

**CENTURION UNIVERSITY OF TECHNOLOGY & MANAGEMENT : : ODISHA
PARALAKHEMUNDI**

R. M and Course Work Information for Ph. D. Scholars 2017 - 18 admitted batch & onward

Course Work Particulars

All the candidates admitted in to Ph. D. programme at CUTM have to earn a Grade Point Average of 6.0 out of 10 through a 12 credits course work which comprises of:

- A. Discipline specific Research Methodology course (4 Credits),*
- B. Topic specific advanced level course (4 Credits) prescribed for each scholar by his / her supervisor and*
- C. A Review Paper on the literature of the candidate's proposed area of research (4 Credits) to be published in CUTM journal.*

A. Details of Research Methodology Course

At present the Research Methodology course for Ph. D. students is offered by different schools of the university as given below. The scholars are required to attend the classes scheduled and shall get qualified in the course pertaining to their faculty.

- 1) School of Engg. & Technology - PDRM1001 Research Methodology for Engineers - For Scholars belonging to disciplines of Civil, CSE, Mechanical, ECE and EEE.
- 2) School of Applied Sciences - PDRM1002 Research Methodology for Basic and Applied Sciences - For Scholars belonging to disciplines Chemistry, Mathematics and Physics.
- 3) School of Agriculture - PDRM1003 Research Methodology for Agriculture Extension - For Scholars belonging to discipline of Agriculture Extension
- 4) School of Management - PDRM1004 Research Methodology for Humanities, Management and Social Sciences - For Scholars belonging to disciplines of Humanities, Management and all disciplines of Social Sciences.

Scholars registered under Interdisciplinary Category have to choose one of these courses as recommended by their respective supervisors.

Evaluation of RM Course

Internal Assessment - 40 Marks; External Evaluation - 60 Marks (Open Book Examination)

Qualifying Marks - 50% in both external, and internal.

Discipline Coordinators

1. Engineering & Technology - Dr. P. S. Rao, Director R & D, Paralakhemundi campus
2. Basic & Applied Sciences - Dr. S. K. Biswal, Dean School of Applied Sciences, Jatani Campus
3. Agriculture - Dr. M. Devendar Reddy, Dean, Academic, Agriculture, Paralakhemundi Campus
4. Humanities & Management - Dr. Smita Mishra Panda Director R & D, Jatani Campus
5. Overall Coordinator - Dr. Smita Mishra Panda (Director R & D, Jatani Campus)

Course Content & Reading Material

Refer

Annexure - I for Engineering & Technology

Annexure - II for Basic & Applied Sciences

Annexure - III for Agriculture Extension

Annexure - VI for Humanities & Management

Annexure - I

PDRM1001 Research Methodology for Engineers

(Common for Scholars belonging to disciplines of Civil, CSE, Mechanical, ECE and, EEE)

Module I: Introduction to Research

Meaning and Objectives, Types of Research - Basic and Applied Researches. Research Approaches - Discrete vs Analytical Research, Applied vs Fundamental Research, Qualitative vs Quantitative Research, Conceptual vs Experimental (or Empirical) Research. Steps in Research Process. Research Methods and Methodology - Criteria for Good Research - Research Objectives.

Module II: Research Problem and Research Design

Types of Research, Definition of Research Problem - Problem Selection - Techniques Involved. Research Design - Different research designs, basic principles of experimental designs, important experimental designs. Meaning and Need for Research Design. Features of Good Design - Concepts Relating to Research Design.

Module III: Literature Review

Significance and importance of Literature Review. Steps in Conducting Literature Review - Steps in Conducting Literature Review - Guidelines on Style, Mechanics and language usage - Writing up to the literature Reviewed - Some Examples.

Module IV: Design of Experiments, Experimental Data collection

(Objective: Understanding basic concepts of procedures required for different specializations of engineering discipline. No specific experimentation or modelling need to be assessed)

Types of Experiments - Experimental Design Factors - Experimental Design Factors - Experimental Design Protocol Numerical and Analytical Experiments - Computer Simulation and Software usage. Calibration.

Types of Data - Different Approaches of Data Collection - Primary and Secondary Data - General Procedure for Data Collection. Sampling Techniques and sample size.

Basic Electrical Measurements and Sensing Devices - Analog and Digital Meters, Amplifiers, Power Suppliers, Signal Conditioning.

Topics for Other than Computer Science Branch: Transducers - Types of Transducers and working principles. Force, Torque and strain Measurement - Pressure, Flow and Temperature Measurement, Electrical - Resistant Strain gauges -Temperature compensation calibration of Instruments. Air Pollution Sampling and Measurement.

Topics for Computer Science Branch Only: Computer Networking - Packet Tracers - Data Transfer. Operating Systems - Scheduling Algorithms - Dealing Dead Lock. - Algorithm Analysis.

Module V: Data Transmission and Data Analysis

Analog Digital and Digital to Analog Conversion - Data Storage and Display.

Data Errors - Identification of Data Errors - Causes and Types of Experimental Errors. Error Analysis on common Basis - Evaluation of uncertainties for complicated Data Reduction. Statistical Analysis of Experimental Data - Probability Distribution - Gaussian and other Distributions. Chi-square test of Goodness of Fit Method of least squares - Correlation Coefficient Multivariable Regression-Standard deviation Student's t-Distribution. Graphical Analysis and Curve Fitting - Choice of Graph's Formats - General considerations in Data Analysis.

Module VI: Thesis & Report Writing and Research Publication

Thesis & Report Writing: Definition and significance of a Thesis, Level of work for Doctoral and Graduate Thesis. General Requirements of a good Thesis - Originality, Style, Presentation, Definitions and Terminology - Terms and Phrases to be avoided. Grammar and logic Bellman's rule of 3 in Report writing. Canonical organisation of chapters in thesis documents - Suggested structure for Thesis.

Research Publication: Citation Styles, Style guides and avoiding plagiarism - APA style of research publication. Writing of a Research paper for a conference or journal - Concepts of a Research Article - Content & Style - Journal Style - Sections of a paper - Significance of sections on results, Discussion and conclusion

Recommended Reading Materials

References:

- 1) Research Methodology - Methods and Techniques by C.R. Kothari New Age International (P) Ltd.
- 2) Experimental Methods for Engineers by J.P. Holman TMH
- 3) Engineering Research Methodology by Krishnan Nallaperumal
- 4) Probability & Mathematical Statistics by Prasanna Sahoo
- 5) Statistics & Data Analysis by A. Abebe, J. Daniels, J. W. McKean and J. A. Kapenga
- 6) Computer Networking - Tanenbaum
- 7) Operating Systems Concepts by Avi Silber Schadz & Galvin

<i>Resource Mapping</i>	
<i>Module</i>	<i>Reference No. & Chapter No.</i>
<i>Module I</i>	Ref. 1 - Ch. 1 and Ref. 3 - Ch. 1, 2 & 3
<i>Module II</i>	Ref. 1 - Ch. 2 and Ref. 3 Ch. 3, 4 and 5
<i>Module III</i>	Ref. 2 - Ch. 14
<i>Module IV</i>	Ref. 2 - Ch. 4 to Ch. 13 and Ch. 16
<i>Module V</i>	Ref. 2 - Ch. 3 & 14, Ref. 4 - Ch. 6, 14, and 19 Any other standard Text Book on Statistics
<i>Module VI</i>	Ref. 1 - Ch. 14, Ref. 2 - Ch. 15 and Ref. 3 - Ch. 6 & 7

Annexure – II

PDRM1002 Research Methodology for Basic and Applied Sciences

(Common for scholars belonging to disciplines of Chemistry, Mathematics and Physics)

Module I: Introduction to Research

Overview and orientation of the course: What constitutes research? An overview of history of mankind and the centrality of human beings (anthropocentrism). Understanding basic concepts of research such as Ontology, Epistemology, Methodologies and Methods.

Module II: Research Problem and Research Design

Types of Research, Selecting and defining a research problem: What is research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, Hypothesis and its functions.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design, different research designs, basic principles of experimental designs, important experimental designs.

Module III: Literature Review

Literature Review: What is literature review? Why the need for literature review? How to carry out a literature review?

Module IV: Research Hypothesis

Hypothesis Testing, Experimental Methods, Theoretical Methods, Observational and Exploratory method, Product Design Method.

Module V: Instrumental Methods, Data Collection and Data Analysis

A. For scholars other than Mathematics (Objective: Exposure to Basic Principles of Operation of the Instruments and their Use)

Microscopy: SEM, TEM, STM, AFM ; Diffractometry: X-Ray Diffraction; Spectroscopy: Emission, Absorption, Photoluminescence, Raman spectra in UV, Visible and IR ranges, Mass Spectroscopy; Calorimetry: DTA, TGA; Chromatography.

Measurements of observables, Measurement errors and error propagation, Minimising errors.

Data Analysis: Theoretical distribution (normal, binomial and Poisson distribution), Central Limit Theorem and its implications, Measures of Central Tendency: Dispersion, Skewness and Kurtosis; Variance and Correlation; Regression Analysis: Linear and non-linear Regression: simple and polynomial relationship; Analysis of variance (ANOVA) (One factor and multiple factor), Duncan's multiple range test (DMRT), least significance difference (LSD) test; tests of significance: z-test, t-test, and Chi-square test.

B. For scholars belonging to Mathematics

Lagrange, Newton forward & Backward interpolation, Roots by Iteration, Secant, Newton Raphson, Gauss Elimination, Gauss Seidel, Gauss Jordan method for solution of a set of algebraic equations, Eigen value & Eigen vectors of a matrix, Matrix Inversion, Trapezoidal and Simpson's Rule of Integration, Rungekutta 4th order method, Shooting Method.

Module VI: Interpretation and Report Writing

Meaning of interpretation and why interpretation, technique of interpretation and precaution in interpretation, Significance of Report Writing, different steps in report writing, layout of research report, Types of reports, oral presentation, mechanics of writing a research report, precautions for writing research report.

Recommended reading materials

References:

- 1) Research Methodology - Methods and Techniques by C.R. Kothari New Age International
- 2) Numerical Methods for Scientific and Engineering Computation, 6th Edition by R. K. Jain , S. R. K. Iyengar, & M.K. Jain (For Mathematics)

Annexure - III

PDRM1003 Research Methodology for Agriculture Extension

(For scholars belonging to Agriculture Extension)

Module I: Introduction to Research

Overview and orientation of the course: What constitutes research? An overview of history of mankind and the centrality of human beings (anthropocentrism). Understanding basic concepts of research such as Ontology, Epistemology, Methodologies and Methods.

Module II: Research Problem and Research Design

Types of Research, Selecting and defining a research problem: What is research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, Hypothesis and its functions.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design, different research designs, basic principles of experimental designs, important experimental designs.

Module III: Literature Review

Literature Review: What is literature review? Why the need for literature review? How to carry out a literature review?

Module IV

Scaling Techniques - meaning, types, principles, steps, and quality. Techniques of attitude scale construction - paired comparison, equal appearing intervals scale, successive intervals, summated ratings. Scalogram analysis, scale discrimination technique, reliability and validity of scales.

Sociometrics, content analysis, case studies, semantic differential techniques, projective and semi-projective techniques, critical incident techniques, Q-sort techniques.

Module V

Knowledge scale measurement, participatory tools and techniques in behavioural research data collection, evaluation, and impact analysis.

Computer packages of analysis used in extension research - meaning, need, types, e-data collection, and information analysis.

Module VI: Interpretation and Report Writing

Meaning of interpretation and why interpretation, technique of interpretation and precaution in interpretation, Significance of Report Writing, different steps in report writing, layout of research report, Types of reports, oral presentation, mechanics of writing a research report, precautions for writing research report.

Recommended reading materials

- 1) Research Methodology - Methods and Techniques by C.R. Kothari New Age International (P) Ltd.
- 2) Tests and Measurements in Social Research. By Chandrakandan K, Venkatapirabu J, Sekar V, and Anand Kumar V. 2000. APH Publ.
- 3) Farmer first: Farmer Innovation and Agricultural Research. By Chambers R, Pacey A, and Trupp LA (ed.). 1989.
- 4) Scaling Methods By Dunn-Rankin P, Knezek GA, Wallace SR, and Zhang S. 2004. (2nd ed.) Psychology Press.
- 5) Fundamentals of Extension Education and Management in Extension By Jalihal KA and Veerabhadraiah V. 2007.. Concept Publ.
- 6) Scaling techniques. What, Why and How. Natarajan V and Gunasekaran K. Association of Indian Universities. 1986.
- 7) New dimensions of extension education. By Venkaiah S. Anmol Publ. 2001

Annexure - IV

PDRM1004 Research Methodology for Humanities and Management (For scholars belonging to disciplines of Humanities and Management)

Module I: Introduction

Overview and orientation of the course: What constitutes research? An overview of history of mankind and the centrality of human beings (anthropocentricism). Understanding basic concepts of research such as Ontology, Epistemology, Methodologies and Methods.

Module II: Research Problem and Research Design

Types of Research, Selecting and defining a research problem: What is research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, Hypothesis and its functions.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design, different research designs, basic principles of experimental designs, important experimental designs.

Module III: Literature Review

Literature Review: What is literature review? Why the need for literature review? How to carry out a literature review?

Module IV: Sampling, Measurement and Scaling

Sampling: Census and sample survey, implications of sample design, steps in sample design, criteria for selecting a sampling procedure, characteristics of a good sample design, different types of sample design.

Measurement and Scaling: Measurement and Scaling Techniques: Measurement in research and measurement scales, Errors in measurements, Tests for sound measurements, Technique for developing measurement tools. Scaling: Meaning of scaling, Scale classification bases, Important scaling techniques.

Module V: Data Collection and Data Analysis

Data Collection: Methods of Data Collection: Collection of primary data, observation method, interview method, data collection through questionnaires and schedules, other methods of data collection including Case study method, collection of secondary data, appropriate method for data collection.

Data Analysis: Analysis and Interpretation in Quantitative and Qualitative Research. Data Presentation. Central Tendency and Dispersion, Associations, Tests of Significance.

Module VI: Interpretation and Report Writing

Meaning of interpretation and why interpretation, technique of interpretation and precaution in interpretation, Significance of Report Writing, different steps in report writing, layout of research report, Types of reports, oral presentation, mechanics of writing a research report, precautions for writing research report.

Recommended reading materials

References:

- 1) Research Methodology - Methods and Techniques by C.R. Kothari New Age International (P) Ltd.
- 2) Research Methodology: A Step by Step Guide, Ranjit Kumar, 2011, Sage South Asia Publications
- 3) Social Research, Sotorios Sarantakos, 2004 (3rd ed.), Palgrave
- 4) Research Methods, Lawrence Neuman, 2010 Pearson (7th ed.),
- 5) Handbook of Qualitative Research Norman Denzin & Yvonna Lincoln, 2005 (3rd ed.), , Sage

B. Details of Topic Specific Course

Supervisors of each scholar decide one course considered necessary for carrying out the research by his / her scholar. The Supervisors prepare the syllabus for the subject and give a model question paper. Apart from this the supervisor shall also give names of two experts other than the supervisors (within CUTM or outside CUTM) for the purpose of obtaining the question paper. Respective discipline coordinators monitor this activity and arrange for conducting the examination preferably during the summer forward the

C. Details of Research Methodology Course

A Review Paper on the literature of the candidate's proposed area of research (4 Credits) to be published in CUTM journal within 1 year of admission for getting eligible for registration of Ph. D. The research committee of the scholar shall evaluate the work in a review and shall recommend a grade to the literature review and the paper published. Paper acceptance letter from the editor of the journal shall be considered as eligibility for allowing the scholar for the review and receiving a grade in case due to any reasons the journal has not been published by the time of the review. The discipline coordinators shall forward to the Ph. D. coordinator the reprint, of the papers or the acceptance letters of all scholars along with the grades recommended to them by the committee.