Pre-Ph.D. Course work Syllabus

Pre-Ph.D. Course Work Mathematics (Effective from 2022)
Structure

Sem.	Paper Code	Title of the Paper	No. of Lectures(hrs.)/Duration	Credits
One	H-049	Research Methodology	60	04
		Advanced Mathematics I	60	06
		Advanced Mathematics II	60	06
		Survey/Research Project	One semester	Qualifying

CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT

Pre-Ph.D. COURSE WORK PAPER I, RESEARCH METHODOLOGY

Programme: Pre-Ph.D. Course work	Duration: Six Months	Semester: First
Subject: Mathematics		
Course Code: H-049	Course Title: Research Methodology	Theory

Course Objectives: The main objective of this paper is to

1. Identify and discuss the role and importance of research in the social 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.
CO6. Write a research proposal (grants).

Credits: 4	Core Compulsory
Max. Marks: 100	Min. Passing Marks:

Total No. of Lectures-Tutorial (in hours per week): L-T: 4-1

Unit	Topics	No. of Lectures 50
I	Perception & Definition of Research, Objectives & Motivations of Research, Importance of Research, Types of Research, Research Methods versus Methodology, Process of Research, Review of Literature, Formulation of the Research Problem, Sources and Identification of a Research Problem, Status of the Research Problem, Formulation of Hypothesis, Research Design, Ethics in Research.	10
II	Synopsis, Funding Agencies in India for Research in Physical	10

	Sciences, Project Proposal, Project Report Writing, Research Paper Writing, Thesis Writing, Referencing, Formats of Writing References, Bibliography, Plagiarism, IPR, Technology Development and Transfer.	
III	Types and Sources of Data, Data Collection Methods, Analysis of Data, Kertosis variance, Central Tendency, Dispersion, Skewness, Correlation, Regression, Probability (Elementary), Binomial, Poisson and Normal Distribution, Baye's rule and Independence of events, Chi-square test.	10
IV	Computer Networking, Internet, Web Browsers, Search Engines, MS Word: Handling graphics tables and charts, Formatting in MS-Word, MS Power point: Creating Slide Show, Screen Layout and Views, Applying Design Template, MS Excel: Features, Formulas and Functions, Number system, Computer codes, BCD Code, EBCDIC, ASCII, Computer Arithmetic.	10
V	Subject Classification Index, Citation, Citation Index, Impact Factor, h-index, i-10index, INFLIBNET, Introduction to Peer Reviewed and Open Access Journals, e-Journals, e-Library, Research Databases in Physical Sciences: Web of Science, Scopus, Science-Direct etc.	10
Teaching Learning Process: Class discussions/ demonstrations, Power point presentations, Class activities/ assignments, Field visits., Internship, etc.		

Suggested Readings:

1. **Creswell. W.**: Research Design, Qualitative, Quantitative and Mixed Methods Approaches (3rdEdition), SAGE, Inc., 2018.
2. **Gupta. S**: Research Methodology: Methods and Statistical Techniques, Deep & Deep Publications, 2010.
3. **Gupta. S.P.:** Statistical Methods, Sultan Chand &Sons, 2014.
4. **Kumar. R**: Research Methodology: A Step-by-Step Guide for Beginners (3rd Edition), SAGE, Inc., 2011.
5. **Melville. S. and Goddard. W.:** Research Methodology: An Introduction (2nd edition),Juta Academic, 2004.
6. **Shortis, T.**: The Language of ICT: Information and Communication Technology, Taylor & Francis, 2016.

CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT

Pre-Ph.D. COURSE WORK PAPER II, ADVANCED MATHEMATICS I

Programme: Pre- Ph.D. Course work	Duration: Six months	Semester: First
Subject: Mathematics		
Course Code:	Course Title: Advance Mathematics I	Theory

Course Objectives: The objective of this paper is

1. To introduce the basic concept of reliability theory, non-linear programming,
2. To learn the concept of Convergence of nets and filters Para compactness and Nagata-Smirnov Metrization theorem, Bing Metrization theorem
3. Learn the concept of Constructions of Fuzzy Sets and Operations on Fuzzy Sets, Fuzzy Optimization, Fuzzy control and fuzzy expert systems,
4. Learn the concept of automorphism on a finite field, Structure of multiplicative group of a finite field, Uniqueness of the splitting field, Solvability by radicals, Solvability of Galois group of a polynomial over a field.
5. To introduce the basic concept of Vedic mathematics

Course Outcomes: At the end of this course, the students should be able to:

CO1. Apply theoretical concepts in topology to understand real world applications.
CO2. Demonstrate knowledge and understanding of concepts of non-linear programming, stability theory.
CO3. Knowledge and understanding thoroughly account for industrial applications of different methods in reliability theory
CO4. Understand the basic ideas of fuzzy sets, operations and properties of fuzzy sets and also about fuzzy relations.

Credits: 6	Core Compulsory
Max. Marks: 100	Min. Passing Marks:
Total No. of Lectures-Tutorial (in hours per week): L-T: 6-0	

Unit	Topics	No. of Lectures 60
I	Nonlinear programming, Kuhn-Tucker optimality condition, Quadratic programming: Wolfe's method. Integer	10

	programming: Modeling using pure and mixed integer programming. Branch and Bound technique. Gomory's cutting plane algorithm.	
II	Basic Concepts of Reliability: General Reliability Function, Failure and Failure modes, Hazard Rate, Bath tub Curve, Mean Time to Failure, Availability concepts. System Reliability: Reliability of Series, Parallel, Stand by Redundancy, k-out-of-n Configuration, Series-Parallel, Parallel-Series configurations and Bridge Structure.	10
III	Convergence of nets and filters, Arbitrary product of topological spaces, Arbitrary product of connected spaces, Path connectedness, Compactness: Compactness through nets and filters, Tychonoff' theorem, Urysohn metrization theorem , Stone-Cech compactification, Para compactness and Nagata-Smirnov Metrization theorem, Bingmetrization theorem.	10
IV	Constructions of Fuzzy Sets and Operations on Fuzzy Sets, Fuzzy Optimization, Fuzzy control and fuzzy expert systems, Fuzzy Inference: Composition rule, Fuzzy rule and Implication, Inference Mechanism, Inference methods, Fuzzy Sets in Decision-Making: Fuzzy Rank Methods& ordering, Multi criteria Decision Making, decision- making under Fuzziness.	10
V	Automorphism on a finite field, Structure of multiplicative group of a finite field, Uniqueness of the splitting field, Determining the degree of the splitting field of polynomials over a field, Finding the splitting field of polynomials over a field, Galois group of a polynomial over a field, Determining the elements of the Galois group of polynomials over a field, Solvability by radicals, Solvability of Galois group of a polynomial over a field.	10
VI	16 Sutra And 13 Sub Sutras of Vedic Mathematics, Explanations of Ekadhiken Purvena, Eknueyena Purvena, Urdhwa Triyagbhyam Sutra. Contribution of Indian	10

	Mathematicians Madhvan, Parmeshvaran, Manjul Bhargav , Shakuntala Devi	

Teaching Learning Process: Class discussions/ demonstrations, Power point presentations, Class activities/ assignments, Field visits., Internship, etc.

Suggested Continuous Evaluation Methods:
Continuous internal evaluation through internal tests quizzes and Presentation.
Course prerequisites: To study this course, a student must have had the subject Mathematics in PG degree.
Suggested equivalent online courses:
There are online courses on the channels such as Swayam Prabha, and NPTEL. E-contents from different online libraires.
Further Suggestions:
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Suggested Readings:

1. **Balagurusamy. E:** Reliability Engineering, Tata McGraw Hill Publications, New Delhi, 2010.
2. **Dubosisand. D, Prade. H:** Fuzzy Sets and Systems Theory and Applications, Academic Press, New York, 1980.
3. **Bazara. M. S., Sherali. H.D, Shetty .C.M:** Nonlinear Programming-Theory and Algorithms (3rd Edition), John Wiley& Sons, Inc., Hoboken, New Jersey, 2006.
4. **Bourbaki.N:** General Topology, Part-I, Addison-Wesley,1966.
5. **Cai, Kai-Yuan:** Introduction to Fuzzy Reliability, Kluwer Academic Publishers, Boston/Dordrecht/London,1996.
6. **Chauthaiwale. Shriram.:** Enjoy Vedic Mathematics", Art of Living international Bangluru, India
7. **George J. Klir and BoYuan:** Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall of India, New Delhi, 2009.
8. **Lidl. R. , Niederreiter. H** : Introduction to Finite Fields and their Applications (2nd Edition), Cambridge University Press, 1994.
9. **Munkres, J.R.:** Topology, Pearson Education Pvt Ltd, Delhi, 2018.
10. **Taha.H.A:** Operations Research-An Introduction (10thEdition), Pearson Publication, 2017.

CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT

Pre-Ph.D COURSE WORK PAPER II, ADVANCED MATHEMATICS II

Programme: Pre-Ph.D. Course work	**Duration:** Six months	Semester: First
Subject: Mathematics		
Course Code:	**Course Title:** Advance Mathematics II	Theory

Course Objectives: The objective of this paper is

1. To study the basic concept of inventory theory, demand, deterioration, shortages etc.
2. To study the Reliability Evaluation Techniques, Software Reliability.
3. To study the basic concept of stability theory, Normal mode technique, stability of flow between two parallel plates.
4. To study the Secret key cryptography and Public key cryptography.
5. To study the Inner product spaces, Hilbert spaces.
6. To study the Derivative and Its Applications , Integrations and Its Applications by Vedic mathematics

Course Outcomes: On completion of this course, students will be able to:

CO1. Comprehend the dynamics of inventory management's principles, concepts, and techniques as they relate to the entire supply chain (customer demand, distribution, and product transformation processes),

CO2. Thoroughly account for industrial applications of different methods in reliability theory

CO3. Provide security of the data over the network, Do research in the emerging areas of cryptography and network security

CO4. Understand the notions of dot product and Hilbert space and apply the spectral theorem to the resolution of integral equations

Credits: 6	**Core Compulsory**
Max. Marks: 100	Min. Passing Marks:

Total No. of Lectures-Tutorial (in hours per week): L-T: 6-0

Unit	Topics	No. of Lectures 60
I	Analytical structure of inventory problems, Different types of demand pattern. Concept of deterioration and shortages. Concept of lead time, Deterministic inventory models, Trapezoidal type demand rate, Stock and price dependent consumption rate, deterioration, time-varying deterioration, imperfect production process, preservation technology, Two-warehouse inventory model, K-release rule, Bulk release rule, different type of holding costs. Concept of partial backlogging	10

VI	Osculator, Recuuring Decimals, Quadratic Equations by Vedic Methods, Bi-quadratic Equations by Vedic Methods, Encryptions, Derivative and Its Applications , Integrations and Its Applications.	10

Teaching Learning Process: Class discussions/ demonstrations, Power point presentations, Class activities/ assignments, Field visits., Internship, etc.

Suggested Readings:

1. **Arya, Vedaveer.:** Indian Contributions to Mathematics and Astronomy , Aryabhata Publications.
2. **Barlowand. R.F, Proschan. F.:** Mathematical Theory of Reliability, John Wiley and Sons, 1996.
3. **Chandrasekhar. S.:** Hydro dynamic and Hydromagnetic Stability-ChaptersI, II,VII,X, XI, Dover, NewYork, 1981.
4. **Eminent Bharatiya** Mathematicians: Dr Shriram Chauthaiwale, Dr Deviprasad Verma Devendra Deshmukh published by Vidya Bharati, Kurukshetra.
5. **G., Whitin. T.M.:** Analysis of Inventory-Systems, Prentice Hall Inc.,1963.
6. **Hoffstein. J, Pipher. J, J.H. Silverman:** An Introduction to Mathematical Cryptography (2nd Edition), Springer, 2014.
7. **Kreyszig. E.:** Introductory Functional Analysis with Applications, John Wiley and Sons, New York, 1978.
8. **Meijer. A.R.** : Algebra for Cryptologists (1st Edition), Springer,2016.
9. **Naddor.E**; Inventory System, John Wiley & Sons, Wiley, New York, 1966.
10. **Nath, L.S.Sri:** Mathematical Theory of Reliability, Affiliated East West Press Pvt. Ltd, 2009.
11. **Rathy, R.K.:**An Introduction of Fluid Dynamics Chapter XIII, Oxford and IBH Publishing Company, New Delhi, 1976.

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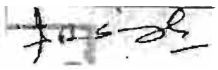
1. Prof. M. K. Gupta

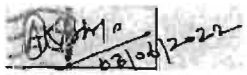
1. Prof. Shiv Raj Singh



2. Dr. Narottam Kumar

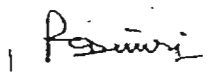
3. Prof. Jaimala

4. Dr. Anirudh Kumar Bhargava



5. Dr. Madan Pal Singh

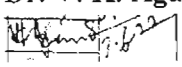
6. Prof. R. C. Dimri



7. Prof. Shri Prakash Sharma ®

8. Prof. D. Pandey ®

9. Dr. V. K. Agarwal (R)



10. Dr. Satya Deo Tripathi

	and lost sales, Inventory models under trade credit.	
II	Reliability Evaluation Techniques: Binomial Theorem to evaluate Network Reliability, State Space Approach, Minimal Cut Set Method, Two identical unit active and passive redundant systems with constant failure and repair rates, Software Reliability. Fuzzy Methods in Probist system, Profust Reliability Theory, Pos bist Reliability Theory.	10
III	Basic concepts of stability theory, Normal mode technique, Stability of flow between two parallel plates: Instability of an inviscid fluid layer, Instability of plane poiseuille flow. Thermal instability of layer of fluid heated from below: the Benard convection, the Boussinesq approximation, the principle of exchange of stabilities and the first variational principle.Stability of superposed fluids: the Rayleigh Taylor instability, stability of non-viscous and viscous stratified fluid, effect of surface tension, effect of rotation, effect of horizontal and vertical magnetic field.	10
IV	Secret key cryptography and Public key cryptography, The discrete logarithm problem, Discrete logarithm problem over a finite field. Diffie-Hellman Key Exchange. Elliptic curves, Elliptic curves over finite field, The elliptic curve discrete logarithm problem. Elliptic curve cryptography: Elliptic curve Diffie-Hellman Key Exchange, Elliptic curve Elgamal cryptosystem.	10
V	Inner product spaces, Hilbert spaces and their examples, Apolloniu's identity, Schwarz inequality, Triangle inequality, Orthogonality, Pythagorean theorem, Gram-Schmidt orthonormalization process, Continuity of inner product, Completion of an inner product space, Subspace of a Hilbert space, Orthogonal complements and direct sums, Projection, Projection theorem, Dual basis and dual spaces, Riesz representation theorem for bounded linear functionals on a Hilbert space, Strong and weak convergence.	10