operators.

Text Book:

Walter Rudin, Functional analysis, second edition, Tata McGraw-Hill Edition 2006, Fourth Reprint (2008).

UNIT I Sections 1.1-1.23
UNIT II Sections 1.24-1.47
UNIT III Sections 2.1-2.17
UNIT IV Sections 3.1-3.32
UNIT V Sections 4.1-4.25

Books for Reference:

1. Sterling K.Berberian, Lectures in Functional Analysis and operator theory, Springer International student Edition (1974).
2. Balmohan V.Limaye, Functional Analysis, New Age International Publishers, Revised Second Edition (1996).
3. S.Kesavan,Functional Analysis, TRIM Hindustan Book Agency (2009).

SEMESTER I: CORE – III
FUZZY ALGEBRA

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours/ Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Fuzzy sets- Height of Fuzzy set – Nomal and Subnormal fuzzy sets- Support level sets – Fuzzy points Cuts

UNIT II **12 hours**

Standard fuzzy operations- Union, intersection and complement – Properties – DeMargan's Laws

UNIT III **12 hours**

α cuts of fuzzy operations – Representations of fuzzy sets – Image and inverse of fuzzy sets

UNIT IV **12 hours**

Various definitions of fuzzy operations – Generalizations – Fuzzy relations **–** α cuts of fuzzy relations

UNIT V **12 hours**

Fuzzy sub groups- Intersection and α cuts of fuzzy subgroups

Text Book:

M.Mrugalingam, S.Palaniammal, Fuzzy Algebra, Sivam Publications, Vickramasingapuram (2006).

UNIT I Chapter I
UNIT II Chapter II
UNIT III Chapter III
UNIT IV Chapter IV
UNIT V Chapter V

Books for Reference:

George J.Klir and Bo Yuan, Fuzzy Sets and fuzzy Logic Theory and Applications, Prentice Hall of India (2004).

SEMESTER I: CORE– III
FUZZY GRAPH THEORY

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours/ Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks: 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Introduction – Fuzzy sets and fuzzy set operations – Fuzzy relations – Composition of fuzzy relations – Properties of fuzzy relations - Introduction to Fuzzy graph – Operations on fuzzy graphs – Complement of a fuzzy graph – Cartesian product and composition – Union and join.

UNIT II **12 hours**

Geodesic, distance, covers and bases – Fuzzy end nodes and fuzzy trees – Medians and fuzzy trees – Triangle and Parallelogram laws.

UNIT III **12 hours**

Fuzzy independent set and fuzzy bipartite graph – Fuzzy bipartite part and maximal bipartite part – Maximal fuzzy bipartite part algorithm.

UNIT IV **12 hours**

Dominating set – Fuzzy Independent set – Bounds for $\gamma(G)$ – More adjacency in Fuzzy graph

UNIT V **12 hours**

Automorphism of fuzzy graphs – metric in fuzzy graphs – Center of a fuzzy tree - Regular Fuzzy Graphs

Text Book:

A.Nagoor Gani and V.T.Chandrasekaran, A first look at fuzzy Graph Theory, Allied Publishers Pvt.Ltd. Chennai, First Edition (2010).

UNIT I Chapter 1 Sections 1.1 to 1.5,
Chapter 2 Sections 2.1 to 2.2.3
UNIT II Chapter 3 Sections 3.4 to 3.5
UNIT III Chapter 4 Sections 4.1 to 4.3
UNIT IV Chapter 5 Sections 5.1 to 5.4
UNIT V Chapter 6 Sections 6.1 to 6.2

Books for Reference:

J.N.Moderson & P.S. Nair Fuzzy graphs and fuzzy hypergraphs. Livro da série: Studies in Fuzziness and Soft Computing, Physica-Verlag, (2000).

SEMESTER I: CORE – III
FUZZY OPTIMIZATION

Course Code: 14MPMA1C3 **Max. Marks : 100**
Hours/Week: 4 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Interval Confidence - Fuzzy Number - Some Types of Fuzzy Numbers and its Operations - Intuitionistic Fuzzy Numbers - Distance formula for Fuzzy Numbers - Some Metric Properties - Lattice of fuzzy number.

UNIT II **12 hours**

Introduction - Mathematical Model - Improving a Basic Feasible Solution – Unbounded solutions - Optimality Conditions - Fuzzy Variable Linear Programming - Fuzzy Basic Feasible Solution - Simplex Method for FVLP problem – Example.

UNIT III **12 hours**

Fuzzy Number Linear Programming - Fuzzy Basic Feasible Solution - Simplex Method for FVLP problem – Example - Duality in FNLP problem - A Fuzzy Dual Simplex Method – Algorithm – Example.

UNIT IV **12 hours**

Introduction- Fuzzy Multi- Objective linear programming problem - Layer Ranking Method - Superiority and Inferiority Between Triangular Numbers – Some Application to Multi- Objective Fuzzy linear programming problem -Multi- Objective Fuzzy linear programming problem with Interval Number - Ranking Interval Numbers - Fuzzy Simulation Analysis Method.

UNIT V **12 hours**

Introduction- Fuzzy General Transportation Problem (FGTP) - A parametric study on problem - Stability notions for the parametric problem - Solution Algorithm - Numerical Examples.

Text Book:

A.Nagoor Gani, Fuzzy Optimization – Materials Prepared

Books for Reference:

1. George Bojadziev & Maria Bojadziev, Fuzzy sets, Fuzzy Logic, Applications –World Scientific Advances in Fuzzy Systems-Applications and Theory Vol.5
2. Bernadette Bouchon-Meunier, Ronald R.Yager and Lofti A.Zadeh, Fuzzy Logic and Soft Computing – World Scientific Advances in Fuzzy Systems - Applications and Theory Vol.4.
3. George J.Klir / Bo Yuan ,Fuzzy sets and Fuzzy Logic Theory and Applications, Prentice Hall of India Private Limited, New Delhi (2005).

SEMESTER I: CORE – III
FUNCTIONAL ANALYSIS

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours/ Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Riesz Theory For Compact Operators: A type of integral equation- Operators of finite rank- Compact operators- Adjoint of a compact operator.

UNIT II **12 hours**

Fredholm Operators: Orientation- Further properties- Perturbation theory- Adjoint operator- A special case- Semi-Fredholm operators- Product of operators.

UNIT III **12 hours**

Unbounded operators: Unbounded Fredholm operators- Further properties- Operators with closed ranges- Total subsets-Essential spectrum- Unbounded semi-Fredholm operators- Adjoint of a product of operators.

UNIT IV **12 hours**

Selfadjoint Operators: Orthogonal projections- Square roots of operators- A decomposition of operators- Spectral resolution- Some consequences - Unbounded selfadjoint oerators.

UNIT V **12 hours**

Measure Of Operators: A seminorm- Perturbation classes- Related measures- Measures of compactness- The quotient space- Strictly singular operators- Norm perturbations- Perturbation functions- Factored perturbation functions.

Text Book:

Martin Schechter, Principles of Functional Analysis, Second Edition, American Mathematical Society, 2009.

UNIT I Chapter 4 Sections 4.1 to 4.4
UNIT II Chapter 5 Sections 5.1 to 5.7
UNIT III Chapter 7 Sections 7.1 to 7.7
UNIT IV Chapter 13 Sections 13.1 to 13.6
UNIT V Chapter 14 Sections 14.1 to 14.9

Books for Reference:

1. B. V. Limaye, Functional analysis, New Age Int. Publishers, Revised Second Edition (1996).
2. K. Yosida, Functional Analysis, Springer Verlog (1974).
3. Bela- Bellobas, Linear Algebra, Introductory Course, Cambridge University Press(1990)

SEMESTER I: CORE– III
TOPOLOGY

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours / Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective:
To acquire skills in applying them to research.

UNIT I **12 hours**
Basis-Subspace -Product topology - Separation axioms -Urysohn lemma-Urysohn Metrization theorem.

UNIT II **12 hours**
Connected spaces -Connected sets in the real line -Components and path components-Local connectedness -Compact spaces-Compact sets in the real line -Limit point compactness-
Local compactness.

UNIT III **12 hours**
Local finiteness -The Nagata Smirnov Metrization theorem (Sufficiency& Necessity)-Paracompactness - The Smirnov Metrization theorem.

UNIT IV **12 hours**
Fundamental group of the circle - Fundamental group of the punctured plane-Fundamental group of S -Fundamental groups of surfaces.

UNIT V **12 hours**
Essential and inessential maps -Fundamental theorem of algebra -Vector fields and fixed points - Homotopy type.

Text Book:
James R.Munkers, Topology A First Course, Prentice Hall of India, (1998).

UNIT I	Chapter 2	Sections 2.2, 2.4, 2.5, 2.8
	Chapter 4	Sections 4.2 to 4.4
UNIT II	Chapter 3	Sections 3.1 to 3.8
UNIT III	Chapter 6	Sections 6.1 to 6.5
UNIT IV	Chapter 8	Sections 8.4 to 8.7
UNIT V	Chapter 8	Sections 8.8 to 8.11

Books for Reference:
1. V.Guillemin and A.Pollack, Differential Topology, Prentice-Hall, Inc., Englewood Cliffs, N.J., (1974).
2. Kelley, J.L.General Topology, Van Nostrand Reinhold Co., Newyork, (1955).

SEMESTER I: CORE - III
INTUITIONISTIC FUZZY GRAPH

Course Code : 14MPMA1C3 **Max. Marks : 100**
Hours/Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks: 60**

Objective:

To acquire skills in applying them to research.

UNIT I **12 hours**

Fuzzy sets and fuzzy set operators – Fuzzy relations – Composition of fuzzy relations – Properties of fuzzy relation.

UNIT II **12 hours**

Intuitionistic Fuzzy sets – Properties of Intuitionistic Fuzzy sets – Operations and relations over Intuitionistic Fuzzy sets.

UNIT III **12 hours**

Intuitionistic Fuzzy Graph – Basic Definitions - Paths and Connectedness – Intuitionistic Fuzzy Bridge in IFG.

UNIT IV **12 hours**

Operations on Intuitionistic Fuzzy Graph – Complement – Union and Join – Cartesian product and Composition.

UNIT V **12 hours**

Degree of a vertex – Properties of various types of degrees – Order and size of and Intuitionistic Fuzzy Graphs – Complete and Regular Intuitionistic Fuzzy Graphs.

Text Book:

A. Nagoor Gani, V.T. Chandrasekaran, A First Look at Fuzzy Graph Theory, Allied Publishers Pvt. Ltd.,(2010).

UNIT I Chapter 1, Sections 1.1 to 1.5 (Page No. 1 – 19)
UNIT II Krassimir T. Atanassov, “Intuitionistic Fuzzy Sets”, Fuzzy sets and systems 20, p 87- 96 (1986).
UNIT III R. Parvathi and M.G. Karunambigai, “Intuitionistic Fuzzy Graphs”, Computational Intelligence, Theory and Applications (2006), part 6, 139-150.
UNIT IV R. Parvathi, M.G. Karunambigai and Krassimir T. Atanassov, “Operations on IntuitionisticFuzzyGraphs”, FUZZ- IEEE 2009,Korea, 20-24 (2009).
UNIT V A. Nagoor Gani and S. Shajitha Begum, “Degree, Order and Size in Intuitionistic Fuzzy Graphs”, International Journal of Algorithms, Computing and Mathematics, Volume 3, Number 3, (2010).

Books for Reference:

Krassimir T. Atanassov, Intuitionistic fuzzy sets: Theory and Applications, Physica Verlag, (1999).