



RAJA MAHENDRA PRATAP SINGH UNIVERSITY

ALIGARH

SYLLABUS

for

PRE-Ph.D. Course Work

in

Mathematics

According to

National Education Policy - 2020

(W.E.F. 2025 - 26 ONWARDS)

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Pre-Ph.D. Course Work (Mathematics) Structure

Sem.	Paper No.	Title of the Paper	No. of Lectures	Credits
One	Paper I	Research Methodology	60	04
	Paper II	Advanced Mathematics	60	04

Pre-Ph.D. Course Work Paper I

Course Title : Research Methodology

Programme: Pre Ph.D Course Work	Duration : 06 Months	Semester : First
Course Objectives: The main objective of this paper is to 1. Identify and discuss the role and importance of research in the Mathematical Sciences. 2. Identify and discuss the issues and concepts salient to the research process. 3. Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project. 4. Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting. Course Outcomes: At the end of this course, the students should be able to: CO1. Understand some basic concepts of research and its methodologies. CO2. Explain key research concepts and issues read, comprehend, and explain research articles in their academic discipline. CO3. Select and define appropriate research problem and parameters. CO4. Organize and conduct research (advanced project) in a more appropriate manner. CO5. Write a research report and thesis.		

Unit	Topic	No. of Lecture
I	Perception & Definition of Research, Objectives & Motivations of Research, Importance of Research, Types of Research.	15
II	Research Methods versus Methodology, Process of Research, Review of Literature, Formulation of the Research Problem, Sources and Identification of a Research Problem, Formulation of Hypothesis, Ethics in Research.	15
III	Types and Sources of Data, Data Collection Methods, Analysis of Data, Kurtosis variance, Central Tendency, Dispersion, Skewness, Correlation, Regression, Probability (Elementary).	15
IV	Synopsis, Funding Agencies in India for Research in Physical Sciences, Project Proposal, Project Report Writing, Research Paper Writing, Thesis Writing, Referencing, Formats of Writing, References, Bibliography, Plagiarism, IPR, Technology Development and Transfer, Subject Classification Index, Citation, Citation Index, Impact Factor, h-index, i-10index, INFLIBNET.	15

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Pre-Ph.D. COURSE WORK PAPER II

Course Title: Advanced Mathematics

Programme: Pre Ph.D Course Work	Duration : 06 Months	Semester : First
Course Objectives: The main objective of this paper is to: 1. To develop proficiency in scientific document preparation using LaTeX. 2. To introduce MATLAB as a tool for mathematical computation and programming. 3. To introduce basic properties of Real numbers 4. To strengthen the theoretical foundations of Group Theory and Ring Theory, including their structural properties and applications. 5. To introduce fuzzy sets and fuzzy relations for handling uncertainty in mathematical models. 6. To apply numerical techniques for solving initial value and boundary value problems. Course Outcomes: At the end of this course, the students should be able to: CO1. Use LaTeX for professional preparation of research papers, theses and presentations. CO2: Demonstrate understanding of completeness, cardinality, and fundamental properties of real numbers. CO3 Demonstrate a thorough understanding of finite groups, group actions, Sylow theorems, solvable groups, and nilpotent groups, and apply them to solve algebraic problems. CO4. Investigate the structure of rings, ideals, quotient fields, Noetherian rings, and Artinian rings, and establish their fundamental properties. CO5. Use fuzzy sets and fuzzy relations to model and analyze uncertain systems. CO6. Apply numerical methods to solve initial value and boundary value problem using MATLAB.		

Unit	Topic	No. of Lecture
I	Installation of the software LATEX, Understanding LATEX Compilation, Page Layout: (Titles, Abstract, Chapters, Sections, Basic Syntax, Writing equations, Matrix, Tables), List making environments, Table of contents, Equation references, Citations, Generating bibliography and Index. Introduction and application of MATLAB.	15
II	Basic properties of Real numbers (Well ordering principle, Archimedean Property, Density property, Complete ordered Field, Supremum, Infimum). Cantor's Theorem, Cantor Intersection Theorem, Basic Properties of Cardinal Numbers.	15
III	Cayley's Theorem, Generalized Cayley's Theorem, Cauchy's Theorem, Group Action, Sylow Theorems and their applications. Normal and Subnormal Series, Composition Series, Solvable Groups and Nilpotent Groups, Prime and Maximal Ideals, Quotient Field of an Integral Domain, Divisibility Theory, Noetherian and Artinian Rings.	15
IV	Fuzzy Sets, Fuzzy relations and their properties, fuzzy sets applications in real world problems. Numerical solution of IVP and BVP, Finite Element Method of BVP or ODE, Solution using MATLAB.	15

Conduct

S. K. Sharma

Vadane

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Bhargava

Radhakrishnan

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