Sri Kaliswari College (Autonomous), Sivakasi

(Affliated to Madurai Kamaraj University,

Re-Accredited with 'A' grade (CGPA 3.30) by NAAC)

Programme Scheme, Scheme of Examinations and Syllabi

(For those who join from June 2018 and afterwards)

Department of Mathematics

Research Programme – M.Phil

Curriculum Design and Development Cell

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
M.Phil. Mathematics (Semester) – (2018-2019)
Objectives, Outcomes, Regulations

Programme Objectives:

- To initiate students into the realm of Mathematical research.
- To prepare the students for better employment of research in Mathematics.

Programme Outcomes:

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 Outcomes:

- 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.

Duration of the Programme: One year (Equivalent to two semesters)

Eligibility:

Candidate should have passed M.Sc., Mathematics or any other degree accepted by the Syndicate of the Madurai Kamaraj University as its equivalent.

Medium of Instruction : English

Age Limit : No age limit

Transitory Permission:

Students joined from 2018 to 2020 may be permitted to write their examinations in this pattern up to April 2023.

Sri Kaliswari College (Autonomous), Sivakasi
Choice Based Credit System
Department of Mathematics
Research Programme – M.Phil.
2018 - 2019
Scheme of Examination/ Question Paper Pattern

Theory Examination

The Internal and External marks should be allotted in the ratio 40:60.

Internal Marks:

i. Test	: 25 Marks (Average of two tests)
ii. Assignment	: 5 Marks (Average of two)
iii. Seminar / Group Discussion/ Peer-Team Teaching	: 10 Marks
Total	**: 40 Marks**

External Question Paper Pattern:

Time: 3 Hours Max .Marks:60

The question paper for external exam will have two parts.

Part – A (5 x 6 = 30)

(Choosing either (a) or (b) pattern – Alternative Choice - One Question from each unit.)

Question No.
1. (a) or 1. (b) – From Unit I
2. (a) or 2. (b) – From Unit II
3. (a) or 3. (b) – From Unit III
4. (a) or 4. (b) – From Unit IV
5. (a) or 5. (b) – From Unit V

Part – B (3 x 10 = 30)

Answer any three out of five. (One Question from each unit)
Question No.6 – 10.

6 - From Unit I
7 - From Unit II
8 – From Unit III
9 – From Unit IV
10 – From Unit V

Summative exam questions are to be according to the following pattern

- Knowledge based - 30 %
- Understanding - 50 %
- Higher Objective (Applications and Skill based) - 20 %

Project

Internal	- 75 Marks
External	- 75 Marks
Viva – Voce	- 50 Marks
Total	**- 200 Marks**

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
Choice Base Credit System- Curriculum Structure
Research Programme – M.Phil Mathematics
2018-2019

Courses	Sem I	Sem II	Total Credits
Core Courses	12(10)	-	10
Elective Courses	6(5)	-	5
Project	-	- (5)	5
Total hours(per week)	18	-	20

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
Choice Base Credit System- Curriculum Pattern
Research Programme – M.Phil Mathematics
2018 - 2019

Semester	Course Code	Course Name	Hours	Credits
I	18HMAC11	**Core Course – I** : Research Methodology	6	5
	18HMAC12	**Core Course – II :** Commutative Algebra	6	5
	Major Elective Course:		6	5
	18HMAO11	1. Advanced Analysis		
	18HMAO12	2. Fuzzy Topology		
	18HMAO13	3. Advanced Complex Analysis		
II	18HMAJ21	Project	-	5

Semester	I	II	Total
Credits	15	5	20

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
Research Programme - M. Phil
Semester I
(2018 – 2019)
Core Course – I: Research Methodology (18HMAC11)
(For those who join from June 2018 and afterwards)

Credits : 5 **Int. Marks : 40**
Hours/Week : 6 **Ext. Marks : 60**
Duration : 90 hrs **Max. Marks: 100**

Course Objectives:

- 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 Outcomes:

1. Ability to critically evaluate current research and propose possible alternate directions for further work.
2. Ability to develop hypothesis and methodology for research.
3. Ability to comprehend and deal with complex research issues in order to communicate their scientific results clearly for peer review.
4. A capability to contribute to research and development work.
5. Able to prepare presentation using LaTeX and write mathematical documents via LaTeX.
6. Understand the concepts of domination, independence and covering in graphs.
7. Understand the concept of homotopy and know its basic properties

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UNIT I **(18 hrs)**

Research Methodology: An Intoduction: Meaning of Research – Objectives of Research – Motivation of Research – Types of Research – Research Methods versus Methodology – Research Process. **Defining the Research Problem:** 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 Page – Certificates – Declaration – Abstracts – Preface / Acknowledgments – Table of Contents – List of Tables – List of Figures and Symbols – Text of the Thesis.

UNIT III **(18 hrs)**

Your LATEX: Sample Files – Editing Cycle. **Typing Text:** The Key Board – Your first note – Lines too wide – More Text Features – Editors in Latex – Latex Editor – Texnic Center – Bokama Tex – Texcad. **Typing math:** A Note with Math – Errors in Math – Building Blocks of a Formula – Displayed Formulas. **Your first Article and Presentation:** The Anatomy of an Article – An Article Template – On using Latex – Converting an Article to a Presentation.

UNIT IV **(18 hrs)**

Introduction – Dominating Queens – Dominating sets in Graphs – Sets of Representatives – An Introduction to NP-Completeness – NP-Completeness of the Domination Problem. **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)**

The Fundamental Group: Homotopy of Paths – The Fundamental Group.

Text Books:

1. Kothari. C.R, "Research Methodology (Methods and Techniques)", New Age International (P) Ltd., Publishers, New Delhi, 2006.
2. F.Abdul Rahim, "Thesis Writing - A Manual for Researchers", New Age International (P) Ltd., Publishers, New Delhi, 1996.
3. George Gratzer, "More Math into Latex", Vol. I, Spinger Science + Business Media, 4th edition, 2007.
4. Teresa W. Haynes, Stephen T. Hedetniemi and Peter J. Slater, "Fundamentals of Domination in Graphs - Vol I", Marcel Dekker, INC., New York, 1998.
5. James R. Munkres, "Topology (Second Edition)", Prentice Hall of India Private Limited, New Delhi, 2000.

Unit	Text Book No.	Chapter	Section	Page No.
I	1	1	-	1-4, 7,8, 10-20
		2	-	27-29
II	2	1	-	4-7
III	3	1	1.2, 1.3	4-5
		2	2.1-2.4	7-15
		3	3.1-3.4	17-33
		4	4.1-4.4	35-56
IV	4	1	1.1-1.3, 1.11,1.12	15-21, 30-36
		2	2.1-2.5	41-60
V	5	9	51, 52	321-334

Reference Books:

1. Dr. Bindrawan Lal, "Research Methodology", ABD Publishers, Jaipur, 2002.
2. Waliker H.B., Acharya B.D. and Sampathkumar E., "Recent Developments in the theory of Domination in Graphs and Its Applications", New Katra Allababad.
3. Gray Chartrand, Ping Zhang, "Introduction to Graph Theory", McGraw Hill Education (India) Private Limited, New Delhi, 2015.
4. Sheldon and W. Davis, "Topology", Tata McGraw - Hill Publishing Company Limited, New Delhi, 2006.

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
Research Programme - M. Phil
Semester I
(2018 – 2019)
Core Course – II: Commutative Algebra (18HMAC12)
(For those who join from June 2018 and afterwards)

Credits : 5 **Int. Marks : 40**
Hours/Week : 6 **Ext. Marks : 60**
Duration : 90 hrs **Max. Marks: 100**

Course 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 Outcomes:

1. Provide a common generalization of the primes of arithmetic and the points of geometry.
2. Gain knowledge in prime ideal which is the central notion of Commutative Algebra.
3. Learn about projective modules and its elementary properties.
4. Demonstrate localization and some of its applications to projective modules.
5. Develop knowledge on integral extensions which includes the results such as going-up theorem and going-down theorem.
6. Study the basic properties of Noetherian rings and Artin rings.
7. Present basic results on Commutative Algebra necessary for elementary Algebraic Geometry.

UNIT I **(18 hrs)**

Rings and Ideals: 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: 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 and Valuations: 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:

M.F. Atiyah and I.G Macdonald, "Introduction to Commutative Algebra", Addison Wesley Publishing Company, New Delhi.

Unit	Chapter	Page No.
I	1	1 - 10
II	2	17 - 31
III	3	36 - 43
	4	50 – 54
IV	5	59 – 67
	6	74 – 78
V	7	80 – 84
	8	89 - 91

Reference Books:

1. Balwant Singh, "Basic Commutative Algebra", Cambridge University Press India Pvt. Ltd., New Delhi, 2013.
2. N.S. Gopalakrishnan, "Commutative Algebra" ,Oxonian Press Pvt. Ltd., New Delhi.

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
Research Programme – M.Phil
Semester I
(2018 - 2019)
Major Elective Course: Advanced Analysis (18HMAO11)
(For those who join from June 2018 and afterwards)

Credits : 5 **Int.Marks : 40**
Hours/Week: 6 **Ext.Marks : 60**
Duration : 90 hrs **Max.Marks:100**

Course Objectives:

- To study separation properties of topological vector spaces.
- To know the basic properties of spectra.
- To know about bounded operators.

Course Outcomes:

1. Understand the concept of continuity and boundedness of linear maps.
2. Inculcate an insight into Banach algebras.
3. Acquire knowledge about the group of invertible elements.
4. Demonstrate the main results on commutative Banach algebras.
5. Analyze the applications of noncommutative algebras.
6. Develop a sound knowledge and appreciation of the ideas and concepts related to bounded operators on a Hilbert space.
7. Demonstrate the concept of the Cayley transform.

UNIT I **(18 hrs)**

Topological Vector Spaces: Topological Vector Spaces - 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 Algebras: Introduction – Complex Homomorphisms – Basic Properties of Spectra – Gelfand Mazur Theorem – The Group of Invertible Elements – Lomonosov's Invariant Subspace Theorem.

UNIT III **(18 hrs)**

Commutative Banach Algebras: Ideals and Homomorphisms –Homomorphisms and Quotient Algebras – Wiener's Lemma – Gelfand Transforms – Involutions – Gelfand-Naimark Theorem – Applications to Noncommutative Algebras.

UNIT IV **(18 hrs)**

Bounded Operators on a Hilbert Space: Basic Facts – Bounded Operators – A Commutativity Theorem – Resolutions of the Identity – The Spectral Theorem.

UNIT V **(18 hrs)**

Unbounded Operators: Introduction – Graphs and Symmetric Operators – The Cayley Transform – The Deficiency Indices.

Text Book:

Walter Rudin, "Functional Analysis", McGraw Hill Education (India) Private Limited, New Delhi, Second Edition, 2013.

Unit	Chapter	Section	Page No.
I	1	1.6 – 1.39	7 - 30
II	10	10.1 -10.20, 10.34, 10.35	245 -258, 267-271
III	11	11.1 - 11.29	275 - 296
IV	12	12.1 - 12.23	306 -325
V	13	13.1 - 13.21	347 - 360

Reference Books:

1. Balmohan V Limaye, "Functional Analysis", New Age International (P) Limited, Publishers, New Delhi, Third Edition, 2017.
2. G. F. Simmons, " Introduction to Topology and Modern Analysis", Tata McGraw Hill Publishing Company Limited, New Delhi, 2007.

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
Research Programme - M. Phil
Semester I
(2018 – 2019)
Major Elective Course: Fuzzy Topology (18HMAO12)
(For those who join from June 2018 and afterwards)

Credits : 5 **Int. Marks : 40**
Hours/Week : 6 **Ext. Marks : 60**
Duration : 90 hrs **Max. Marks: 100**

Course Objectives:

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

Course Outcomes:

1. Able to learn fuzzy set theory.
2. Gain Knowledge about fuzzy relations and fuzzy graphs.
3. Gain knowledge about the fundamental concepts of fuzzy topological space.
4. Understand the relationships between Intuitionistic fuzzy topological spaces and induced fuzzy topological spaces.
5. Gain knowledge about fuzzy separation axioms.

UNIT I **(18 hrs)**

Fuzzy Set Theory: Introduction - 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:** Introduction - Different Types of Fuzzy Sets – Further Operations on Fuzzy Sets – t-norms and t-conorms or s-norms – The Extension Principle and Application – Oprations for Type 2 Fuzzy Sets – Algebraic Operations with Fuzzy Numbers and Arithmetic.

UNIT II **(18 hrs)**

Fuzzy Relations and Fuzzy Graphs: Introduction - Fuzzy Relations – Projects of a Fuzzy Relation - Fuzzy Graph – Fuzzy Network.

UNIT III **(18 hrs)**

Fuzzy Topological Spaces: Introduction - Fuzzy Topology – Intuitionistic Fuzzy Topological space .**Induced Fuzzy Topological spaces:** Introduction - Lower Semi Continuous Function – Induced Fuzzy Topological Spaces.

UNIT IV **(18 hrs)**

Connectedness in Fuzzy Topological Space: Introduction - Fuzzy Separated Sets – Fuzzy Connectedness – Some Stronger and Weaker Form of Fuzzy Connectedness.

UNIT V **(18 hrs)**

Separation Axioms: Introduction - **Fuzzy** Separation Axiom- Unification of Fuzzy Separation Axiom.

Text Book:

Anjan Mukherjee and Bhattacharya Halder. S, "Fuzzy Set and Fuzzy Topology", Narosa Publishing House PVT. LTD, New Delhi, 2008.

Unit	Chapter	Section	Page No.
I	1	1.1 - 1.7	1.1 - 1.10
	2	2.1 - 2.7	2.1 - 2.14
II	3	3.1 - 3.5	3.1 - 3.17
III	4	4.1- 4.3	4.1 - 4.8
	5	5.1 - 5.3	5.1 - 5.8
IV	6	6.1 - 6.4	6.1 - 6.20
V	7	7.1 - 7.3	7.1 - 7.15

Reference Books:

1. Dr. Sudhir K. Pundir, Dr. Rimple Pundir, "Fuzzy Sets and Their Applications", Pragati Prakashan Educational Publishers, Meerut, 2013.
2. N. Palaniappan, "Fuzzy Topology (Second Edition)", Narosa Publishing House, New Delhi, 2006.

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
Research Programme – M.Phil
Semester I
(2018 - 2019)
Major Elective Course: Advanced Complex Analysis (18HMAO13)
(For those who join from June 2018 and afterwards)

Credits : 5 **Int.Marks : 40**
Hours/Week: 6 **Ext.Marks : 60**
Duration : 90 hrs **Max.Marks:100**

Course Objectives:

- To know explicit representations of elementary transcendental functions and other specific functions.
- To study about doubly connected regions.

Course Outcomes:

1. Acquire knowledge about Weierstrass theorem.
2. Inculcate an insight into Riemann mapping theorem.
3. Learn about the basic properties of conformal mapping.
4. Demonstrate the main results on regions of finite connectivity.
5. Analyze the properties of simply connectedness.
6. Develop a sound knowledge and appreciation of the ideas and concepts related to analytic automorphisms of regions in the complex plane.
7. Know about the Bieberbach conjecture and its solution.

UNIT I **(18 hrs)**

Riemann Mapping Theorem: 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 Publishing House , New Delhi, Second Edition, 2006.

Unit	Chapter	Section	Page No.
I	5	5.1.1 – 5.1.14	333 – 342
II	5	5.3	356 – 365
III	5	5.4	365 – 371
IV	5	5.5	371 – 382
V	5	5.6, 5.7	383 – 406

Reference Books:

1. Walter Rudin, " Real and Complex Analysis", McGraw Hill Book Company, Singapore, Third Edition.
2. Lars V.Ahlfors ,"Complex Analysis", McGraw Hill Book Company, New Delhi, Third Edition.

Sri Kaliswari College (Autonomous), Sivakasi
Department of Mathematics
Research Programme – M.Phil
Semester II
(2018 - 2019)
Project (18HMAJ21)
(For those who join from June 2018 and afterwards)

Credits : 5

Course Objectives:

- To enable students understand the purpose and importance of research in Mathematics.
- To plan and carry out research work by conducting review, collecting materials, and find the results by applying different critical theories.

Course Outcomes:

1. Get familiarized with basic concepts of research.
2. Identify and state the research topic.
3. Design and conduct research study accordance with the identified research need.
4. Develop skill to search online and offline sources to carryout research.
5. Assess ways to collect, compile and conduct a data analysis.
6. Appropriately document the data collected.
7. Apply academic skills to present the research study findings in a formal academic oral presentations and a written research paper.

Project work:

- Each learner can select for his/her research project any one of the areas of Mathematics in consultation with his/her guide and the Head of the Department.
- The project dissertation should be submitted to the Principal through the Head of the Department of Mathematics one week prior to the commencement of the summative examination. If a candidate fails to submit his/her project report on the date presented above, he/she may be permitted to submit the same 4 days prior to the date of viva-voce examination with a fine as prescribed by the college.
- Each learner shall submit 2 copies of his/her project dissertation for valuation.
- The project dissertation shall contain at least 50 pages excluding bibliography and appendices.
- The project dissertation shall be valued for a total of 150 marks out of which 75 is internal mark and 75 is external mark and sum of the two is taken for 150.
- The viva-voce carries 50 marks and it will be conducted jointly by the guide and the external examiner.
- For a pass in this course as a whole, a learner should secure at least 50% marks in project dissertation and viva-voce put together.