



Syllabus

First Semester Courses in MSc (Physics)

2023-2024

Contents:

- **Syllabus for Research Methodology:**
 - **PSPHY6001RM1 – Research Methodology**
- Evaluation and Assessment guidelines


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APPROVED SYLLABUS





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- **Syllabus for Research Methodology:**
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Research Methodology

Credits: 4 (Theory 4 - Total 60 hours)

Number of lectures: Four hours per week for 15 weeks

Prerequisite: Students who have completed a Three-Year Bachelor Degree in Science with Physics Major (Level 5.5)

Course Objectives:

1. To understand how to identify a research problem, execute the methods of research and interpret the results
2. To understand how to communicate the results of research with academic integrity

Course Outcomes (COs):

On completing the course, the student will be able to:

1. Understand the various steps of the scientific method along with the meaning of and need for research
2. Identify a research problem and formulate the objectives efficiently
3. Analyse and evaluate reliability of academic sources and carry out a survey of literature
4. Apply statistical analysis methods and techniques to data and interpret the results.
5. Design effective structures for communication of research results in different forms
6. Evaluate any academic source for plagiarism

Unit 1

(20 lectures)

The Scientific Method in Research

1. Steps of the scientific method - question, collection of data, hypothesis, performing the experiment, analysis of data, drawing inferences, and communication of results.
2. Research: purpose and types, research within the context of physics and astrophysics in India and in other countries
3. Identifying a research problem, formulating the objective, literature survey, reliable academic sources, predatory journals, specific examples in physics and astrophysics

Unit 2

(20 lectures)

Statistical analysis

1. Error analysis and propagation, types of data. Representation of data: tabular and diagrammatic methods, inference from data: averages and higher moments. Scatter plots: Correlation tests.
2. Conditional probability, Bayes theorem, Probability distributions, likelihood estimation.
3. Model fitting on data (regression), types of errors, hypothesis testing and confidence limits.

Unit 3

(20 lectures)

Communicating research and academic integrity

1. Structure and components of a written report, types of reports: thesis versus research paper, basic language/grammar rules for effective writing, making effective tables and graphs, bibliography and citation styles
2. Oral communication: seminars, posters, interacting with other researchers at conferences
3. Plagiarism: meaning, why and how to avoid it, self-plagiarism, Intellectual Property Rights, copyrights and patents
4. Introduction to tools: LaTeX, natbib, Zotero, Turnitin

List Of Recommended Reference Books

1. Research methodology techniques and methods by C L Kothari, New age International publishers
2. Research Methodology: A step-by-step guide for beginners, 3rd Edition, Ranjit Kumar, SAGE Publications
3. A Manual for Writers of Research Papers, Theses, and Dissertations, 8th Edition, Kate Turabian, The University of Chicago Press
4. The Craft of Research, 4th Edition, Wayne Booth, Gregory Colomb, Joseph Williams, Joseph Bizup, William Fitzgerald, The University of Chicago Press
5. Scientific Inference: Learning from Data, Simon Vaughan, Cambridge University Press
6. Data Reduction and Error Analysis for Physical Sciences, P R Bevington and D K Robinson, McGraw Hill

Evaluation: Total marks per course – 100

- I. Formative Assessment ‘for’ Learning (continuous internal assessment - CIA to improve learning).
 CIA - 40 marks
 CIA 1: Written test - 20 marks
 CIA 2: Field trip/ Sit-in exams/ Research article review/ Assignments/ Presentations/ MCQs - 20 marks
- II. Summative Assessment ‘of’ Learning (focus on outcomes, quantitative data for outcomes of instruction).
 End Semester Examination – 60 marks

Template for the End Semester examination in Semester I for the Research Methodology course

UNITS	KNOWLEDGE	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS- Per unit
1	6	8	6	20
2	6	8	6	20
3	6	8	6	20
-TOTAL- Per objective	18	24	18	60
% WEIGHTAGE	30%	40%	30%	100%



Syllabus

Second Semester Courses in MSc (Physics)

2023-2024

Contents:

- **Syllabus for On-Job Internship:**
 - **PSPHY6001OJ1 – Internship**

Internship

Credits: 4

Prerequisite: Students who have completed a Three-Year Bachelor Degree in Science with Physics Major (Level 5.5)
