FIRST-YEAR OF MASTER OF SCIENCE IN PHYSICS REVISED SYLLABUS ACCORDING TO CBCS NEP2020

COURSE TITLE:- RESEARCH METHODOLOGY
SEMESTER – I
W.E.F. 2023-2024

RECOMMENDED BY THE BOARD OF STUDIES IN PHYSICS
AND
APPROVED BY THE ACADEMIC COUNCIL

Devrukh Shikshan Prasarak Mandal's
Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and
Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh.
Tal.Sangmeshwar, Dist. Ratnagiri-415804, Maharashtra, India

Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce and Vid. Dadasaheb Pitre Science College, Devrukh (An Autonomous College Affiliated with University of Mumbai)

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Academic Council Item No: **03 dated 8 July 2023**

Name of the Implementing Institute	:	Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal. Sangmeshwar, Dist. Ratnagiri-415804,
Name of the Parent University	:	University of Mumbai
Name of the Programme	:	Master of Science
Name of the Department	:	Physics
Name of the Class	:	First Year
Semester	:	First
No. of Credits	:	04
Title of the Course	:	Research Methodology
Course Code	:	S509PHT
Name of the Vertical in adherence to NEP 2020	:	Major
Eligibility for Admission	:	BSc in Physics
Passing Marks	:	40%
Mode of Assessment	:	Formative and Summative
Level	:	PG
Pattern of Marks Distribution for SEE and CIA	:	60:40
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2023-2024

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Syllabus for First Year of Master of Science in Physics

(With effect from the academic year 2023-2024)

SEMESTER - I

Course Title: Research Methodology   **No. of Credits -   04**

Type of Vertical: Elective   **COURSE CODE: S509PHT**

Learning Outcomes Based on BLOOM's Taxonomy:

After completing the course, the learner will be able to…

Course Learning Outcome No.	Blooms Taxonomy	Course Learning Outcome
CLO-01	Knowledge	Know uncertainties in measurements, probability distributions and error analysis
CLO-02	Understand	Describe the appropriate research theory for a problem
CLO-03	Analysis	Design the report base on interpretation of the data
CLO-04	Comprehension	Justify the hypothesis and conclude the limitation of it
CLO-05	Analysis	Evaluate data collection from proper method
CLO-06	Comprehension	Examine data by statistical approach

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Syllabus for First Year of Master of Science in Physics
(With effect from the academic year 2023-2024)
SEMESTER - I

Course Title: Research Methodology	**No. of Credits - 04**
Type of Vertical: Elective	**COURSE CODE: S509PHT**

COURSE CONTENT			
Module No.	**Content**	**Credits**	**No. of Lectures**
Unit 1	Research objectives: Types of research, Development of a research question; Science, pseudoscience and rationalism; Physical science and metaphysics; Literature survey, Identification of knowledge gaps and a research problem; Concept of novelty, Formulation and implementation of a research plan; Serendipity, creativity, discovery and innovation. Research process and tools: Design of experiments, testing and characterization; Measurement - Standardization, calibration and sampling; Primary and secondary data; Computer programming, theory, modelling and simulation; Data acquisition, processing, observation, critical analysis and interpretation; Presentation of data; Reliability and reproducibility.	**01**	**15**
Unit 2	UNCERTAINTIES IN MEASUREMENTS, PROBABILITY DISTRIBUTIONS, ERROR ANALYSIS (08 Hours) Uncertainties in Measurements: Measuring Errors, accuracy and Precision, systematic errors, Random errors, Significant figures and Round off, Uncertainties, Parent and Sample Distributions, Mean, median and mode, Standard Deviation of Distributions. Probability Distributions: Binomial Distributions, Poisson distribution, Gaussian or Normal Error Distribution, Lorentzian Distribution. Selected problems and examples. Error Analysis: Instrumental and Statistical Uncertainties, Propagation of Errors, Specific Error Formulas withy examples, Application of Error Equations. Numerical Errors, Conditioning and Stability, Convergence of Iterative Processes	**01**	**15**
Unit 3	**Communicating research results:** Journal paper – types of available publishing services; Research proposal, Report, Thesis; Presentation in Seminar and conference; Journal abbreviations, Bibliography standards; Indices of quality assessment of publications. **Statistical techniques**: Mathematical tools for analysis, Statistical data treatment and evaluation; Probability and probability distributions; Sampling and sampling designs, Data analysis, Testing of hypothesis, statistical tests and analysis, Data interpretation, multivariate analysis, Model building	**01**	**15**

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Unit 4	**Analytical and numerical technique**s: Mean deviation, Root mean square deviation, Histogram, Skewness, Kurtosis, Moments, Variance, Chi-square, Correlation, Factor analysis, Mean square weighted deviation, Regression, Time series analysis **Statistical and graphical packages**: MS Excel, MATLAB, Microcal Origin / Sigma plot, gnu plot, xmgr – Key Features; Developing algorithms and applications, Tex.	**01**	**15**
	Total	**04**	**60**

Reference Books:-
1. Research Methodology: The Aims, Practices and Ethics of Science, P. Pruzan, Springer, 2016
2. Research Methods for Science, M. P. Marder, Cambridge University, 2011
3. Fundamentals of Research Methodology and Statistics, Y.K. Singh, New Age, 2006
4. Research Methods the Basics by Nicholas Walliaman, Taylor and Francis London& New York 2011.
5. Research Methodology- Methods and Techniques 2nd edition. By C R Kothari, New Age Int. Publ. 2004.
6. Data Reduction and Error Analysis for the Physical Sciences 3rd Ed by Philip R Bevington & D Keith Robinson, McGraw – Hill (2003)
7. Numerical Methods by Balagurusamy, Tata McGraw – Hill(2000) 7. Numerical Analysis, 2nd Ed. by Francis Scheid, McGraw-Hill(2009)
8. Research Methodology: An Introduction for Science and Engineering Students; Melville and Goddard, Juta, 1996
9. Research Methods in Science and Engineering, Scott A. Gold, CRC Press, 2016

Access to the Course
The course is available for all the students admitted for Master of Science in Physics.

Methods of Assessment
The assessment pattern would be 60:40, 60% for Semester End Examination (SEE) and 40% for Continuous Internal Assessment (CIA). The structure of the SEE and CIA would be as recommended by the Board of Studies and approved by the Board of Examination and the Academic Council of the college.

Pattern of Evaluation
The Examination/Evaluation pattern shall be framed by the Board of Examination with its final approval from the Academic Council of the College.

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