

ETHIRAJ COLLEGE FOR WOMEN

(AUTONOMOUS)

CHENNAI-600 008

DEPARTMENT OF MATHEMATICS

(Aided)

SYLLABUS

(Effective from the academic year 2015-16)

ETHIRAJ COLLEGE FOR WOMEN
(AUTONOMOUS)
CHENNAI- 600 008

M.Phil., Mathematics

SYLLABUS

To be offered from the Academic Year

2015-16

Ethiraj College for Women (Autonomous)

Department of Mathematics

Revised Syllabus with effect from June 2015

Preamble

As per the guidelines given by the University Grants Commission and the Tamil Nadu State Council for Higher Education, the M.Phil degree program is designed in such a way to have a foundation in discrete and continuous Mathematics; a Mathematical attitude towards problem formulation and solving; an analytical skill and desire for correctness; an appreciation of the approaching of Mathematical techniques; the programming skill at higher level computer language and research aptitude to Mathematics.

Objectives of the course

- To provide the student a firm grip on all the facets of pure and applied mathematics and inculcate the student an ardor for mathematical knowledge.
- To propel the student towards higher academic ambitions in Advanced Mathematics.
- To develop in the student logical, heuristic, systematic and critical ways of thinking to assist in problem solving in their chosen career.

To provide the student some inputs in teaching methodology and psychology of teaching

REGULATIONS

1. ELIGIBILITY FOR ADMISSION:

All candidates should have passed two year PG degree course after three year degree course and higher secondary of 12 years duration or pre –university and 11 year SSLC plus one year or 10 +2 pattern. Candidates who have passed the PG degree examination with less than 17 years of total duration of the course are not eligible for admission to M.Phil degree course.

2. DURATION OF THE PROGRAMME: 1 Year (Full time)

One year M.Phil course is divided into two semesters. In the first semester two core papers are covered. In the second semester, one specialization paper (Internal) is covered along with the admission of dissertation.

3. COURSE OF STUDY

The main subject of study for M.Phil Degree shall consist of the following:

Part – I: Algebra and Analysis

Part-II: Topology, geometry, Methods and psychology of teaching mathematics.

4. PASSING MINIMUM

A candidate shall be declared to have passed in each paper/dissertation of the main subject of study wherever prescribed, if she secured NOT LESS THAN 50% of the marks prescribed for the examination.

5. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Part I& II

Successful candidates passing the examination and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class respectively. All other candidates shall be declared to have failed in the M Phil examination.

6. COURSE PROFILE

| SEM | COURSE TITLE | COURSE CODE | HOURS | L | T | P | CREDIT | CA | SE | TOTAL |
|-----|---|---|-------|---|---|---|--------|-----|-----|-------|
| I | Paper I-Algebra & Analysis | 11M15/ALA | 6 | 3 | 3 | 0 | 5 | 40 | 60 | 100 |
| I | Paper II-Topology, Geometry, Methods And Psychology Of Teaching Mathematics | 11M15/TGP | 6 | 3 | 3 | 0 | 5 | 40 | 60 | 100 |
| II | Paper III-Specialization Paper | 11M15/SP/AAL 11M15/SP/CA 11M15/SP/FTA 11M15/SP/GRT | 6 | 3 | 3 | 0 | 5 | 40 | 60 | 100 |
| II | Dissertation | 11M15/DIS | 12 | | | | 21 | 100 | 100 | 200 |

Question Paper Pattern

ALGEBRA AND ANALYSIS

| Components | Nature of the Question | Maximum Marks |
|------------|------------------------------------|---------------|
| Part A | Understanding Description/Problems | 100 Marks |
| Part B | Understanding Description/Problems | |

Answer any five questions choosing at least two from each Part A and Part B, each question carries 20 marks

Part A : At least 2 questions to be answered out of 4 questions covering all the Algebra units.

Part B : At least 2 questions to be answered out of 4 questions covering all the Analysis units.

TOPOLOGY, GEOMETRY, METHODS AND PSYCHOLOGY OF TEACHING MATHEMATICS

| Components | Nature of the Question | Maximum Marks |
|------------|------------------------------------|---------------|
| Part A | Understanding Description/Problems | 40 Marks |
| Part B | Understanding Description/Problems | 40 Marks |
| Part C | Understanding Description/Problems | 20 Marks |

Answer any five questions. Part C Question is compulsory

Part A : 2 questions to be answered out of 4 questions covering all the Topology units.

Part B : 2 questions to be answered out of 4 questions covering all the Geometry units.

Part C : Can have 'either or pattern' of two questions from Methods and Psychology of Teaching Mathematics.

SPECIALIZATION PAPER

| Nature of the Question | Maximum Marks |
|------------------------------------|---------------|
| Understanding Description/Problems | 100 Marks |

5 questions to be answered out of 8 questions covering all the 5 units, each question carries 20 marks, each question may have a subdivision.

EVALUATION PATTERN – CORE COURSE

Valuation Pattern

Marks

| | |
|-----------------------------------|-----|
| Project Presentation (Guide) | 50 |
| Final Report (Guide and External) | 100 |
| Viva-Voce(Guide and External) | 50 |
| Total | 200 |

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT

(Effective from 2015 – 16)

| | |
|--|-----------------|
| (a) Assignment/ Seminar (Report to be prepared and presented) | 10 marks |
| (b) Participatory Learning/ Problem Solving/ Group Discussion | 10 marks |
| (c) Test 1 (2 Hours – 50 marks) | 10 marks |
| (d) Test 2 (2 Hours – 50 marks) | 10 marks |
| TOTAL | 40 Marks |

RUBRICS FOR CONTINUOUS ASSESSMENT EVALUATION

Assignment : Appearance/Contents/Originality/Presentation/Schematic
Representation and diagram/ Bibliography

Seminar : Organization / Subject knowledge / Visual Aids /
Confidence level / Presentation

Participatory Learning : Answering questions/ clearing doubts / participation in
discussion / attendance/ communication and language

SEMESTER – I

M.PHIL MATHEMATICS

PAPER I: ALGEBRA AND ANALYSIS

Course Code: 11 M15/ALA

Teaching hours: 90

Credits: 5

L T P : 3 3 0

Objectives:

- To understand various higher level topics in Algebra and Analysis.
- To equip the students in pursuing research in Mathematics
- To prepare the student for lectureship in Mathematics.

Course Outline:

UNIT - I: The Associative Algebra

Chapter 1 (Section 1.1 – 1.7 (Omit section 1.5)) (20 hours)

UNIT- II: Modules

Chapter 2 (Section 2.1 – 2.7) (18 hours)

UNIT- III: The Structure of Semi – simple Algebras

Chapter 3 (Section 3.1 – 3.6) (18 hours)

UNIT- IV: L^p Spaces

Chapter 3 (17 hours)

UNIT- V: Integration on Product Spaces

Chapter 8 (17 hours)

Books Recommended:

1. Richard S. Pierce, Associative Algebras (For Unit I, II, III)
2. Walter Rudin, Real And Complex Analysis (For Units IV and V)

PERIODICALS:

1. The Mathematics Intelligencer
2. Mathematics Newsletters

WEBSITES & e-LEARNING SOURCES:

<http://www.mathforum.org>

<http://www.opensource.org>

QUESTION PAPER TEMPLATE

| Components | Nature of the Question | Maximum Marks |
|------------|------------------------------------|---------------|
| Part A | Understanding Description/Problems | 100 Marks |
| Part B | Understanding Description/Problems | |

Answer any five questions choosing at least two from each Part A and Part B, each question carries 20 marks

Part A : At least 2 questions to be answered out of 4 questions covering all the Algebra units.

Part B : At least 2 questions to be answered out of 4 questions covering all the Analysis units.

SEMESTER – I

M.PHIL MATHEMATICS

PAPER II: **TOPOLOGY, GEOMETRY, METHODS AND PSYCHOLOGY OF TEACHING MATHEMATICS**

Course Code: **11 M15/TGP**

Credits: **5**

Teaching hours: **90**

L T P : **3 3 0**

Objectives:

- To understand various higher level topics in Topology, Geometry, Methods and Psychology of Teaching Mathematics
- To equip the students in pursuing research in Mathematics
- To prepare the student for lectureship in Mathematics.

Course Outline:

UNIT - I: **The Fundamental Group**

Chapter 9 (Section 51 – 52) (20 hours)

UNIT - II: **Covering Spaces**

Chapter 9 (Section 53 – 54) (19 hours)

UNIT - III: **Deformation Retracts and Homotopy Type**

Chapter 9 (Sections 58 – 59) (18 hours)

UNIT - IV: **Differential Forms in $\mathbb{R} - n$ and Differentiable Manifolds**

Chapter 1 & Chapter 3 (18 hours)

UNIT - V: **Methods of Teaching Mathematics:**

**Inductive, Deductive, Analytic, Synthetic, Heuristic, Project
Problem solving and Laboratory methods**

(10 hours)

Psychology of Teaching:

Psychology of adolescents- Developmental tasks and education,

Role of motivation in learning, Motivation in the classroom

Context – Praise and Blame, Importance of rewards and

Punishments.

(5 hours)

Books Recommended:

Unit I, II& III: James R. Munkres, TOPOLOGY, Second Edition

UNIT IV: Manferdo, P.do Carmo, Differential Forms and Applications

UNIT V: Sidhu. K.S, The teaching of Mathematics, New Delhi, Sterling Publishers (P) Ltd. (1967) Bernard, Psychology of Learning and Teaching, Chapters 9 &10, Tata McGraw Hill Book Co.

Periodicals:

1. The Mathematics Intelligencer.
2. Mathematics Newsletters

Websites & E-Learning Sources:

<http://www.mathforum.org>

<http://www.opensource.org>

QUESTION PAPER TEMPLATE

| Components | Nature of the Question | Maximum Marks |
|-------------------|---------------------------------------|----------------------|
| Part A | Understanding Description/Problems | 40 Marks |
| Part B | Understanding Description/Problems | 40 Marks |
| Part C | Understanding Description/Problems | 20 Marks |

Answer any five questions. Part C Question is compulsory

Part A : 2 questions to be answered out of 4 questions covering all the Topology units.

Part B : 2 questions to be answered out of 4 questions covering all the Geometry units.

Part C : can have 'either or pattern' of two questions from Methods and Psychology of Teaching Mathematics

SEMESTER – II

M.PHIL MATHEMATICS

SPECIALIZATION PAPER III: COMPLEX ANALYSIS

Course Code: **11M15/SP/CA**

Credits: 5

Teaching Hours: 90 hours

L T P : 3 3 0

OBJECTIVES:

To enable students to

- Understand the basic concepts of univalent functions.
- Analyze and understand the concepts and theorems on univalent functions.
- Equip the students in pursuing research in Mathematics.

UNIT I : Elementary Theory Of Univalent Functions :

Introduction – The Area Theorem – Growth and Distortion theorems – Coefficient estimates – Convex and Starlike functions – Close to convex functions – Starlike functions.

Chapter 2 : 2.1 to 2.7

UNIT II : Elementary Theory Of Univalent Functions (Contd.):

Growth and integral means – Odd univalent functions – Asymptotic Bieberbach Conjecture .

Chapter 2 : 2.10 to 2.12

UNIT III : Generalizations Of The Area Principle :

Faber polynomials – Polynomial Area theorem – The Grunsky Inequalities – Inequalities of Goluzin and Lebedev – Unitary matrices – The Fourth Coefficients – Coefficient problem in the class Σ .

Chapter 4 : 4.1 to 4.7

UNIT IV : Subordination :

Basic principles – Coefficient inequalities – Sharpened Forms of the Schwarz Lemma – Majorization – Univalent Subordinate Functions.

Chapter 6 : 6.1 to 6.5

UNIT V : General Extremal Problems :

Functionals on Linear spaces – Representation of Linear functional – Extreme points and Support points – Properties of Extremal functions – Extreme points of S – Extreme points of Σ .

Chapter 9 : 9.1 to 9.6

RECOMMENDED TEXT:

Univalent Functions By P.L.Duren

REFERENCES :

1. Univalent Functions Vol I and Vol II By Goodman . A.W.
2. Conformal Mapping by Z.Nehari, McGraw-Hill ,New York (1952).

PERIODICALS:

The Mathematics Intelligencer.
Mathematics Newsletters

WEBSITES & E-LEARNING SOURCES:

<http://www.mathforum.org>
<http://www.opensource.org>

Question Paper Pattern

| Nature of the question | Maximum Marks |
|-------------------------------------|----------------------|
| Understanding./Description/Problems | 100 Marks |

Five questions to be answered out of eight questions, each carrying 20 marks. Each question may have sub-divisions.

SEMESTER – II

M.PHIL MATHEMATICS

SPECIALIZATION PAPER III: FUZZY THEORY AND APPLICATIONS

Course Code: **11M15/SP/FTA**

Teaching Hours: 90 hours

Credit: 5

L T P: 3 3 0

OBJECTIVES:

To enable students to

- Understand the concepts of fuzzy sets and its applications.
- To introduce advanced concepts in Fuzzy Mathematics leading to research.

UNIT I: From Classical (Crisp) Sets to Fuzzy Sets:

A Grand Paradigm Shift – Introduction – Crisp Sets: An Overview – Fuzzy Sets: Basic Types – Fuzzy Sets: Basic Concepts – Characteristics and Significance of the Paradigm Shift.

Fuzzy Sets Versus Crisp Sets: Additional Properties of α – cuts – Representations of Fuzzy Sets – Extension Principle for Fuzzy Sets.

Operations on Fuzzy Sets: Types of Operations – Fuzzy Complements. (17 hrs)

Sections: 1.1 – 1.5, 2.1 – 2.3, 3.1 & 3.2.

UNIT II : Fuzzy Arithmetic:

Fuzzy Numbers – Linguistic Variables – Arithmetic Operations On Intervals – Arithmetic Operations On Fuzzy Numbers – Lattice of Fuzzy Numbers – Fuzzy Equations.

Fuzzy Relations: Crisp Versus Fuzzy Relations – Projections and Cylindric Extensions – Binary Fuzzy Relations - Binary Relations on a Single Set – Fuzzy Equivalence Relations (17 hrs)

Sections: 4.1 – 4.6, 5.1 – 5.5.

UNIT III: Fuzzy Relations (cont.):

Fuzzy Ordering Relations – Fuzzy Morphisms – Sup- ω_i Compositions of Fuzzy Relations – Inf- ω_i Compositions of Fuzzy Relations.

Fuzzy Relation Equations: Solution Method – Fuzzy Relational Equations Based on sup- ω_i compositions – Fuzzy Relational Equations based on inf- ω_i Compositions. (18 hrs)

Sections: 5.7 – 5.10, 6.3 – 6.5.

UNIT IV: Fuzzy Logic:

Fuzzy Propositions – Fuzzy Quantifiers – Linguistic Hedges – Inference From Conditional Fuzzy Propositions.

Constructing Fuzzy Sets: Methods of Construction: An Overview – Direct Methods with One Expert – Indirect Method With One Expert.

Fuzzy Systems: Fuzzy Controllers: An Overview – Fuzzy Controllers: An Example. (20 hrs)

Sections: 8.3 – 8.6, 10.2, 10.3, 10.5, 12.2 &12.3.

UNIT V: Fuzzy Decision Making: General Discussion – Individual Decision Making – Multiperson Decision Making – MultiCriteria Decision Making – MultiStage Decision Making – Fuzzy Ranking Methods – Fuzzy Linear Programming. (18 hrs)

Sections: 15.1 – 15.7.

RECOMMENDED TEXT:

George Klir and Bo Yuan, Fuzzy Sets And Fuzzy Logic – Theory and Applications, 2009, PHI Learning Pvt Ltd, New Delhi.

REFERENCE BOOKS:

1. Ahmad M. Ibrahim, *Introduction to Applied Fuzzy Electronics*.New Delhi : Prentice Hall India, 1997.
2. Bart.Kosko, *NeuralNetworks and fuzzy systems*, New Delhi :Prentice-Hall of India, 2003.
3. George Klir J. and Folger Tina A., *Fuzzy Sets, Uncertainty and Information*.New Delhi: Prentice Hall India, 2004.
4. Toshiro Terano,AsaiKiyoji, SugenoMichio, *Applied Fuzzy Systems*.New York : A.P. Professional, 1994.
5. ZadehLotfi A., *Fuzzy Sets and Their Applications to Cognitive and Decision Processes*, New York, Academic Press, 1975.

PERIODICALS:

The Mathematics Intelligencer.
Mathematics News Letter.

WEBSITES AND E-LEARNING SOURCES:

<http://mathforum.org>
<http://www.opensource.org>

Question Paper Pattern

| Nature of the Question | Maximum Marks |
|-------------------------------------|---------------|
| Understanding /Description/Problems | 100 Marks |

Five questions to be answered out of eight questions, each carrying 20 marks. Each question may have sub-divisions.

SEMESTER – II

PAPER III: SPECIALIZATION PAPER GRAPH THEORY

Course Code: **11M15/SP/GRT**

Credits: 5

Teaching Hours: 90 Hours

L T P: 3 3 0

OBJECTIVES:

To enable students to

- Understand the concepts of Graph Theory and its applications.
- Analyze and understand theorems on Graph Theory.
- To equip the students in pursuing research in Mathematics.

UNIT I: Matching and factors:

Maximum Matching, Hall's matching condition, Min-Max theorems, Tutte's 1- factor theorem

From Book 1: Chapter 3: 3.1, 3.3 (15 hours)

UNIT II: Colouring of graphs:

Definitions and examples, upper bounds, Brook's theorem
Edges and cycles Edge colourings, Hamiltonian cycles
(Necessary and Sufficient conditions) Tait's theorem

From Book 1: Chapter 5 :5.1 , Chapter 7 : Section 7.1, 7.2, 7.3
(20 hours)

UNIT III: Independent Sets and Cliques

Independent sets, Ramsey's theorem, Turan's theorem

From Book 2: Chapter 7 Sections 7.1, 7.2, 7.3 (15 hours)

UNIT IV: Directed Graphs

Directed Graphs, Directed paths, Directed cycles

From Book 2:Chapter10 Sections 10.1 - 10.4 (20 hours)

UNIT V: Planar graphs:

Drawings in the plane, Dual graphs, Euler's formula, preparation for Kuratowski's theorem, convex embeddings

From Book 1: Chapter 6 Section 6.1, 6.2
Networks: Flows, cuts, The Max –flow Min-cut theorem

From Book 2: Chapter11 Sections 11.1-11.3 (20 hours)

Recommended Text:

Book 1: Graph Theory and its applications - Doughlas. B. West
Book 2: Graph Theory and its applications – J. A. Bondy and
U. S. R.Murty

Books for References:

1. A.Gibbons, Algorithmic Graph Theory, Cambridge University Press, Cambridge, 1989.
2. S.A.Choudum, A First Course in Graph Theory, MacMillan India Ltd.1987.

PERIODICALS:

The Mathematics Intelligencer.
Mathematics News Letter.

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