



Hemchandracharya North Gujarat University, Patan

PH.D. COURSE WORK SYLLABUS

SUBJECT : MATHEMATICS

Scheme & Course

Sr.	Paper	Nomenclature	Credits	Marks
1.	Paper-I-MATHS-CW-101	Research Methodology	04	70+30
2.	Paper-II-MATHS-CW-102	Advance Course in Mathematics	04	70+30
3.	Paper-III-MATHS-CW-103	Computer Applications in the subject	04	70+30
4.	Paper-IV-MATHS-CW-104	Review of published research in the relevant field	04	70+30
5.	Paper-V-MATHS-CW-105	Comprehensive Viva	04	100

Notes:

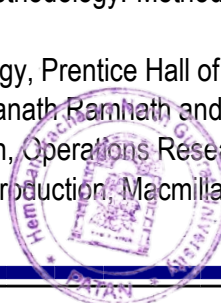
- The candidate has to obtain a minimum of 55% of marks or its equivalent grade points in aggregate in the course work in order to be eligible to continue in the Ph.D. programme.
- If candidate obtains 'F' or 'Ab.' grade in the course/ subject. He/ she will be treated to have failed in that course. He/ She has to reappear in the examination in the next semester.

Paper-I	MATHS-CW-101	Research methodology	Credit-4	(70+30)
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UNIT-I	Research Methodology: An Introduction (1.1 to 1.10), Defining the Research Problem (2.1 to 2.4), Research Design (3.1 to 3.4), Testing of Hypothesis (10.0 to 10.15). Interpretation and Report Writing (19.1 to 19.10)
UNIT-II	Literature survey, Internet as a medium for research, Knowledge of web search, Elements of an article: Title, Abstract, Keyword, Introduction, Formulation, Result and discussion, References, Evaluation of research: plagiarism, citation, Impact factor etc. Review of research papers, Working knowledge of Google Scholar, Research Gate, Web of Science, MathSciNet, SCOPUS and/or other open-source/ subscribed journals and books.
UNIT-III	Simulation-What is Simulation, Types of Simulation, Why to use Simulation, Limitations of Simulation Techniques, Phases of Simulation model, Generation of Random Numbers, Monte-Carlo Simulation, Simulation and its applications.
UNIT-IV	Inventory, Types of Inventory model, Inventory Decision, Cost involving in Inventory Problems, Variables in Inventory problems, Concept of EOQ, The EOQ model with shortage.
UNIT-V	Replacement and Reliability models, Failure mechanisms of items, Replacement of items that deteriorate, Replacement Policy for items whose maintenance cost increase with time and money value is constant, Money value, Present work factor and discount rate.

Recommended Books:

- Kothari, C.R. and Garg, G: Research Methodology: Methods and Techniques, 3rd Edition, New age International Publshes (2014).
- Panneerselvam, R, Research Methodology, Prentice Hall of India, New Delhi, 2004.
- S.D.Sharma, Operations Research, Kedar Nath Ramnath and Company.
- Kanti Swarup, P.K.Gupta and Manmohan, Operations Research, Sultan Chand & Sons, Delhi.
- H.A. Taha, Operations Research - An Introduction, Macmillan Publishing Co.



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UNIT-I	Ordinary Differential Equations, Numerical Method, Single Step Method, Multi-Step Methods, Predictor-Corrector Methods, Stability Analysis, Boundary Value Problems, Initial Value Methods, Finite Difference Methods.
UNIT-II	Improvement of the Initial Solution by Using Method of Bisection, Regula Falsi and Newton-Raphson Method of Fixed Point Iterative Schemes. System of Linear Algebraic Equation and Eigen Value Problem and Errors.
UNIT-III	Theory of Automata, Description of a Finite Automaton, Transition System, Properties of Transition Function, Acceptability of a String by a Finite Automaton, Non Deterministic Finite State Machines.
UNIT-IV	Markov Analysis Introduction, Stochastic (Random) Process, Markov Process, Transition Probability, Transition Probability Matrix, First Order and Higher Order Markov Process, N-Step Transition Probabilities, Markov Chain, Steady State (Equilibrium) Condition, Markov Analysis (Illustrative Example). Decision Theory: Introduction, Type of Decisions, Component of Decision Making, Decision Models, Types of Environment, The Expected Monetary Value (EMV), Steps for Calculating EMV, The Expected Value of Perfect Information (EVPI), The Expected Opportunity Loss (EOL), Decision Making Under Uncertainty, Decision Making Under Conflict, Decision Tree Analysis, Decision Making Under Utilities: Utility Function, Utility Curve, Construction of Utility Curve. Posterior Probabilities and Bayesian Analysis.
UNIT-V	Sensitivity Analysis Introduction, An Important Lemma, Changes in the Coefficients 'Cj' of the Objective Function, Illustrative Example, Change in the Component 'bi' of Vector. New Variable, Deletion of Existing Variable, Addition of New Constraint, Deletion of Existing Constraint. 1. Kanti Swarup, Gupta, P.K. and Manmohan: Operations Research, Sultan Chand & Sons, New Delhi, India. 2. Sharma, S.D. (2003): Operations Research, Kedarnath Ram Nath & Co. Fourteen edition, Meerut, Indian 3. M. K. Jain, R.R. Kanungo. R. K. Jain: Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd. 4. K.L.P. Mishra, N. Chandrasekharan: Theory of Computer Science, PHI-India. 5. V. Rajaraman, Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd, Delhi. 6. D. S. Heera and P. K. Gupta, Operations Research and Introduction, Sultan Chand & Sons, Delhi. 7. H. A. Taha, Operations Research-An Introduction, Macmillan Publishing Co.

UNIT-I	Introduction to Computer fundamental, Characteristics of Computers, Evolution of computers, Computer memory, computer generations, Basic computer organization; System software, Application software, introduction to operating system, single user, multi-user, multi-tasking single tasking, application of computer for business and research, MS-windows.
UNIT-II	MS-Office and its application, File handling in window, various versions of MS-Office, Research publishing tool- MS-Word, Adobe Acrobat, Graphics tool- MS-Excel, MS-Power Point.
UNIT-III	History of C Language, Identifiers in C, Variables and Data Types, Constants, Printf and Scanf, Control Flow - Conditional Branching, the Switch Statement. Looping. nested loops, The Break and Continue statement, the goto statement infinite loops.



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Operators and Expressions: Precedence and associativity. Unary plus and minus operators. Binary Arithmetic operators arithmetic assignment operators. Increment and decrement operators. Comma Operator, Relational operators, logical operators, bit-Manipulation operators, Bitwise assignment operators. Cast operators size of Operators, Conditional Operators, Memory Operators.

UNIT-IV Introduction:- Latex and open office, Writing of simple article, letters and applications, Mathematical symbols and commands, arrays, formulas and equations, Spacing, Borders and Colors, Creating different templets, Writing of research article, reports etc. Preparation of templets of thesis and books. Preparation of ppt. poster, etc., Pictures and Graphics.

UNIT-V MATLAB introduction: Arithmetic, functions, Jotting the of different functions, Matrix operations, finding roots of an equation, Finding roots of a system of equations, Solving differential equations. Basic 2-D plots and 3-D plots.

Recommended Books:

1. Balaguruswami, E.: Programming in C, Tata Mcgraw Hill. (2012)
2. Peter A Darnell and Philip E. Margolis, CA Software Engineering Approached narosa Publishing House (Springer International Student Edition) 1993.
3. Pratap, R.: Getting started with MATLAB, Oxford University Press, 2010.
4. Lynch, S.: Dynamical Systems with Applications using MATLAB, Birkhiuser, 2014.
5. Lamport, L.W.: LaTeX: A document Preparation Systems, Addison-Wesley Publishing Company, 1994.
6. Kopka, Daly, P.W.: Guide to LATEX, Fourth Edition, Addison Wesley, 2004

Paper-IV MATHS-CW-104 Review of published research in the relevant field Credit-4 (70+30)

For this paper candidates will have to review literature in an area of research, prepare a research proposal and submit a report to the University at the end of the course work. The selection of the problem and preparation of the proposal will be in consultation with research guide.

Paper-V MATHS-CW-105 Comprchensive viva voce Credit-4 (70+30)

Candidate will face a Comprehensive Viva-Voce of 4 credits on the subject of Research Methodology, Advanced Course in Mathematics and literature review report submitted to the university. The Presentation will have to be made by the candidate and it will need to be prepared in consultation with research guide.



(Signature)
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