

DEPARTMENT OF MATHEMATICS

M.Phil SYLLABUS

(REGULATION 2020)



DEPARTMENT OF MATHEMATICS

COURSE STRUCTURE

SEMESTER - I								
COURSE CODE	COURSE TITLE	L	T	Р	С			
20311	Research Methodology	2	2	0	2			
(Common Paper)								
203MAC12	Algebra and Analysis	2	2	0	2			
203MAC13	Advanced Numerical Analysis	2	2	0	2			
(Common Paper)	Research and Publication Ethics	2	2	0	2			
CPE_RPE								
	Total	08	08	00	08			
SEMESTER - II								
203MAC31	Project Work				02			

M Phil- SYLLABUS

(For the candidates admitted from the academic year 2020-2021 onwards)

PAPER – I Research Methodology

(Common for all Subjects except Languages)

Unit – I:

Methods and Technique. An introduction – Defining the research problem – What is a research problem?, Selecting the problem, Necessity of defining the problem, Technique involved in defining the problem, An illustration and conclusion. Research design – Meaning of research design, Need for research design, Features of good design, Important concepts of relating to research design, different research designs, Basic principles of experimental design and conclusion.

Unit – II:

Assignment and Thesis at the tertiary level: Writing at the tertiary level – assignments and term papers, thesis and dissertations, conventions of writing-the question of style. Planning the assignment – A time schedule, consulting source materials, preparing a work bibliography, taking notes, the outlines and the first draft. Planning the thesis – selecting a topic, reviewing the literature, designing the study and the chapter outline. Scholarly writing – a case study

Unit – III:

Writing the thesis or assignment: General format – preliminaries, the text, the reference material, the abstract and final product Page and Chapter format – chapter divisions and subdivisions, spacing, pagination, margins, paragraph indentation and sample pages Tables and Figures – use of tables and figures, placement of tables and figures, Numbering of tables, numbering of pages, numbering of figures, table and figure captions, format of tables, format of figures, preparation of figures, foot notes to tables and figures, very large table and figures, pagination and margin, spacing and alignment, abbreviations and special symbols and numbers. Referencing – Reference systems, Essential informations, spacing capitalization and underline, alphabetical and chronological order, edited works and sum special cases.

Unit – IV:

Computer packages and Internet: Word Basics – Creating and working with documents – working with text and tables – Using Mail Merge. Using Excel: Working with worksheets – creating chart – working with Formula and Functions. Using Power Point: Working with power point – User Interfaces – Using templates and wizard (slide Presentation) - Creating chart and Tables. Internet and World Wide Web (WWW) – Electronic Main (E-mail) – Intranet and Extranet.

Unit – V:

Descriptive statistics – tabulation, graphical representation – bar diagram – and pie diagrams – various measures of variance, measures of central tendency and normal distribution. Differential statistics "t" test, Chi – square test, "F" test (ANOVA) co -variance (ANCOVA) correlation and multiple regression analysis - Introduction to SPSS.

References:

- Thesis and Assignment writing by Janarthan Anderson and others Wiley Eastern Ltd, 1970. Part I Sections 1,2,3,4. Part II Sections 5,6,9,10.
- Research Methodology by C.R. Kothari, Chapter 1,2,3.
- Microsoft Office 2003 Edward C. Willet. First Edition 2004, Wiley Publications, USA , (Chapters 2,3,4,5,6,12,14,15,26,28,29)

Department of Mathematics M.Phil Mathematics Paper – II 203MAC12-ALGEBRA AND ANALYSIS

Course Outcomes:

- 1. To empower scholars with knowledge of pure mathematics.
- 2. To introduce the algebraic structure through modules.
- 3. To acquaint with advance concepts in algebra
- 4. To understand Borel measures.
- 5. To enhance problem solving skills in algebra.
- 6. To understand the techniques in algebra.

Unit-I: Modules

Modules homomorphism and exact sequence–Projective and injective– Modules homomorphism and duality. (Chapter 4.1, 4.3, 4.4, Text Book-1)

Unit-II: Commutative Rings and Modules

Chain conditions – Prime and primary ideals – Primary decomposition – Noetherian Rings and modules (Chapter 8.1, 8.2, 8.3, 8.4, Text Book – 1)

Unit III: Positive Borel Measures

Vector spaces – Topological preliminaries – Urysohn's Lemma–The Riesz representation theorem. (Chapter 2, Text Book -2, Sections 2.1-2.14).

Unit-IV: Problems in Algebra

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, Field extensions, Galois theory. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms

Unit V: Banach Algebras

Banach algebras – Spectrum of an element in Banach algebra – Spectral radius formula – Quotient algebras–applications.

(Chapter 18, Text Book-2)

Books for Study:

- 1. Algebra by Thomas W Hungerford, Springer Verlog Indian reprint
- 2. Real and Complex Analysis by Walter Rudin, Tata McGraw Hill (II Edn) 1996.

Reference Books:

Abstract Algebra by David.S.Dummit and Richard.M.Foote, 3rd Edition, Wiley Student Edition

2. Linear Algebra by Stephen H. Freidberg, Arnold J. Insel, Lawrence E.Spence, Fourth Edition, Pearson

Paper –III

M.Phil Mathematics

203MAC13-ADVANCED NUMERICAL ANALYSIS

Course Outcomes

- 1. Basic Knowledge of numerical methods
- 2. Approximation methods.
- 3. Linear and nonlinear approximation
- 4. Understanding polynomial equations
- 5. Techniques in numerical analysis
- 6. Initial and boundary value problems.

Unit-I: Transcental and Polynomial Equations -Iteration method based on

second degree equation – Rate of convergence –iterative methods – Methods for finding complex roots – iterative methods:-Birge-Vieta method, Bairtow's method, Gracffe's root squaring method.

Unit-II:System of Algebraic Linear Equations-Direct methods – Gauss Jotdan Elimination Method – Triangularization-method – Cholesky method – Partition method. Error Analysis – iteration methods : Jacobi iteration method – Gauss - seidal iteration method – SOR-method, Jacobi's method for symmetric matrices – power method – Inverse-power method.

Unit-III: Interpolation and Approximation-Hermite interpolation – Piecewise and spline interpolation – Approximation– Least square Approximation.

Unit-IV: Differentiation And Integration-Numerical differentiation – Numerical Integration – Methods based on interpolation.

Unit-V: Ordinary Differential Equations-Multi – step method – predictor – Corrector method – Boundary value-problem – initial value methods – shooting method – Finite Difference method.

Text Book

M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for scientific and Engineering Computation, III Edn, Wiley Eastern Ltd., 1993. Unit I - Chapter 2 - 2.4 to 2.8Unit II - Chapter 3 - 3.2 to 3.5Unit III - Chapter 4 - 4.4 - 4.6, 4.8 to 4.9Unit IV - Chapter 2 - 2.4 to 2.8Unit IV - Chapter 2 - 2.4 to 2.8Unit V - Chapter 6 - 6.4, 6.5, 6.8, 6.9, 6.10

References:

1. Kendall E. Atkinson, An introduction to Numerical Analysis, II Edn., John Wiley & Sons, 1988.

2. M.K. Jain, Numerical Solution of Differential Equations, II Edn., New Age International Pvt. Ltd., 1983.

3. Samuel. D. Conte, Carl, De boor, Elementary Numerical Analysis,Mc Graw-Hill International Edn., 1983.

RESEARCH AND PUBLICATION ETHICS

Course Code	Course Title	L	Т	Р	С
CPE_RPE	Research and publication ethics				2

THEORY

Unit I: PHILOSOPHY AND ETHICS (3 hours)

- 1. Introduction to philosophy, definition, nature and scope, concept, braches.
- 2. Ethics: definition, moral philosophy, nature of moral judgements and reactions.

Unit II: SCIENTIFIC CONDUCT (5 hours)

- 1. Ethics with respect to science and research.
- 2. Intellectual honesty and research integrity.
- 3. Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)
- 4. Redundant publications: duplicate and overlapping publications, salami slicing.
- 5. Selective reporting and misrepresentation of data.

Unit III : PUBLICATION ETHICS (7 hours)

- 1. Publication ethics: definition, introduction and importance.
- 2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
- 3. Conflicts of interest.
- 4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types.
- 5. Violation of publication ethics, authorship and contributorship.
- 6. Identification of publication misconduct, complaints and appeals.
- 7. Predatory publishers and journals.

PRACTICE

Unit IV: OPEN ACCESS PUBLISHING (4 hours.)

- 1. Open access publications and initiatives.
- 2. SHERPA/RoMEO online resourse to check publisher copyright & selfarchiving policies.
- 3. Software tool to ideitify predatory publications developed by SPPU.
- 4. Journal finder / journal suggestion tools viz, JANE, Elsevier Journal Folder, Springer Journal Suggester, etc.

UNIT V : PUBLICATION MISCONDUCT (4 hours)

A. Group Discussions (2 hours)

- 1. Subject specific ethical issues, FFP, authorship
- 2. Conflicts of interest.
- 3. Complaints and appeals: examples and fraud from India and abroad.

B. Software tools (2 hours)

Use of plagiarism software like Turnitin, Urkund and other open source software tools.

UNIT VI: DATABASES AND RESEARCH METRICS (7 hours)

A. Databases (4 hours)

- 1. Indexing databases.
- 2. Citation database: Web of Science, Scopus etc.

B. Research Metrices (3 hours)

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score.

Metrices: h-index. g index, i10 index, altmetrics.