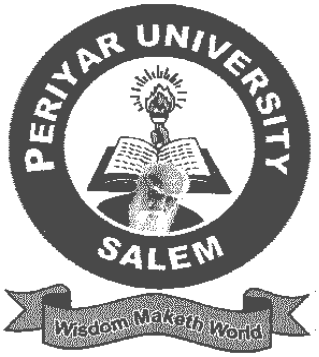
PERIYAR UNIVERSITY
SALEM - 11



M.Phil. Mathematics

(SEMESTER PATTERN)
(Under Choice Based Credit System)

REGULATIONS AND SYLLABUS
(Candidates admitted from 2008-2009 onwards)

BOARD OF STUDIES IN MATHEMATICS-PG

1	Dr. A. Muthusamy, Professor and Head i/c, Department of Mathematics, Periyar University, Salem.	Chairman
2	Dr.K.Gowri Navada, Reader, Department of Mathematics, Periyar University, Salem.	Member
3	Dr.C.Selvaraj Reader, Department of Mathematics, Periyar University, Salem	Member
4	V.Muthulakshmi, Lecturer, Department of Mathematics, Periyar University, Salem.	Member
5	Dr.P.Prakash, Lecturer, Department of Mathematics, Periyar University, Salem.	Member
6	Dr.K. Thangavel, Professor and Head, Department of Computer Science, Department of Mathematics, Periyar University, Salem	Member
7	Dr.P. Venkatesan Professor of Statistics TRC, ICMR Chetpat, Chennai - 600 031	Member
8.	Dr.A. Krishnamoorthy Prof & Head Department of Mathematics Chochin University of Science & Technology, Cochin, Kerala - 22	Member

PERIYAR UNIVERSITY, SALEM –11

M.Phil., MATHEMATICS - CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS

(F*or the candidates admitted from 2008-2009 onwards)*

1. Duration of the course:

The duration of the M.Phil. Programme shall be one year consist of two semesters under Choice Based Credit System.

2. Eligibility for Admission:

A Master degree in Mathematics of Periyar University or any other university recognized by the Syndicate as equivalent thereto, provided that those who have qualified for the Master's degree prior to 1ST January 1991 must have secured a minimum of 50 percent of marks and those who have qualified for the Master's degree on or after 1ST January 1991 must have secured a minimum of 55 percent of marks. For SC / ST candidates who have qualified on or after 1ST January 1991 a concession of 5 percent of marks shall be given in the minimum eligibility marks.

3. Distribution of Credit points

The minimum credit requirement for one year M.Phil, programme shall be 24 Credits. The break-up of credits for the programme is as follows:

PART - I

- Core Course : 4 credits
- Core Course : 4 credits
- Elective Course : 4 credits

PART - II

- Dissertation and viva-voce : 12 credits

4. Structure of the Programme:

The Programme of study for the degree shall consist of (a) Part-I comprising three courses according to the syllabus prescribed from time to time; and (b) Part-II Dissertation.

Course Code	Title of the Course	Core/Elective	Credits			
			L	T	P	C
First Semester						
MAT101	Analysis and Differential Equations	C	3	1	0	4
MAT102	Algebra and Topology	C	3	1	0	4
MAT103	Oscillation Theory of Differential Equations	E	3	1	0	4
MAT104	Abstract Hamonic Analysis	E	3	1	0	4
MAT105	Rings and Categories of Modules	E	3	1	0	4
MAT106	Theory and Applications of Fuzzy Sets	E	3	1	0	4
MAT107	Advanced topics in Graph Theory	E	3	1	0	4
Second Semester						
	Dissertation and Viva- Voce	C	-	-	-	12

5. Scheme of Examinations:

Part-I Written Examination:

The examination for the courses I, II and III shall be held at the end of the first semester. Each course carries a maximum of 100 marks of which 75 allotted for external and 25 for internal.

The examiners will be appointed from the panel of four names of each course (I, II and III) submitted by the department concerned. If one examiner awards a pass mark and the other fail mark, the paper will be valued by a third examiner whose award of marks will be final.

Part-II – Dissertation:

The exact title of the dissertation shall be intimated within one month after the registration of the Programme. Candidates shall submit the dissertation to the university through the supervisor and Head of the Department at the end of the year from the commencement of the programme which shall be valued by internal examiner (supervisor) and one external examiner appointed by the university from a panel of four names sent by the supervisor through the Head of the Department at the time of submitting the dissertation.

The examiners who value the dissertation shall report on the merit of candidates as "**Highly Commended**" (75% and above) or "**Commended**" (50% and above and below 75%) or **"Not Commended"** (below 50%).

If one examiner commends the dissertation and the other examiner, does not commend, the dissertation will be referred to a third examiner and the third valuation shall be final.

Submission or resubmission of the dissertation will be allowed twice a year.

6. Question Paper Pattern:

Time: Three Hours Maximum: 75 Marks

Part - A (5x 5 = 25 Marks)

Two questions from each unit with internal choice

Answer **ALL** questions

Part - B (5 x 10 = 50 Marks)

Two questions from each unit with internal choice

Answer **ALL** questions

* Dissertation evaluation : 150

* Viva – Voice : 50

7. Dissertation:

(a) Topic:

The topic of the dissertation shall be assigned to the candidate within one month (based on paper III) after registration and a copy of the same should be submitted to the university for approval.

(b) Number of copies of dissertation:

The students should prepare three copies of dissertation and submit the same to the university for evaluation.

Format to be followed:

The format of the dissertation to be submitted by the students is given below:

Format for the preparation of project work:

(a) Title page

(b) Bonafide Certificate

(c) Acknowledgement

(d) Table of contents

CONTENTS

Format of the Title Page:

TITLE OF THE DISSERTATION

Dissertation Submitted in partial fulfilment of the requirement for the award of Degree of Master of Philosophy in **MATHEMATICS** to the Periyar University, Salem – 636 011.

By

Student's Name :

Register Number :

Department/College :

Month and Year :

Format of the Certificate:

CERTIFICATE

This is to certify that the dissertation entitled ...(Title)....submitted by ……(Candidate Name)……. to the Periyar University, Salem in partial fulfilment of the requirement for the award of degree of Master of Philosophy in **MATHEMATICS** is a bonafide record of work carried out by the candidate during ..... in the Department and that no part of the dissertation has been submitted for the award of any Degree/Diploma/Associateship/Fellowship or other similar titles that the Dissertation represents independent work on part of the candidate under my guidance.

Date:

Place:

Signature of the Guide

Signature of the Head of the Department

8. Passing Minimum:

A candidate shall be declared to have passed Part-I of the examination if he/she secures not less than 50% of the marks in each course.

A candidate shall be declared to have passed Part-II of the examination if his/her dissertation is atleast commended.

A candidate who has passed parts I and II and earned a minimum of 24 credits shall be considered to have passed the M.Phil programme.

9. Restriction in number of chances:

No candidate shall be permitted to reappear for the written examination in any paper for more than two occasions or to resubmit a Dissertation more than once. Candidates shall have to qualify for the degree passing all the written papers and dissertation within a period of two years from the date of joining the course.

10. Commencement of this regulation

These regulation and syllabus shall take effect from the academic year 2008 –2009, that is, for students who are admitted to the Programme during the academic year 2008 – 2009 and thereafter.

PAPER I

MAT101 ANALYSIS AND DIFFERENTIAL EQUATIONS

L + T + P = C
3 + 1 + 0 = 4

Unit-I Abstract Integration

Abstract integration – The concept of measurability – arithmetic in [0 ∞] - simple functions – Elementary properties of measures – Integration of positive functions – The role played by sets of measure zero – L^p spaces – Convex functions and Inequalities.

Unit-II Fourier Transform

Fourier Transform – Formal Properties – The Inversion Theorem – The Plancheral Theorem- The Banach algebra L^1 – The Holomorphic Fourier transform – Two theorems of Paley and Wiener – Quasi analytic class – The Denjoy – Carleman Theorem.

Unit-III Nonlinear Differential Equations

Analysis and Method of Nonlinear Differential Equations – Existence Theorem – Extremal solutions – Upper and lower solutions – Monotone Iterative Method – Bihari Inequality – Variation of parameters.

Unit-IV Boundary Value Problems

Boundary Value Problems – Introduction – Sturm Liouville problem – Green's function – Application of Boundary Value Problems- Picard's Theorem – Oscillation of second order equations – Fundamental Results – Sturms Comparison Theorem – Elementary linear oscillation – Comparison Theorem of Hille-Wintner.

Unit-V Stability

Stability of linear and nonlinear system – Elementary critical points – System of equations with constant coefficients – Linear equation with constant coefficients – Lyapunav stability – Stability of quasilinear system – Second order linear differential equations.

Text Books:

1. **Walter Rudin,** Real and Complex Analysis, McGraw Hill International Edition, New Delhi, 1987(Chapters 1,3,9 and 19).

2. **S.G.Deo, V.Lakshmikantham** and **V.Ragavendra**, Text Book of Ordinary Differential Equations, Tata McGraw Hill Publ. Co. New Delhi, 1997. (Chapters 6 ,7,8, and 9)

Reference Books:

1. T.Hawkins, Lebesgue Theory of Integration, University of Wisconsin Press, Madison, 1970.
2. N. Wiener, The Fourier Integral and Certain of its Applications, Dover Publ. Inc. New York.
3. W. Coppel, Stability and Asymptotic Behavior of Differential Equations, Heath Boston,1965.
4. P.Bailey, L. Shampine and P. Waltman, Nonlinear Two Point Boundary Value Problems, Academic Press, New York, 1968.

PAPER II

MAT102 ALGEBRA AND TOPOLOGY

L + T + P = C
3 + 1 + 0 = 4

Unit-I

Simple modules – Semisimple modules - Structure of semisimple modules – the radical – Semisimple algebras – Simple Algebras – Wedderburn's structure theorem.

Unit-II

Maschke's theorem – the radical of algebra – Nakayama's lemma – Nilpotent algebras – the radical of a group algebra – ideals in Artinian algebras.

Unit-III

Direct decompositions – local algebras – the krull-Schmidt theorem – indecomposable and irreducible representations – tensor products of R-modules.

Unit-IV

Fundamental group and covering spaces – Homotopy - Fundamental group-covering spaces-Simplicial complexes – Geometry of simplicial complexes – Bary centre subdivision – simplicial approximation theory

Unit-V

Manifolds – Differential manifolds – Differential form – Miscellaneous facts.

Text Books:

1. **I.M.Singer and J.A.Thorpe**, Lecture Notes on Elementary Topology, Springer Verlag, New York, 1967.
2. **R.S. Pierse**, Assotative Algebras, GTM Vol. 88, Springer Verlag, 1982 Chapters 2,3,4,5 and 9 Section 9.1.

Reference Books:

1. M.F.Atiyah and F.G. Macdonald, Introduction to Commutative Algebra, Addition – Wesley Pub. Co., Mass. 1969.
2. J.G. Hocking and G.S.Young, Topology, Addition – Wesley Pub. Co., Mass. 1961
3. L.Auslander and R.F.Mackenzie, Introduction to Differentiable Manifolds, McGraw-Hill, New York, 1963.

ELECTIVE

MAT103 OSCILLATION THEORY OF DIFFERENTIAL EQUATIONS

L + T + P = C

3 + 1 + 0 = 4

Unit-I Differential Equations with Deviating Arguments

Introduction – Oscillation Theorems – Comparison Theorems.

Unit-II Differential Equations with Deviating Arguments (Contd.)

Oscillation of Functional Equations with a Damping Term – Oscillation of Second Order linear Delay Differential Equations – Forced Equations.

Unit-III Differential Equations with Deviating Arguments (Contd.)

Oscillation of Functional Equations with a Damping and Forceing Term – Necessary and Sufficient Conditions – Asymptotic Behavior of Oscillatory Solutions.

Unit-IV Neutral Functional Equations

Introduction – Oscillation of Nonlinear Neutral Equations - Neutral Equations with Damping – Forced Neutral Equations.

Unit-V Conjugacy and Nonoscillation

Introduction – Conjugacy of Second Order Equation- Nonoscillation Theorems – Integral Conditions and Nonoscillation.

Text Book:

- **R.P.Agarwal, S.R.Grace** and **D.O' Regan**, Oscillation Theory for Second Order Dynamic Equations, Taylor & Francis, New York, 2003.
  Sections 2.0 – 2.8, 2.10 of chapter 2, Sections 3.0 – 3.3 of Chapter 3 and Sections 4.0 – 4.3 of Chapter 4.

Reference Books:

1. I.Gyori and G.Ladas, Oscillation Theory of Delay Differential Equations with Applications, Clarendon Press, Oxford, 1991.
2. L.H.Erbe, Q.K.Kong and B.G.Zhang, Oscillation Theory for Functional Differential Equations, Marcel Dekker, New York, 1995.
3. G.S.Ladde, V.Lakshmikantham and B.G.Zhang, Oscillation Theory of Differential Equations with Deviating Arguments, Marcel Dekker, New York, 1995.

ELECTIVE

MAT104 ABSTRACT HARMONIC ANALYSIS

L + T + P = C
3 + 1 + 0 = 4

Unit-I Integration

The Daniell Integral – Equivalance and Measurability – The Real L^p - Spaces – The Conjugate Spaces of L^p – Integration on Locally Compact Hausdorff Sapce- Complex L^p spaces.

Unit-II Banach Algebras

Definitions and Examples – Function Algebras – Maximal Ideals – Spectrum – Banach Algebras – Elementary theory – The Maximal Ideal space of a Commutative Banach Algebra – Some basic general Theorems.

Unit-III The Haar Integral

The tpopol;ogy of Locally compact groups – the Haar integral – the modular function – the group algebra representations.

Unit-IV Locally compact abelian groups

The character group – Examples – the Bochner and Plancherel Theorem, Miscellaneous theorems – Compact abelian groups and generalised Fourer series.

Unit-V Compact groups and Almost periodic function

The group algebra of a compact group – Representation theory – Almost periodic functions

Text Book:

- **L.H. Loomis**, An Introduction to Abstract Harmonic Analysis, D.Van Nastrand Comp., New Jerscy, 1953.

Reference Books:

1. W.Rudin Fourier Analysis on Groups, Interscience Pub.,New York, 1960
2. E.Hewitt and K.A. Ross, Abstract Harmonic Analysis, Springer-Verlag, Berlin, 1963.

ELECTIVE

MAT105 RINGS AND CATEGORIES OF MODULES

L + T + P = C
3 + 1 + 0 = 4

Unit-I Modules and Homomorphism

Reviews of Rings and their homomorphism – Modules and submodules – homomorphism of Modules.

Unit-II Direct sums and products

Direct summands – direct sums and products of Modules – decomposition of Rings.

Unit-III Semisimple Modules

Generating and cogenerating - Semisimples Modules – The Socle and the redical – finnitely generalised and finitely generated Modules – Chain conditions.

Unit-IV Finiteness conditions for Modules

Modules with Composition series – indecomposable decompositions of Modules – Semisimple rings.

Unit-V Classical Ring – Structure Theorem

The Density Theorem – the radical of a ring – local rings anf Artinian rings.

Text Book:

- **F.W. Anderson** and **K.R.Fuller**, Rings and Categories of Modules, Second Edition, Springer-Verlag, New York 1992.

Reference Books:

1. D.M.Burton, Rings and Ideals, Addition-Wesley publishing Comp., 1970.
2. L.H. Rowen, Ring Theory, Student Edition, Academic Press Inc, 1991.
3. J.Lambek, Lectures on Rings and Modules Blaisdell, Walthan, Massachussetts, 1966.

1. R.Conti, Linear Differential Equations and Control, Academic Press, London, 1976.

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

3. R.F.Curtain and A.J.Pritchard, Functional Analysis and Modern Applied Mathematics, Academic Press, New York, 1977.

4. J.Klamka, Controllability of Dynamical systems, Kluwer Academic Publisher, Dordrecht, 1991.

5. D.L.Russell, Mathematics of Finite Dimensional Control Systems, Marcel Dekker, New York, 1979.

ELECTIVE

MAT106 THEORY AND APPLICATIONS OF FUZZY SETS

L + T + P = C
3 + 1 + 0 = 4

Unit I:

Fuzzy Sets: Definition of a Fuzzy Set – Basic Operations on Fuzzy Sets. Spaces of Subset of $\Re^n$: Introduction – Algebraic Operations on Subsets – The Hausdorff Metric – Compact Subsets of $\Re^n$. Compact Convex Subsets of $\Re^n$: Support Functions–Steiner Centroid and Parametrization–L_p–Metrics–A Banach Space of Asymmetry Classes.

Unit II:

Set Valued Mappings: Continuity and Measurability – Differentiation – Integration. Crisp Generalizations: Star Shaped Sets – Subsets of a Banach Space.

Unit III:

The Space ε^n: Definitions and Basic Properities – Useful Subsets of D^n and ε^n – Parametrization by a Single Valued mapping – The Bobylev Characterization of Fuzzy Sets. Metrics on ε^n: Definitions and Basic Properties – Completeness – Separability – Convergence Relationships.

Unit IV:

Compactness Criteria: Introduction – Compact Subsets in $(\varepsilon^n, d_\infty)$- Compact Subsets in (ε^n, d_p).Generalizations: Fuzzy Star Shaped Fuzzy Sets – Banach Base Space – Higher Order Fuzzy Sets**.**

Unit V:

Fuzzy Set Valued Mappings of Real Variables: Continuity and Measurability – Differentiation – Integration. Fuzzy Differential Equations: Introduction – Existence and Uniqueness of Solutions – Solutions as Fuzzy Dynamical Systems

Text Book:

- **Phil Diamond** and **Peter Kloeden**, Metric Spaces of Fuzzy Sets, Theory and Applications, World Scientific, Singapore 1994.

Reference Books:

1. D.Dubois and H.Prade, “Fuzzy Sets and Systems: Theory and Applications” Academic Press, New York, 1990.
2. C.V.Negoita and D.A.Ralescu, “Applications of Fuzzy Sets to Systems Analysis”, John Wiley and Sons, New York, 1975.

MAT107 **ADVANCED TOPICS IN GRAPH THEORY** **L + T + P = C**
3 + 1 + 0 = 4

Unit I:

Perfect graphs

Unit II:

Other classes of perfect graphs

Unit III:

Labeling of graphs

Unit IV:

Factorizations and decompositions

Unit V:

Domination in graphs

Text Book:

- **D.B. West**, Introduction to Graph Theory, PHI (2002).
  Unit – I & II – Chapter 8.1 (Imperfect graphs **excluded**)
- **G. Chartrand** and **L. Lesniak,** Graphs and Digraphs, Chapen & Hall / CRC press, 1996.
  Unit – III – Chapter 9; Section 3
  Unit – IV – Chapter 9; Section 2
  Unit – V – Chapter 10; Section 1 and 2

Reference Books:

1. R. Balakrishnan and K. Ranganathan, A text book of Graph Theory, Springer, 2000.
2. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press, Cambridge, 1989.
3. R.J. Wilson and J.J. Watkins, Graphs: An Introducing Approach, John Wiley and sons, New York, 1989.
4. K.R. Parthasarathy, Basic Graph Theory, Tata Mc – Graw Hill Publishing Company New Delhi, 1994.