

SRI KALISWARI COLLEGE,SIVAKASI

(An Autonomous Institution, Affiliated to Madurai Kamaraj University,

Reaccredited with 'A' Grade by NAAC with CGPA 3.30)

DEPARTMENT OF MATHEMATICS



Programme Scheme of Examinations and Syllabi

(with effect from June, 2015)

Research Programme – M.Phil. (Mathematics)

Programme Outcome (PO) for M.Phil Programmes

Knowledge

PO 1: Research Oriented knowledge and updated acumen.

PO 2: Application of research on emerging recent trends.

Skills

PO 1: Contribution to research culture through publications.

PO 2: Ability to take up Minor/ Major research projects

Attitude

PO 1: Technological Competency for global needs.

PO 2: Competency to address latest socio economic issues.

Programme Specific Outcome

- Enables the students to obtain advanced knowledge in a specialized field.
- Engages in life-long learning through self-study, continuing education or doctoral level studies.
- Work as mathematical professionals, or are qualified for a training as scientific researcher.

Sri Kaliswari College (Autonomous)-Sivakasi
Department of Mathematics
Choice Base Credit System- Curriculum Pattern
Research Programme – M.Phil - [Mathematics]
2015-2016

Course code	Course Name	Hours	Credits
Semester I			
15HMAC11	Core – I : Research Methodology	6	5
15HMAC12	Core – II : Commutative Algebra	6	5
Major Elective I		6	5
15HMAO11	1. Algorithmic Graph Theory		
15HMAO12	2. Advanced Analysis		
15HMAO13	3. Fuzzy Topology		
15HMAO14	4. Stochastic Processes		
15HMAO15	5. Advanced Complex Analysis		
	TOTAL	18	15
Semester II			
15HMAJ21	Project	-	5

Semester	I	II	Total
Credits	15	5	20

Sri Kaliswari College (Autonomous) – Sivakasi
Choice Based Credit System
Research Programme - M. Phil Mathematics - 2015-2016
Semester I

Core-I : Research Methodology – 15HMAC11 Duration :90 Hrs
Credits : 5

Aim and Objectives:

- To empower scholars with Research Methodology.
- To initiate students into the realm of Mathematical research
- To study the use of Latex for preparing project report
- To know the preliminaries of domination in Graph Theory
- To know the basic ideas of Algebraic Topology

Course Outcome :

- Present basic idea of objectives of Research and its types.
- Familiar with the basic concepts of Research Methods versus methodology.
- Gain knowledge of Survey of Literature, Journals, Periodicals, Patents and Abstracts.
- Demonstrate concepts of Serials and Monographs.
- Learn about the idea of publishing research articles in mathematics.
- Demonstrate ability to work within Thesis Layout.
- Know about Editors in latex and Texnic center.
- Present the idea of Converting an article to a presentation.
- Study about Elementary properties of dominating sets in graphs.
- Inculcate the insight knowledge of Algebraic Topology

Unit I

(18 Hrs)

Meaning of Research – Objectives of Research – Motivation of Research – Types of Research – Research Methods versus methodology – Research Process – Technique involved in defining the problem – Survey of Literature – Journals – Periodicals – Patents – Abstracts – Reviews

Unit II

(18 Hrs)

Treatises – Serials – Monographs – Science citation index – Publishing research articles in Mathematics – Thesis Layout – Preliminaries – Title Pages – Certificates – Declaration –

Abstracts – Preface – Acknowledgments – Table of contents – List of Tables – Figures and symbols – Text of the thesis.

Unit III

(18 Hrs)

Sample files – Editing cycle – The key board – your first note-lines too wide-more text features – Editors in latex – Latex editor – Texnic center – Bokama tex – Texcad – A note with math – Errors in math – Building blocks of a formula – Displayed formulas – The anatomy of an article – An article template using latex – Converting an article to a presentation.

Unit IV

(18 Hrs)

Elementary properties of dominating sets in graphs – Bounds on the Domination number – Bounds in terms of order – Bounds in terms of order, Degree and Packing – Bounds in terms of order and Size – Bounds in terms of Degree, Diameter and Girth – Bounds in terms of Independence and Covering.

Unit V

(18 Hrs)

Algebraic Topology – Homotopy of Paths – The Fundamental Group.

Text Books:

1. Abdul Rahim , “Thesis writing a manual for Researchers,”, New Age International Ltd., New Delhi, 1996.
2. Kothari. C.R , “Research Methodology (Methods and Techniques),”, Wiley Eastern Ltd., New Delhi, 2002.
3. Teresa W. Haynes, Stephen T. Hedetniemi and Peter J. Slater, “Fundamentals of Domination in Graphs”, 1998
4. Waliker H.B., Acharya B.D. and Sampathkumar E., “Recent Development in the theory of Domination in Graphs”, 1979.
5. George Gratzler, “More Math into Latex (4th edition)
6. James R. Munkres, “Topology” , Prentice Hall of India Private Limited, New Delhi, Second Edition

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Semester I

Core –II : Commutative Algebra – 15 HMAc12

Duration: 90 Hours

Credits : 5

Aim and Objectives:

- To study the operations on ideals
- To know the Tensor product of modules and of Algebras
- To study about Noetherian rings and Artin rings

Course Outcome :

- Inculcate the basic knowledge of Rings and Ideals.
- Learn the concept of Zero divisors, Nilpotent elements, Prime ideals and Maximal ideals.
- Explain the concept of Nil radical and Jacobson radical.
- Develop the idea of Modules and module homomorphisms.
- Gain knowledge of Sub modules and quotient modules.
- Understand Tensor product of modules and its exactness properties.
- Understand the concept of modules of fractions and its local properties.
- Learn about first and second uniqueness theorems.
- Gain an in-depth knowledge of integral domains and valuation rings.
- Introduce new algebraic structures namely Noetherian rings and Artin rings.

Unit I

(18 Hrs)

Rings and ring homomorphisms – Ideals – Quotient rings – Zero divisors – Nilpotent elements – Units – Prime ideals and Maximal ideals - Nilradical and Jacobson radical – Operations on ideals - Extension and Contraction.

Unit II

(18 Hrs)

Modules and module homomorphisms – Submodules and quotient modules – Operations on submodules – Direct sum and product – Finitely generated modules – Exact sequences –

Tensor product of modules – Restriction and extension of scalars – Exactness properties of the Tensor product – Algebras – Tensor product of Algebras.

Unit III

(18 Hrs)

Rings and modules of fractions – Local properties – Extended and contracted ideals in rings of fractions - Primary decomposition - First and second uniqueness theorems.

Unit IV

(18 Hrs)

Integral dependence – The going-up theorem – Integrally closed-Integral domains – The going-down theorem – Valuation rings – Chain conditions – Composition series of modules.

Unit V

(18 Hrs)

Noetherian rings – Hilbert’s basis theorem – Primary decomposition in Noetherian rings – Artin rings – Structure theorem for Artin rings.

Text Book:

Atiyah, M.F and Macdonald, I.G, “Introduction to commutative Algebra (1969)”, Addison Wesley Publishing Co., New Delhi.

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Research Programme - M. Phil Mathematics - 2015-2016
Semester I

Major Elective - I : Algorithmic Graph theory – 15 HMAO41 Duration: 90 Hrs
Credits : 5

Aim and Objectives:

- To study algorithms in Graph Theory
- To introduce characteristics of Hamiltonian Graphs and Eulerian Graphs

Course Outcome :

- Provide a formal introduction to the concept of Algorithmic complexity.
- Introduce the concept of NP.
- Learn about the Sorting algorithms and Greedy algorithms
- Gain knowledge of trees and its properties.
- Explain the tool for finding Blocks.
- Evaluate the Distance in Graphs and weighted Graphs.
- Gain an insight knowledge into the concept of matchings.
- Get the idea of maximum matchings in general Graphs and in bipartite graphs also.
- Introduce the concept of Hamiltonian Graphs and its Characterizations.
- Gain the knowledge about Eulerian Graphs and its Characterizations.

Unit I

(18 Hrs)

Algorithmic complexity – Search algorithms – Sorting algorithms – Introducing NP – Completeness – Greedy algorithms – Representing Graphs in Computer.

Unit II

(18 Hrs)

Properties of trees – Rooted Trees – Depth first search – A tool for finding Blocks – Breadth first search – The minimum spanning tree problem.

Unit III

(18 Hrs)

Distance in Graphs - Distance in weighted Graphs – The centre and median of a Graph – Activity digraphs and critical paths – Error correcting codes.

Unit IV

(18 Hrs)

An introduction to matching – Maximum Matchings in bipartite Graphs - Maximum Matchings in general Graphs - Factorizations

Unit V

(18 Hrs)

An introduction to Hamiltonian Graphs – Characterizations of Hamiltonian Graphs – An introduction to Eulerian Graphs – Characterizing Eulerian Graphs

Text Book:

Chartrand, G. and Oellerman, O.R, “Applied and Algorithmic Graph Theory, 1993”, MC-Graw Hill Inc., Newyork.

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Semester I

Major Elective – I : Advanced Analysis – 15HMAO12 Duration : 90 Hrs
Credits : 5

Aim and Objectives:

- To study separation properties of a topological vector space
- To know the basic properties of spectra
- To know about bounded operators

Course Outcome :

- Explain the fundamental concepts of advanced analysis such as topology and Lebesgue integration and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced analysis techniques.
- Apply problem-solving using advanced analysis techniques applied to diverse situations in physics, engineering and other mathematical contexts.
- Prove important theorems, such as the Intermediate Value Theorem, Rolle's Theorem and Mean Value Theorem, and will continue the study of power series and their convergence.
- Apply limiting properties to describe and prove continuity and differentiability conditions for real and complex functions.
- Able to solve unseen mathematical problems in real analysis.
- Gain knowledge about the interdependency of different areas of mathematics, as well as connections between mathematics and other disciplines.

Unit I

(18 Hrs)

Topological vector space – Types of topological vector spaces – Separation properties – Linear mappings – Finite dimensional spaces – Metrization – Boundedness and continuity – Seminorms and local convexity.

Unit II

(18 Hrs)

Banach algebra – Complex homomorphism – Basic properties of spectra – Gelfand Mazur theorem – The group of invertible elements – Lomonosov’s invariant subspace theorem.

Unit III

(18 Hrs)

Ideals and homomorphisms – Wiener’s lemma – Gelfand transforms – Involutions – Gelfand-Naimark theorem - Applications to Noncommutative Algebras.

Unit IV

(18 Hrs)

Basic facts – Bounded operators – A commutativity theorem – Resolutions of the Identity – The spectral theorem.

Unit V

(18 Hrs)

Unbounded operators – Graphs and symmetric operators – The cayley transform – The deficiency indices.

Text Book:

W.Rudin, “Functional Analysis”, Tata MC-Graw Hill Co. Ltd., New Delhi, 2007

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Research Programme - M.Phil Mathematics -2015-2016
Semester I

Major Elective – I : Fuzzy Topology – 15HMAO13

Duration: 90 Hours

Credits : 5

Aim and Objectives:

- To introduce Fuzzy relations
- To know Fuzzy Topological spaces
- To study separation axioms in Fuzzy Topological spaces

Course Outcome:

- Gain knowledge about the concept of subsets of Euclidean space are homeomorphic by constructing a homeomorphism.
- Use the definitions of the subspace topology, the product topology and the quotient topology,
- Understand the use and proof of their universal properties and be familiar with standard examples such as topological surfaces
- Understand whether or not a topological space is Hausdorff.
- Familiarize the basic properties of Hausdorff spaces and their proofs;
- Determine whether a collection of subsets of a set determines a topology;
- Understand whether or not a subset of a topological space is compact and be familiar with the basic properties of compact subsets and their proofs.
- Understand of the basic mathematical elements of the theory of fuzzy sets.
- Gain knowledge of important parts of fuzzy set theory, which will enable them to create effective mathematical models.

Unit I

(18 Hrs)

Fuzzy set Theory - Sets and subsets – Fuzzy subsets – Basic operations on Fuzzy subsets – Graphical representation of some terms – concept of Uncertainty – Support of a Fuzzy set and r-cut or r-level – Types of Fuzzy sets – Different types of Fuzzy sets – Further operations on Fuzzy sets – t-norms and t-conorms or s-norms – The extension principle and application – Operations for type 2 Fuzzy sets – Algebraic operations with Fuzzy numbers and arithmetic.

Unit II**(18 Hrs)**

Fuzzy relations and Fuzzy graphs – Fuzzy relations – Projects of a Fuzzy relation - Fuzzy graph – Fuzzy network.

Unit III**(18 Hrs)**

Fuzzy Topological spaces – Fuzzy Topology – Intuitionistic Fuzzy Topological spaces – Induced Fuzzy Topological spaces – Lower semi continuous function – Induced Fuzzy Topological spaces.

Unit IV**(18 Hrs)**

Connectedness in Fuzzy Topological space – Fuzzy separated sets – Fuzzy connectedness – Some stronger and weaker form of Fuzzy connectedness.

Unit V**(18 Hrs)**

Separation axioms – Fuzzy Separation axiom- Unification of Fuzzy Separation axiom.

Text Book:

Anjan Mukherjee & S. Bhattacharya Halder , “Fuzzy Set and Fuzzy Topology”, Narosa Publishing House, New Delhi.

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Semester I

Major Elective – I : Stochastic Processes

Duration : 90 Hrs
Credits : 5

Aim and Objectives:

- To enrich the knowledge of applied probability and applied stochastic processes.
- To introduce non negative integral valued random variables and generating functions.
- To know about Markov chain.

Course Outcome :

- Apply the specialised knowledge in probability theory and random processes to solve practical problems.
- Gain advanced and integrated understanding of the fundamentals of and interrelationship between discrete and continuous random variables and between deterministic and stochastic processes.
- Analyse the performance in terms of probabilities and distributions achieved by the determined solutions.
- Demonstrate essential stochastic modelling tools like Markov chains.
- Evaluate the n-step transition probability.
- Learn about renewal theory.
- Demonstrate the transition function
- Know about the Birth – Death and Yule process
- Study the properties of Poission process and their characterization.
- Understand the relationship between the purpose of a model and the appropriate level of complexity and accuracy.

Unit I

(18 Hrs)

Probability Distributions - Generating functions – Laplace transforms – Laplace (Stieltjes) transform of a probability distribution or of a random variable - Stochastic processes – Introduction – Specification of stochastic processes – Stationary processes.

Unit II

(18 Hrs)

Markov Chains - Definition and examples – Higher transition probabilities – Generalisation 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 - Markov chain with denumerable number of states.

Unit III

(18 Hrs)

Markov Processes with Discrete State Space : Poisson process and its extension - Poisson Process – Poisson Process and Related Distributions – Generalisations of Poisson Process – Birth and Death Process – Markov Processes with Discrete State Space (Continuous Time Markov Chains) – Erlang process.

Unit IV

(18 Hrs)

Markov Processes with continuous State Space - Brownian motion - Wiener process – Differential equations for a Wiener process - Kolmogorov equations – First passage Time Distribution for Wiener process.

Unit V

(18 Hrs)

Stochastic processes in queueing and reliability – Non-birth and death queueing processes: Bulk queues – Network of Markovian queueing system – Non-Markovian queueing models – The model GI/M/1 - The model M/G(a,b)/1

Text Book:

J. Medhi, “Stochastic processes”, New age international (P) limited, publishers, Second edition, Reprint 2004.

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Semester I

Major Elective – I : Advanced Complex Analysis – 15HMAO15

Duration : 90 Hrs

Credits : 5

Aim and Objectives:

- To know explicit representations of elementary transcendental functions and other specific functions
- To handle more difficult case of multiply connected regions

Course Outcome :

- Explain the fundamental concepts of complex analysis and their role in modern mathematics and applied contexts
- Demonstrate accurate and efficient use of complex analysis techniques.
- Introduce the concept of analytic function, rational function etc.,
- Gain an insight into the sequence of analytic functions using Weierstrass theorem.
- Learn about Riemann mapping theorem in the complex plane.
- Evaluate the conformal mappings of doubly connected regions and regions of finite connectivity
- Get the idea of simply connectedness and its equivalent conditions
- Understand the significance of analytic automorphisms of regions in the complex plane
- Present the idea of Univalent functions defined on the open unit disc.
- Explain the brief history of the Bieberbach conjecture and its solution

Unit I

(18 Hrs)

Introduction- Weierstrass theorem for sequence of analytic functions – Riemann mapping theorem

Unit II

(18 Hrs)

Conformal mappings of doubly connected regions and regions of finite connectivity

Unit III**(18 Hrs)**

Simply connectedness and Equivalent conditions

Unit IV**(18 Hrs)**

Analytic automorphisms of regions in the complex plane

Unit V**(18 Hrs)**

Univalent functions defined on the open unit disc - A brief history of the Bieberbach conjecture and its solution

Text Book :V.Karunakaran, "Complex Analysis" , Narosa Publications, New Delhi, 2nd Edition.