M.Phil. Mathematics

SEM	SUB CODE	COURSE	SUBJECT TITLE	HRS / WEEK	CREDIT	CIA Mark	ESE MARK	TOTAL MARK
I	20MPMA1CC1	Core I	Research Methodology	4*	4	25	75	100
	20MPMA1CC2	Core II	Analysis and Applied Mathematics	4*	4	25	75	100
	20MPMA1CC3	Core III	Teaching & Learning Skills (Common Paper)	4*	4	25	75	100
	20MPMA1CC4	Core IV (Elective)	Paper on Topic of Research (The syllabus will be prepared by the guide and examination will be conducted by the COE)	4*	4	25	75	100
		*One hour library for each course						
	TOTAL			16*	16	100	300	400
II	20MPMA2PD		Dissertation##	-	8	-	-	200
GRAND TOTAL				-	**24**	-	-	**600**

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC1	Core – I	RESEARCH METHODOLOGY	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Demonstrate and analyze creatively to propose research problem of research design.

2. Analyze the concept of Noetherian modules, Primary decomposition and Artinian modules

3. Apply domain knowledge of topological preliminaries and regularity properties of Borel measures.

4. Transcribe and concentrate on a total variation, Consequences of the Random Nikodym theorem and Riesz representation Theorem.

5. Adopt the results of the Fundamental group and Covering spaces

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

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).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	**Code**		**Title of the Paper**			**Hours**				**Credits**
I	**20MPMA1CC1**		**RESEARCH METHODOLOGY**			4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2		✓	✓			✓			✓	✓
CO3	✓		✓	✓		✓		✓	✓	
CO4		✓		✓	✓		✓	✓		✓
CO5	✓	✓			✓		✓		✓	
Number of Matches= 32, Relationship : MODERATE										

Prepared by :
Dr.S.Shajitha Begum
Dr.A.Solairaju
Dr.S.Mohamed Yusuff Ansari
Dr. A.Prasanna
Dr.D.Dhamodharan

Checked by :
Dr.R.Jahir Hussain

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC2	Core – II	ANALYSIS AND APPLIED MATHEMATICS	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Examine the Gelfand mapping theorem and Gelfand – Neumark theorem
2. Analyze and distinguish the concepts of Linear and Non-Linear systems of Differential Equations.
3. Determine the domain knowledge on the domination number of graph, Exploration and Stratification.
4. Infer and illustrate the modular arithmetic and ciphers .
5. Illustrate the Fuzzy Graph: Paths and Connectedness- Fuzzy Bridges and Fuzzy Cut nodes- Fuzzy Forests and Fuzzy Trees.

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**

Mathematics of Cryptography: Introduction – Integer Arithmetic- Modular Arithmetic – Matrices – Linear Congruence. Traditional Symmetric-key. Ciphers: Introduction – Substitution Ciphers – Transposition Ciphers – Stream and Block Ciphers.

UNIT V **12 Hours**

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

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 Behrouz A. Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, Tata McGraw Hill Education Private Limited, New Delhi, Second Edition(2010).

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	Chapter 2	Sections 2.1 - 2.4	
	Chapter 3	Sections 3.1, 3.4	**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. New Delhi, Second Edition (2009).

2. M.Murugan, Topics in Graph Theory and Algorithms, Muthali Publishing House, Annanagar, Chennai, First Edition (2003).

3. William Stallings, Cryptography and Network Security, Dorling Kindersley India Pvt. Ltd, Fifth Edition (2011)

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC2	ANALYSIS AND APPLIED MATHEMATICS	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓	✓		✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓		✓	✓	✓		✓	✓	
CO4	✓	✓		✓	✓	✓	✓		✓	✓
CO5			✓	✓			✓	✓		✓

Number of Matches= 39, Relationship : HIGH

Prepared by :

Dr.A.Mohamed Ismayil
Dr.P.Muruganantham
Dr.R.Jahir Hussain
Dr.A.Prasanna
Dr.A.Nagoor Gani

Checked by :

Dr.A.Solairaju

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC3	Core – III	TEACHING & LEARNING SKILLS	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Make use of variety of Teaching - learning strategies, Instructional Designs in higher education
2. Apply the domain knowledge of teaching and technology in Lecture, Seminar, Symposium, Panel Discussion, Team Teaching, Project and workshop.
3. Identify the effective teaching methods for classroom management.
4. Demonstrate pursuit of knowledge as a character formation and interpersonal skills.
5. Utilize the MATLAB software's for Problem Solving.

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.

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).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC3	TEACHING AND LEARNING SKILLS	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓		✓	✓	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓		✓	✓	✓	✓	✓		✓
Number of Matches= 46, Relationship : VERY HIGH										

Prepared By:

Mr.N.Abdul Ali

Dr.R.Jahir Hussain

Mr.M.Mohammed Jabarullah

Dr.A.Mohamed Ismayil

Checked by:

Dr.A.Nagoor Gani

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	CODES AND CRYPTOGRAPHY	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Analyze and study on the entropy and Efficient codes.
2. Transcribe and solve Fano's inequality and Shannons's noisy coding theorem
3. Demonstrate and classify of linear codes, Cyclic codes and BCH codes.
4. Discuss and classify cryptography, Symmetric and Asymmetric Ciphers.
5. Formulate and illustrate the discrete logarithm ciphers

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. 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).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC4	CODES AND CRYPTOGRAPHY	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓	✓			✓	✓
CO2	✓	✓	✓		✓	✓		✓		✓
CO3			✓	✓	✓		✓	✓	✓	
CO4	✓		✓	✓	✓	✓		✓		✓
CO5	✓	✓		✓	✓	✓	√		✓	✓
Number of Matches= 35, Relationship : HIGH										

Prepared By :
Dr.M.Mohammed Jabarullah

Checked by:
Dr.S.Ismail Mohideen

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	NETWORK OPTIMIZATION & GENETIC ALGORITHMS	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Discuss the various classes of network optimization problems
2. Show solution of Polynomial time algorithms for an MOSPP using various mean concepts
3. Examine the solution of non-linear mean, centroidal mean and contra harmonic mean
4. Recognize the concept of Genetic algorithms
5. Build on the Inheritance operators.

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.**

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC4	NETWORK OPTIMIZATION & GENETIC ALGORITHMS	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓			✓	✓			✓	✓
CO2	✓	✓		✓			✓	✓		✓
CO3		✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓		✓	✓	✓		✓	✓		✓
CO5		✓	✓		✓	✓	✓		✓	✓
Number of Matches= 35, Relationship : HIGH										

Prepared By:
Dr.S.Ismail Mohideen

Checked by:
Dr.A.Mohamed Ismayil

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	NUMERICAL SOLUTION OF BOUNDARY VALUE PROBLEMS	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Analyze the finite element methods.
2. Discuss the solution of first and second order initial value problems.
3. Illustrate parabolic and hyperbolic equations with examples
4. Examine Galerkin method for Mixed boundary conditions
5. Demonstrate and study the assembly of element equations

UNIT I **12hours**

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).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC4	NUMERICAL SOLUTION OF BOUNDARY VALUE PROBLEMS	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓	✓	✓	✓		✓
CO2	✓	✓			✓	✓	✓	✓		✓
CO3	✓	✓	✓	✓		✓	✓		✓	
CO4	✓		✓		✓			✓	✓	✓
CO5	✓		✓	✓			✓	✓	✓	✓
Number of Matches= 35, Relationship : HIGH										

Prepared By:
Mr.N.Abdul Ali

Checked by:
Dr.U.Abuthahir

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	STOCHASTIC PROCESSES	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Examine the Kolmogorov's Forward and Backward Equation and Wierner levey process.
2. Show the solution of Khintchine's Limit Theorem and Palm's Theorem
3. Analyze the concept of Coveriance Function for continuity, Differentiability, Integrals of Second Order Processes in the mean square sense.
4. Recall the Wiener process and wiener integrals with examples.
5. Describe the concepts of Generating Function and Fundamental theorem of Branching processes

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**

Coveriance Function – continuity, Differentiability, Integrals of Second Order Processes in the mean square sense- Stationary processes – Herglotz theorem- Bochner's theorem – Spectral Represenation 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, E.Wong, Mc Graw Hill, New York,.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper				Hours				Credits
I	20MPMA1CC4	STOCHASTIC PROCESSES				4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓		✓	✓	✓		✓		✓
CO2		✓			✓		✓		✓	
CO3	✓	✓	✓	✓		✓		✓	✓	✓
CO4	✓		✓	✓		✓	✓		✓	
CO5	✓		✓		✓		✓	✓		✓
Number of Matches= 30, Relationship : MODERATE										

Prepared By:
Dr.P.Muruganantham

Checked by:
Dr.S.Mohamed Yusuff Ansari

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	ADVANCED GRAPH THEORY	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Recognize and Recall the concept of digraphs.
2. State on Polya's enumeration theorem with examples.
3. Demonstrate the concept of domination and independent domination.
4. Explain the concepts domination numbers.
5. Apply the concept of domination numbers in Edge domination number and Total edge domination number.

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**

Enumeration - Labeled graphs – Polya's enumeration theorem – Enumeration of graphs – Enumeration of 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.

Textbooks:

T.B.1 V.R.KULLI, College graph theory, first edition, vishwa international publications (2012).
T.B.2 Frank Harary, Graph Theory, Narosa Publishing House, New Delhi (Reprint 2001).
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 15	Page No. 178 to 191	**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. Narasingh Deo, Graph theory with application to Engineering and computer science, Prentice Hall of India Pvt. Ltd (2008).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code		Title of the Paper			Hours				Credits
I	20MPMA1CC4		ADVANCED GRAPH THEORY			4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO2		✓	✓			✓	✓		✓	✓
CO3	✓			✓	✓	✓		✓	✓	✓
CO4		✓	✓		✓		✓	✓		
CO5	✓	✓		✓			✓			✓
Number of Matches= 32, Relationship : MODERATE										

Prepared By :
Dr.R.Jahir Hussain

Checked by:
Dr.P.Muruganantham

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	TOPOLOGICAL VECTOR SPACES	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Recognize the concept of finite dimensional spaces with examples.
2. Discuss the Metrication and Quotient spaces with examples.
3. Demonstrate the Baire category, The Banach-Steinhaus theorem and the open mapping theorem.
4. Analyze The Hahn-Banach theorems for Weak topologies.
5. Describe the concept of compact operators.

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 **12hours**

The normed dual of normed space – Adjoints – Compact operators.

Text Book

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

UNIT I Sec 1.1-1.23
UNIT II Sec 1.24-1.47
UNIT III Sec 2.1-2.17
UNIT IV Sec 3.1-3.32
UNIT V Sec 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)

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code		Title of the Paper					Hours		Credits
I	20MPMA1CC4		TOPOLOGICAL VECTOR SPACES					4		4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2		✓	✓			✓		✓	✓	
CO3	✓	✓		✓	✓	✓	✓			✓
CO4	✓		✓	✓	✓		✓	✓	✓	
CO5	✓		✓		✓	✓	✓		✓	✓
Number of Matches= 36, Relationship : HIGH										

Prepared By :
Dr.A.Solairaju

Checked by:
Dr.M.Mohamed Althaf

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	FUZZY ALGEBRA	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Recognize the concept of fuzzy sets and their properties.
2. Apply the domain knowledge for Standard fuzzy operations and DeMargan's Laws in fuzzy sets.
3. Build the domain knowledge for the Representations of fuzzy sets, Image and inverse of fuzzy sets
4. Analyze the various definitions of fuzzy operations and fuzzy relations.
5. Show the concept of Fuzzy sub groups.

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).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC4	FUZZY ALGEBRA	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓		√
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3		✓	✓					✓	✓	
CO4	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO5	✓			✓	✓	✓	✓		✓	✓
Number of Matches= 38, Relationship : HIGH										

Prepared By :
Dr.A.Prasanna

Checked by:
Dr.A.Solairaju

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	FUZZY GRAPH THEORY	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Discuss the concept of fuzzy graphs and their properties with examples.
2. Examine the concept of Geodesic, distance, covers, bases and Triangle, Parallelogram laws
3. Demonstrate the concept of Fuzzy independent set and fuzzy bipartite graph with algorithm.
4. Classify the Dominating set and fuzzy independence set.
5. Transcribe the idea of Automorphism of fuzzy graphs and metric in fuzzy graphs.

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).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC4	FUZZY GRAPH THEORY	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓		✓
CO2	✓		✓	✓	✓	✓		✓	✓	
CO3	✓		✓			✓			✓	✓
CO4	✓	✓	✓	✓			✓			✓
CO5		✓	✓		✓		✓	✓	✓	✓
Number of Matches= 33, Relationship : MODERATE										

Prepared By :
Dr.A.Nagoor Gani

Checked by:
Dr.R.Jahir Hussain

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	FUZZY OPTIMIZATION	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Demonstrate the examples of Interval Confidence of Fuzzy Number and Some Types of Fuzzy Numbers.
2. Adopt information on mathematical Model in Fuzzy Variable Linear Programming
3. Examine in detail Fuzzy Number Linear Programming and find Fuzzy Basic Feasible Solution with example.
4. Show the properties of Fuzzy Multi- Objective linear programming problem and Layer Ranking Method.
5. Analyze Fuzzy General Transportation Problem (FGTP) with Numerical example.

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)

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code		Title of the Paper			Hours				Credits
I	20MPMA1CC4		FUZZY OPTIMIZATION			4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2		✓	✓			✓		✓		✓
CO3	✓		✓	✓	✓		✓		✓	✓
CO4		✓	✓			✓		✓	✓	
CO5	✓	✓		✓	✓	✓	✓		✓	✓
Number of Matches= 35, Relationship : HIGH										

Prepared By :
Dr.A.Prasanna

Checked by:
Dr.M.A.Rifayath Ali

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	FUNCTIONAL ANALYSIS	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Demonstrate and Study the concept of Riesz Theory for Compact Operators
2. Analyze the concept of Fredholm Operators and Perturbation theory.
3. Examine unbounded operators and Adjoint of a product of operators.
4. Illustrate the Self-adjoint Operators and properties.
5. Recognize the concept of measure Of Operators in seminorm and Perturbation

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	Sec 4.1 to 4.4
UNIT II	Chapter 5	Sec 5.1 to 5.7
UNIT III	Chapter 7	Sec 7.1 to 7.7
UNIT IV	Chapter 13	Sec 13.1 to 13.6
UNIT V	Chapter 14	Sec 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)

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code		Title of the Paper			Hours				Credits
I	20MPMA1CC4		FUNCTIONAL ANALYSIS			4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓		✓	✓		✓
CO2	✓	✓	✓		✓	✓	✓		✓	✓
CO3	✓	✓	✓					✓	✓	✓
CO4	✓			✓		✓	✓		✓	
CO5		✓		✓	✓	✓			✓	✓
Number of Matches= 32, Relationship : MODERATE										

Prepared By :
Dr.A.Mohamed Ismayil

Checked by:
Dr.D.Dhamodharan

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	TOPOLOGY	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Recognize the concepts of Urysohn lemma and Urysohn metrization theorem.
2. Compare the concepts of connected spaces and compact spaces.
3. State the Nagata Smirnov metrization theorem
4. Construct the concept of fundamental group of the circle, punctured plane and surfaces with examples
5. Discuss the fundamental theorem of algebra and Homotopy type.

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., New York, (1955).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code		Title of the Paper			Hours				Credits
I	20MPMA1CC4		TOPOLOGY			4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓	✓		✓		✓	✓	✓
CO2	✓	✓			✓		✓	✓	✓	
CO3		✓	✓				✓	✓		
CO4		✓	✓	✓	✓	✓	✓		✓	✓
CO5	✓	✓	✓			✓	✓	✓		
Number of Matches= 30, Relationship : MODERATE										

Prepared By:
Dr.A. Prasanna

Checked by:
Dr.A.Nagoor Gani

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	INTUITIONISTIC FUZZY GRAPH	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Recognize the concept of fuzzy sets, fuzzy set operators and Fuzzy relations with Properties of fuzzy relation with examples.
2. Demonstrate and illustrate the concepts of intuitionistic fuzzy sets.
3. Define Intuitionistic fuzzy graph and fuzzy bridge in IFG.
4. Discuss the concepts on operations on intuitionistic fuzzy graph with examples
5. Analyze the concept of degree of a vertex and Intuitionistic Fuzzy Graphs – Complete and Regular Intuitionistic Fuzzy Graphs with examples.

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) T.B - 1

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).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC4	INTUITIONISTIC FUZZY GRAPH	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓		✓	✓	✓	✓		✓	✓	✓
CO3	✓	✓		✓		✓		✓		✓
CO4		✓	✓				✓	✓	✓	
CO5	✓	✓		✓	✓		✓	✓	✓	
Number of Matches= 36, Relationship : HIGH										

Prepared By :
Dr.S.Shajitha Begum

Checked by:
Dr.V.Krishnan

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	CONTROL THEORY	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Examine the concepts of observability.
2. Distinguish the controllability in linear and non-linear
3. Illustrate the concept of asymptotic stability of linear systems and perturbed linear systems with examples.
4. Discuss the concept of stabilization via linear feedback control and stabilization with restricted feedback.
5. Demonstrate matrix Riccati equation and nonlinear Systems

UNIT I **12 hours**

Observability: Linear Systems – ObservabilityGrammian – Constant coefficient systems – Reconstruction kernel – Nonlinear Systems.

UNIT II **12 Hours**

Controllability: Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – steering function – Nonlinear systems.

UNIT III **12 Hours**

Stability: Stability – Uniform Stability – Asymptotic Stability of Linear Systems - Linear timevarying systems – Perturbed linear systems – Nonlinear systems.

UNIT IV **12 Hours**

Stabilizability: Stabilization via linear feedback control – Bass method – Controllable subspace –Stabilization with restricted feedback.

UNIT V **12 Hours**

Optimalcontrol: Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Linear time invariant systems – Nonlinear Systems.

Text Book:

Elements of Control Theory by K. Balachandran and J.P.Dauer, Narosa, New Delhi, 1999.

UNIT I Chapter 2
UNIT II Chapter 3 Sections 3.1 - 3.3
UNIT III Chapter 4
UNIT IV Chapter 5
UNIT V Chapter 6

Books for Reference:

1. Linear Differential Equations and Control by R.Conti, Academic Press, London, 1976.
2. Functional Analysis and Modern Applied Mathematics by R.F.Curtain and A.J.Pritchard, Academic Press, New York, 1977.
3. Controllability of Dynamical Systems by J.Klamka, Kluwer Academic Publisher, Dordrecht, 1991.
4. Mathematics of Finite Dimensional Control Systems by D.L.Russell, MarcelDekker, New York, 1979.
5. E.B. Lee and L. Markus, Foundations of optimal Control Theory, John Wiley,New York, 1967.

Semester	Code	Title of the Paper	Hours	Credits
I	20MPMA1CC4	CONTROL THEORY	4	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓	✓		✓		✓	✓	✓	
CO2	✓	✓		✓	✓		✓		✓	✓
CO3	✓		✓		✓		✓	✓		✓
CO4		✓	✓		✓	✓		✓	✓	
CO5		✓	✓			✓		✓	✓	
Number of Matches= 30, Relationship : MODERATE										

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Prepared By :
Dr.S.Mohamed Yusuff Ansari

Checked by:
Mr. N.Mohamed Thoiyab

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	MATHEMATICAL MODELLING	4	4	100	25	75

Course Outcomes

At the end of the Course, Scholars will be able to:

1. Discuss and analyze the technique of linear regression model.
2. Find the solution by using multiple linear regression model.
3. Analyze the model adequacy checking and correct the model.
4. Describe the Diagnostics for leverage & influence for the polynomial regression model
5. Bring out the solution of real life problem using nonlinear regression model.

UNIT I **12 hours**

Regression and model building – Simple linear regression model – Least squares estimation of the parameters – Prediction of new observations - Coefficient of determination – Estimation by maximum likelihood.

UNIT II **12 hours**

Multiple regression models – Estimation of the model parameters– Hypothesis testing in multiple linear regression – Prediction of new observations – Hidden extrapolation in multiple regression – Standardized regression coefficients.

UNIT III **12 hours**

Residual analysis – The PRESS statistics – Detection and treatment of outliers – Lack of fit of the regression model – Variance-Stabilizing transformations – Transformation to linearize the model – Analytical methods of selecting a transformation – Generalized and weighted least squares.

UNIT IV **12 hours**

Importance of detecting influential observations – Leverage – Measures of influence: Cook's D and DFFITS AND DFBETAS – A measure of model performance – Detecting groups of influential observations – Treatment of influential observations – Polynomial models in one variable –Nonparametric regression – Polynomial models in two or more variables.

UNIT V **12 hours**

Computational techniques for variable selection – Validation techniques– Data from planned experiments – Linear and nonlinear regression model – Nonlinear least squares – Transformation to a linear model – Parameter estimation in a nonlinear system – Statistical inference in nonlinear regression.

Text Book:

1. Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, "INTRODUCTION TO LINEAR REGRESSION ANALYSIS", fifth edition, Wiley Interscience Publication, 2004.

UNIT I	Chapter 1	Section 1.1
	Chapter 2	Section 2.1, 2.2, 2.5, 2.6, 2.11
UNIT II	Chapter 3	Sections 3.1, 3.2, 3.3, 3.5, 3.8, 3.9
UNIT III	Chapter 4	Sections 4.2, 4.3, 4.4, 4.5
	Chapter 5	Sections 5.2, 5.3, 5.4, 5.5
UNIT IV	Chapter 6	Sections 6.1, 6.2, 6.3, 6.4, 6.5
	Chapter 7	Sections 7.2, 7.3, 7.4
UNIT V	Chapter 10	Sections 10.2;
	Chapter 11	Sections 11.2, 11.3
	Chapter 12	Sections 12.1, 12.3, 12.4, 12.5, 12.6

Reference Books

1. Damodar N. Gujarati and Sangeetha, "BASIC ECONOMETRICS", fourth edition, Tata Mc Graw Hill Edition 2007.

2. William H. Greene, "ECONOMETRIC ANALYSIS", fifth edition, Pearson Education Pte. Ltd., Delhi, 2005.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code		Title of the Paper			Hours				Credits
I	20MPMA1CC4		MATHEMATICAL MODELLING			4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓	✓		✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3		✓			✓			✓	✓	
CO4	✓	✓	✓	✓			✓	✓	✓	✓
CO5	✓		✓	✓	✓	✓		✓	✓	✓
Number of Matches= 38, Relationship : HIGH										

Prepared by:
Dr. U. Abuthahir

Checked by:
Mr. N.Mohamed Thoiyab

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	FIXED POINT THEORY	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Examine how the study of fixed point theory helps to solve problems which are theoretical as well as practical and Realize contraction, contractive maps have elegant results on the existence and uniqueness of fixed points.
2. Analyze the theory of non-expansive fixed point theorems and understand the geometry of the spaces involved.
3. Describe the generalizations of Brouwer's fixed point theorem, viz., Schauder and the use of it in analysis and differential equations.
4. Recognize the ideas behind Applications to Michael's selection theorem.
5. Discuss the Kyfan's best approximation theorem and its consequences and Application to Pancake problems.

UNIT I **12 hours**

Banach's contraction principle – Further extensions- Caristi – Ekeland principle - Equivalance of Caristi- principles.

UNIT II **12 hours**

Tarsiki's Fixed-point theorem - Hyperconvex spaces – Properties – fixed-point theorems – intersection of hyper convex spaces – Isbell's convex hull.

UNIT III **12 hours**

Uniformly convex Banach spaces – Fixed-point theorem of Browder, Gohde and Kirk. Reflexive Banach spaces –Normal structure- Fixed point theorems.

UNIT IV **12 hours**

Generalized Banach Fixed-point theorem- Upper and lower semi continuity of multivalued maps – Generalized Schauder Fixed point theorem – Variational Inequalities and the Browder Fixed-Point theorem – Extremal Principle – Applications to Game Theory – Michael's selection theorem

UNIT V **12 hours**

Fixed point theorem for continuous functions- Brouwer's theorem -Schauder's theorem - applications - Hairy ball theorem - pancake problems- Kyfan's best approximation theorem.

TEXT BOOK(S)

1. M. A. Khamsi& W. A. Kirk, An introduction of Metric spaces and Fixed point theory, John Wiley & sons (2001).
2. E. Zeidler, Nonlinear Functional Analysis and its applications, Vol. I Springer – Verlag New York (1986)

UNIT – I	Chapter 3	Sections 3.1 - 3.4	**T.B-1**
UNIT – II	Chapter 4		**T.B-1**
UNIT – III	Chapter 5	Sections 5.1 -5.4	**T.B-1**
	Chapter 10	Section 10.1 -10.3	**T.B-2**
UNIT – IV	Chapter 9		**T.B-2**
UNIT – V	Chapter 2		**T.B-2**

Books for References

1. D.R. Smart, Fixed point theory, Cambridge University Press, (1974).
2. V.I. Istratescu, Fixed point theory, D. ReidelPublsihing Company, Boston (1979).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	**Code**		**Title of the Paper**			**Hours**				**Credits**
I	**20MPMA1CC4**		**FIXED POINT THEORY**			**4**				**4**
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓		✓	✓		✓	✓	✓	
CO3	✓	✓	✓		✓	✓		✓	✓	
CO4	✓		✓		✓	✓	✓	✓	✓	✓
CO5	✓	✓		✓	✓	✓	✓	✓		✓
Number of Matches= 40, Relationship : HIGH										

Prepared by:
Dr. D.Dhamodharan

Checked by:
Dr.R.Jahir Hussain

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	FUZZY PROBABILITY	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Recognize the concept of fuzzy set, fuzzy arithmetic and fuzzy functions with the examples.
2. Apply the domain knowledge for fuzzy probabilities and study fuzzy baye's formula.
3. Discuss and classify the discrete and continuous fuzzy random variables with illustrate the examples.
4. Examine the ideas behind Political Polls and Fuzzy Reliability Theory with the examples.
5. Demonstrate and discuss fuzzy queuing process and fuzzy markov chains.

UNIT I **12 Hours**

Fuzzy Sets: Introduction – Fuzzy sets – Fuzzy Arithmetic – Fuzzy Functions – Finding a minimum of a Fuzzy Number – Ordering Fuzzy Numbers – Fuzzy Probabilities – Fuzzy Numbers from Confidence intervals – Computing Fuzzy Probabilities.

UNIT II **12 Hours**

Fuzzy Probability Theory: Introduction– Fuzzy Probability – Fuzzy Conditional Probability – Fuzzy Independence – Fuzzy Bayes' Formula – Applications.

UNIT III **12 Hours**

Discrete & Continuous Fuzzy Random Variables: Introduction – Fuzzy Binomial – Fuzzy Poisson – Applications – Fuzzy Uniform – Fuzzy Normal – Fuzzy Negative Exponential – Applications.

UNIT IV **12 Hours**

Joint Fuzzy Probability Distributions & Fuzzy Random Variables: Introduction – Continuous Case – Political Polls – Fuzzy Reliability Theory – Discrete Fuzzy Random Variables – Continuous Fuzzy Random Variables – One-to-One Transformation – Other Transformations.

UNIT V **12 Hours**

Fuzzy Queuing Theory & Fuzzy Markov Chains: Introduction – Regular, Finite, Markov Chains – Fuzzy Queuing Theory – Applications – Regular Markov Chains – Absorbing Markov Chains – Applications: Decision Model.

Text Book:

James J. Bucklaey, Fuzzy Probabilities New Approach and Applications, Springer, 2005.

Books for Reference

1. James J. Bucklaey, Fuzzy Probability and Statistics, Springer, The Netherlands 2006.
2.ReinhardViertl, Statistical Methods for Fuzzy Data, John Wiley & Sons. Ltd., 2011.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code		Title of the Paper			Hours				Credits
I	20MPMA1CC4		FUZZY PROBABILITY			4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓	✓		✓	✓	
CO2	✓	✓	✓		✓	✓		✓		✓
CO3			✓	✓			✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓		✓		✓
CO5	✓	✓		✓	✓	✓	✓		✓	✓
Number of Matches= 35, Relationship : HIGH										

Prepared By :
Dr.A. Prasanna

Checked by:
Dr.M.A.Rifayath Ali

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPMA1CC4	Core – IV	Algorithmic Graph Theory	4	4	100	25	75

Course Outcomes:

At the end of the Course, Scholars will be able to:

1. Analyze the basic concepts of Graph theory and design of efficient algorithms.
2. Transcribe and illustrate the algorithms for characterizing the Perfect graphs.
3. Demonstrate algorithms for coloring, clique, stable set and clique-cover problems.
4. Classify the algorithms for coloring and maximum weighted clique of comparability graphs.
5. Formulate the algorithms for characterizing the Split graphs, Permutation graphs and Interval graphs.

UNIT I **12 Hours**

Graph Theoretic Foundations: Basic Definitions and Notations - Intersection Graphs-Interval Graphs - A Sneak Preview of the Notions Coming Up.

The Design of Efficient Algorithms: The Complexity of Computer Algorithms- Data Structures- How to Explore a Graph -Transitive Tournaments and Topological Sorting

UNIT II **12 Hours**

Perfect Graphs: The perfect graphs theorem – P-critical and partitionable graphs – A polyhedral characterization of perfect graphs and P-critical graphs – the strong perfect graph conjecture and recent theorem.

UNIT III **12 Hours**

Triangulated Graphs: Introduction - Characterizing Triangulated Graphs - Recognizing Triangulated Graphs by Lexicographic Breadth-First Search- The Complexity of Recognizing Triangulated Graphs-Triangulated Graphs as Intersection Graphs-Triangulated Graphs Are Perfect-Fast Algorithms for the COLORING, CLIQUE, STABLE SET, and CLIQUE-COVER Problems on Triangulated Graphs.

UNIT IV **12 Hours**

Comparability Graphs: Γ-Chains and Implication Classes – Uniquely Partially Orderable Graphs – The Number of Transitive Orientations – Schemes and G-Decompositions—An Algorithm for Assigning Transitive Orientations – The Γ^*Matroid of a Graph – The Complexity of Comparability Graph Recognition - Coloring and Other Problems on Comparability Graphs - The Dimension of Partial Orders.

UNIT V **12 Hours**

Split Graphs: Introduction - Characterizing Split Graphs – Degree Sequences and Split Graphs. Permutation Graphs: Introduction– Characterizing Permutation Graphs – Permutation Labelings-Applications - Sorting a Permutation Using Queues in Parallel. Interval Graphs: Some Characterizations of Interval Graphs -The Complexity of Consecutive 1's Testing - Applications of Interval Graphs - Preference and Indifference – Circular Arc Graphs.

TEXTBOOK:

Martin Charles Golumbic, Algorithmic Graph Theory and Perfect graphs,Elsevier Publication, Edition 2004.

Unit I Chapters 1 and 2
Unit II Chapter 3
Unit III Chapter 4
Unit IV Chapter 5
Unit V Chapters 6, 7 and 8

Books for References:

1.Alan Gibbons, Algorithmic Graph theory, Cambridge University Press, 1985.
2. Martin Charles Golumbic, Algorithmic Graph theory and its applications, 2003.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes :

Semester	Code		Title of the Paper			Hours				Credits
I	20MPMA1CC4		Algorithmic Graph Theory			4				4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓		✓		✓	✓			✓
CO2	✓		✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO4	✓		✓	✓	✓	✓		✓	✓	✓
CO5	✓		✓	✓	✓	✓		✓	✓	✓
Number of Matches= 35, Relationship : HIGH										

Prepared By:
Dr. S. Mohamed Yusuff Ansari

Checked by:
Dr.M.Mohammed Jabarulla