# MANNAR THIRUMALAI NAICKER COLLEGE PASUMALAI, MADURAI- 625 004

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

(Re-accredited with 'A' Grade by NAAC)



## M.Phil., Mathematics

## SYLLABUS AND REGULATIONS

UNDER CHOICE BASED CREDIT SYSTEM (CBCS) (For those who joined during 2018-2019 and after)

#### **SEMESTER I**

Sub.Code	Subject	Weekly	Credits	Exam	Marks		6
		Contact		Hours	Int	Ext	Tot
		Hours					al
18LMTC11	Paper I : Research Methodology	6	5	3	25	75	100
18LMTC12	Paper II: Advanced Analysis	6	5	3	25	75	100
18LMTE11 18LMTE12 18LMTE13 18LMTE14	<ul> <li>Paper III: Any one of the Papers from the list of optional papers</li> <li>1. Labeling, Colouring and Domination in Graphs</li> <li>2. L<sup>P</sup> Spaces and Fourier Transforms</li> <li>3. Stochastic Process</li> <li>4. Fuzzy Algebra</li> </ul>	6	5	3	25	75	100
	Total	18	15		75	225	300

#### SEMESTER II

Subject Code	Title of the Paper	Credit	Max. Marks Internal	Max. Marks External	Total
18LMTD21	Dissertation and Viva-Voce**	10	-	-	200

\*\*Evaluation of the Dissertation and Viva-Voce shall be made jointly by the research supervisor and the External Examiner.

Dissertation M.Phil

Maximum Marks	:	200 Marks
Evaluation of the Dissertation	:	150 Marks
Viva-Voce	:	50 Marks

Academic Council Meeting Held on 20.03.2018



Class	: M.Phil (Mathematics)	PartIII	: Core
Semester	: I	Hours	: 06
Sub code	: 18LMTC11	Credits	: 05

#### **RESEARCH METHODOLOGY**

#### **Course Outcomes:**

**CO1 :** To pay due attention to designing and adhering to the appropriate methodologies for improving the quality of research.

**CO2:** To introduce a brief treatment of simple properties of algebra.

**CO3:** To familiarize the applications.

CO4:To Ethical issues in conducting research on skill based.

#### Unit- I:

Research Methodology – Mathematical Research – Pure and applied – Assignment, Dissertation, Thesis – AMS Classification – Articles, Monographs, Research papers, Technical reports, Reviews, Citation index – Websites for searching Mathematical Articles – Mathematical Society – Prizes, Medals for outstanding results.

#### Unit -II:

Rings and Ideals - Ring homomorphisms – Ideals, Quotient rings – Zero divisors, Nilpoint elements, Units – Prime ideals and Maximal ideals – Nilradical and Jacobson Radical – Operations on Ideals – Extension and Contraction – Modules and Module homomorphisms- Submodules – Exact sequences.

#### Unit- III:

Tensor product of modules – Restriction and extension of scalars – Exactness properties of Tensor product – Algebras - Tensor product of Algebras – Rings and Modules of fractions – Local properties – Extended and contracted ideals in rings of fractions.

#### Unit -IV:

Primary decomposition – Chain condition.

Unit- V:

Noetherian rings - Primary decomposition in Noetherian rings – Artin rings.

#### **Text Book:**

1. M.F. Atiya and I.G. Macdonald, **Introduction to Commutative Algebra**, Addison – Wesley Publishing Company, 1969.

Unit II -	Chapter [	1: pages	1 to	16 and	Chapter	2: pages	17	to 23.
	Chapter	r pages	1 10	10 unu	Chapter	2. puges	1 /	10 25.

- Unit III Chapter 2: pages 24 to 35 and Chapter 3: pages 36 to 49.
- Unit IV Chapter 4: pages 50 to 58 and Chapter 6: pages 74 to 79.
- Unit V Chapters: 7 and 8.

- 1. J.Anderson, B.H. Durston and M.Poole, **Thesis and Assignment writing**, WileyEastern Limited, 1987.
- 2. N.S.Gopalakrishnan, University Algebra, New Age International (P) Ltd. Reprinted 2001.
- 3. Richard S.Pierce, Associative Algebra, Springer Verlag, New York, Heidelberg, Berlin.



Class	:	M.Phil (Mathematics)	Part III	: Core
Semester	:	I	Hours	:06
Sub code	:	18LMTC12	Credits	: 05

#### ADVANCED ANALYSIS

#### **Course Outcomes:**

**CO1:** To develop the skills connected with the different concepts of measures. **CO2:** To teach the characteristics of measurable sets on various spaces. CO3: To learn about functions and the basic properties of Fourier Transforms. **CO4:** To equip the students with the advanced research topics and predictive analysis for employability. Unit I: The Concept of measurability - Simple functions - Elementary properties of measures - Integration of positive functions - Integration of complex functions -Therole played by sets of measure Zero. Unit II: The Riesz representation theorem – Regularity properties of Borel measures – Lebesgue measure – Continuity properties of measurable functions. Unit III: Convex functions and inequalities – L<sub>p</sub> spaces – Approximation by continuous functions. Unit IV: Inner Products and linear functional- Orthonormal sets- Trigonometric Series.

- **Unit IV.** Inner Froducts and finear functional<sup>2</sup> of thonormal sets<sup>2</sup> (Figure 1) for the setter.
- **Unit V:** Fourier Transforms : Formal properties The Invension theorem The Plancheral theorem The Banach Algebra L<sub>1</sub> Complex Homomorphism.

#### **Text Book:**

1. Walter Rudin, **Real and Complex Analysis**, Third Edition, Tata McGraw – Hill Publishing Company Limited, New Delhi, 1987.

Unit I -Chapter 1: Section 1.2 to 1.41 Unit II -Chapter 2 : Section 2.1 to 2.25 Unit III -Chapter 3: Section 3.1 to 3.17 Unit IV- Chapter 4 : Section 4.1 to 4.26 Unit V - Chapter 9: Section 9.1 to 9.23

- 1. H.L.Royden, Real Analysis, Mac Millan, New York, 1988.
- **2.** B.V.Limaye, **Functional Analysis**, Revised Second Edition, New Age InternationalPublishers, 2011.



Class	: M.Phil (Mathematics)	Part III	: Elective
Semester	: I	Hours	:06
Sub code	: 18LMTE11	Credits	: 05

#### LABELING, COLOURING AND DOMINATION IN GRAPHS

#### **Course Outcomes:**

CO1: To inculcate research attitude on instructing the Advancement in Domination.

**CO2:** To introduce advance topics in Directed graphs and factorization of graphs.

**CO3:** To learn more about Coloring, Labeling and the theory of Domination numbers.

**CO4:** To get prior idea on preparing research articles for employability.

#### Unit - I:

Trees and Connectivity: Property – Vertex Arboricity- Connectivity and Edge connectivity – Mengers theorem

#### Unit - II:

Graph Coloring: Vertex coloring – Edge coloring – Map coloring and flows

#### Unit - III:

Matching, Factors and Decomposition: Matching and Independence in Graphs – Factorization and Decomposition

#### Unit - IV:

Graph operations – Graph Labeling Techniques –Labeling of Graphs– Rosa theorem on Eulerian Graph – Rosa theorem on Cycles.

#### Unit - V:

Domination in Graphs: Domination Number – Independent Domination Number – other domination parameters

#### **Text Book:**

- 1. G.Chartrand and L.Lesniak., **Graphs and Digraphs**, Chapman & Hall, CRC company, Boca Raton, Florida., 4<sup>th</sup> Edition, 2004.
- 2. Amit H.Roakad and Kalpesh M.Patadia, Various **Graph Labeling Techniques**, Rigi Publication, 2016.

Unit I - Chapter 3 : Section 3.1 to 3.4 (Text book 1)
Unit II - Chapter 8 : Section 8.1 to 8.3 (Text book 1)
Unit III- Chapter 9 : Section 9.1 & 9.2(Text book 1)
Unit IV- Chapter 9 : Section 9.3(Text book 1)
Chapter 3 & 4 (Text book 2)
Unit V - Chapter 10 : Section 10.1 to 10.3(Text book 1)

- 1. Gary Chartand, Ping Zhang, **Introduction to Graph theory**, Tata Macraw Hill Company Ltd, New Delhi, 2006.
- Russell Merris, Graph theory, Inter Science Publication, John Wiley & Sons, Inc, Newyork, Reprint, 2013.
- 3. Terasa W.Hayness Stephen T.Hedetniemi,Peter J.S,Fundamentals of Domination in Graphs, Marcel Dekke Inc, New York,1998.
- 4. F.Harary, Graph theory, Addison Wesley, Reading Mass, London, 1969.
- 5. Alison M.Marr and W.D.Wallis, Magic Graphs, Birkhauser, Second edition, 2013.
- 6. Jurai Bosak, Decomposition of Graphs, Kluwer Academic Publications, London, 1990.



Class	:	M.Phil (Mathematics )	Part III	: Elective
Semester	:	I	Hours	:06
Sub code	:1	8LMTE12	Credits	: 05

#### L<sup>P</sup> SPACES AND FOURIER TRANSFORMS

#### **Course Outcomes:**

**CO1:** To teach the characteristics of convex sets on L<sup>p</sup> spaces.

**CO2:** To learn about functions and the properties of Fourier Transforms.

**CO3:** To learn how the fourier transforms are applied in various fields.

**CO4:**To apply how the fourier series is extended to aperiodic signals in the form of fourier transform for employability.

#### Unit - I:

Topological vector space – Separation properties – Linear mappings – Finite Dimensional spaces.

#### Unit - II:

Metrization –Boundedness and continuity –Seminorms and local convexity – Quotient spaces.

#### Unit - III:

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

#### Unit - IV:

The Hahn – Banach theorems - weak topologies –compact convex sets – Vector-valued integration – Holomorphic function.

#### Unit - V:

Holomorphic Fourier Transforms – Two theorems of paley and wiener – Quasi – Analytic classess – The Denjoy – Carleman Theorem.

#### **Text Book:**

- 1. Walter Rudin, Functional Analysis, TMH edition, Sixteenth Reprint, 1992.
- 2. Walter Rudin, Real and Complex Analysis, MaGraw Hill Book Company, International Editing Third Edition, 1987.

Unit I : Chapter 1: Sections 1.1 to 1.23 (T1) Unit II : Chapter 1 : Sections 1.24 to 1.43 (T1) Unit III: Chapter2 : Sections 2.1 to 2.17 (T1) Unit IV:Chapter3 : Sections 3.1 to 3.24 (T1) Unit V : Chapter 19 : Sections 19.1 to 19.11(T2)

- 1. B.V.Limaye, **Functional Analysis** Revised second Edition New Age International Publishers, 2011.
- 2. Edward.R.E, Functional Analysis, Holt, Rinehart and Winston, New York.



Class	: M.Phil (Mathematics)	Part III	: Elective
Semester	: I	Hours	:06
Sub code	: 18LMTE13	Credits	: 05

#### STOCHASTIC PROCESS

#### **Course Outcomes:**

- **CO1:** To inculcate research attitude in Stochastic differential equations
- **CO2:** To develop the concepts of Markov Chains and Markov process.
- **CO3:** To introduce the Renewal process.
- **CO4:** To expose the students to the random processes for their subsequent study of analog and digital communication.

#### Unit - I :

Generating Functions – Laplace transform – Important properties of Laplace transforms – Difference equations – Differencial Difference equations – Matrix Analysis.

#### Unit - II:

Markov Chains : Definitions and Examples – Higher Transition probabilities – Generalization of independent Bernoulli Trials: Sequence of chain dependent trials – Classification of States and Chains – Determination of Higher Transition Probabilities – Stability of a Markov System – Graph theoretic approach.

#### Unit - III:

Markov process with Discrete State Space: Poisson process and its Extensions- Poisson process – Poisson process and Related Distributions – Generalizations of a Poisson process – Birth and Death process – Markov processes with Discrete state space.

#### Unit -IV:

Markov process with continous state space : Introduction – Brownian Motion – Wiener process – Differential Equations for a wiener process – kolmogorov Equations – First passage time distribution for wiener process- Ornstein Uhlenbeck process.

#### Unit -V:

Renewal process – Renewal processes in continuous Time – Renewal Equation – Stopping time : Wald's Equation – renewal Theorems

#### **Text Book:**

J.Medhi, Stochastic Process, New Age International Publishers, Third Edition, 2009.

Unit I - Chapter 1 : Section 1.1 to 1.2

Unit II - Chapter 2 : Section 2.1 to 2.7

Unit III - Chapter 3 : Section 3.1 to 3.5

Unit IV - Chapter 4: Section 4.1 to 4.6

Unit V - Chapter 6: Section 6.1 to 6.5

- Paul G.Hoel, Sidney C.Port, Charles J.Stone, Introduction to Stochastic Process, Haughton Mifflin Comp, 1972.
- 2. Sheldon M.Ross, Stochastic Process, Wiley India, Second Edition, 2011.



Class	: M.Phil (Mathematics)	Part III	: Elective
Semester	: I	Hours	:06
Sub code	: 18LMTE14	Credits	: 05
	FUZZY ALGEBRA		

#### **Course Outcomes:**

- **CO1:** To Study Fuzzy numbers, Fuzzy relations, Fuzzy homomorphisms on single and double sets.
- CO2: To develop the concepts of Fuzzy relations and Fuzzy normal subgroups.
- **CO3:** To develop its applications.
- **CO4:** To design fuzzy logic based controllers and explore their unique characteristics.

#### Unit - I:

Fuzzy sets – Basic types – Fuzzy sets – Basic concepts – Additional properties of  $\alpha$  - cuts – Representation of Fuzzy sets – Extension principle for Fuzzy sets – Types of operations – Fuzzy complements.

#### Unit -II:

Fuzzy numbers – Linguistic variables – arithmetic operations on intervals – arithmetic operation on fuzzy numbers, fuzzy equations

#### Unit -III:

Fuzzy relation – Crisp versus fuzzy relations – projections and cylindrical Extensions – Binary fuzzy relations on a single set – Fuzzy equivalence relations – Fuzzy compatibility relations – Fuzzy ordering relations, fuzzy morphisms

#### Unit - IV:

Definition of fuzzy subgroups - Examples and properties - Union of two fuzzy subgroups

- Fuzzy subgroups generated by a fuzzy subsets - Fuzzy Normal subgroups

#### Unit - V:

Fuzzy normal subgroups under homomorphisms – characteristics subgroups – Fuzzy conjugate sub groups – Fuzzy Sylow subgroups

#### **Text Book:**

- George J.Klir and B.Yuan, Fuzzy set, Fuzzy logic Theory and Applications, Prentice Hall of India, Second Edition, 2008.
- 2. Rajesh kumar, Fuzzy Algebra Vol I, University of Delhi, Publication Division, 1993.

#### Chapters: 1, 2, 3, 4, 5 from text book 1 Chapters: 1, 2 from text book 2

- Unit I Chapter 1 : Section 1.2 to 1.4 from text 1 Chapter 2 : Section 2.1 to 2.3 from text 1
- Unit II Chapter 3 : Section 3.1 to 3.2 from text 1 Chapter 4 : Section 4.1 to 4.6 from text 1
- Unit III Chapter 5 : Section 5.1 to 5.8 from text 1
- Unit IV Chapter 1 : Section 1.2.16 to 1.2.21 from text 2 Chapter 2 : Section 2.1 to 2.3.3 from text 2
- Unit V Chapter 2: Section 2.3.4 to 2.4 from text 2

- H.J.Zimmer Mann, Fuzzy set theory and its applications, Springer International Ltd, Fourth Edition, 2006.
- John.N.Mordeson and T.S.Malik, Fuzzy Competitive Algebra, World Scientific Publishing Com Pvt.Ltd,1998.



Class	: M.Phil (Mathematics)	Part III	: Core
Semester	: I	Hours	:10
Sub code	: 18LMTD21	Credits	:08+02

#### **Dissertation and Viva Voce**

# Evaluation of the Dissertation and Viva-Voce shall be made jointly by the research supervisor and the External Examiner.

Dissertation M.Phil

Maximum Marks	:	200 Marks
Evaluation of the Dissertation	:	150 Marks
Viva-Voce	:	50 Marks