

COURSES OF STUDY



M.PHIL. DEGREE UNDER SEMESTER SYSTEM IN GANGADHAR MEHER UNIVERSITY,
AMRUTA VIHAR, SAMBALPUR

SCHOOL OF PHYSICS
GANGADHAR MEHER UNIVERSITY, AMRUTA VIHAR,
SAMBALPUR- 768004, ODISHA

COURSE STRUCTURE OF M.Phil. PROGRAMME (PHYSICS)

The M. Phil Course in Physics spans a period of one academic year beginning from 1st January to 31st December comprising of two semesters with the following course structure. In Semester-I, each theory paper (PH- 611, PH-612 and PH- 613) carries 100 marks out of which 20 marks are for internal assessment examination except for the paper PH-614 i.e. the Teaching Assignment, which does not have internal examination. There will be one internal assessment examinations for each theory paper. There will be no internal examination in Semester-II. The duration of an examination for each theory is 3 hours. The pattern of teaching and examination in M. Phil classes are displayed in the Table given below for 2019 batch.

Semester	Paper Code	Nomenclature	Maximum Marks	Credit
Semester I	PH-611	Recent Trends in Physics	100 (80+20)	04
	PH-612	Research Methodology - I	100 (80+20)	04
	PH-613	Research Methodology - II	100 (80+20)	04
	PH-614	Teaching Assignment & Assessment	100 (50+50) ✓ Seminar- 50 ✓ ✓ Assignment-50 (30+20)	04
	Total in Semester - I			400
Semester II	PH-621	Dissertation	200 (Written - 150 Presentation - 25 And Viva Voce - 25)	08
Complete Course			600	24

SEMESTER I
COURSE: PH-611
Marks: 80+20 (4CH, 40 Hours)

Recent Trends in Physics

Unit I

10-Lectures

Superconducting Materials: BCS theory, Flux quantization, Josephson effect, High TC superconductor & Applications.

Magnetic materials: Different Type of Magnetic Materials and their properties, Weiss-molecular field theory of Ferromagnetism, antiferromagnetism, Ferrimagnetism, antiferrimagnetism, Applications.

Unit II

10-Lectures

Dielectric materials: Polarization mechanism, Dielectric constant, temperature dependence of dielectric constant, behavior of dielectric in AC field, AC and DC conductivity, Dielectric loss, Dielectric breakdown, ferroelectric, piezoelectric, pyroelectric materials, Applications.

Ceramic Materials:

Materials Properties and Requirements, Classification of Engineering Materials: Metals, polymers, ceramics, nano crystalline, biomaterials. Definition of Ceramics, Ceramic Microstructure, Traditional Versus Advanced Ceramics, General Characteristics of Ceramics, Applications, Ceramic Structure, Composite Crystal Structure, Structure of Covalent Ceramics, Applications.

Unit III

10- Lectures

Modern Materials:

Polymers, Composite materials; Meta materials, Smart materials, Characteristic properties and their applications.

Optical Materials:

Scattering, refraction, theory of refraction and absorption, Reflection and transmission, Atomic and Quantum theory of optical properties of, optical materials, Magneto optic and electro optic materials.

Synthesis of Materials:

High Temperature Ceramic Methods: Microwave Synthesis, Combustion Synthesis, High Pressure Method, Chemical Vapour Deposition (CVD), Sol-gel Method, High energy ball milling method.

Sintering and Grain Growth: Solid-State sintering, Liquid-Phase Sintering, Hot pressing and Hot Iso static Pressing.

Books for Reference

1. A. D. Helfrick and W. D. Cooper, Modern electronic instrumentation and measurement techniques, Prentice Hall of India (1996).
2. J. P. Bentley, Principles of measurement systems, Longman (2000).
3. G. K. White, Experimental techniques in low temperature physics, Calrendon (1993).
4. A. Roth, Vacuum technology, Elsevier (1990).
5. D. A. Skoog, F. J. Holler and T. A. Nieman, Principles of Instrumental analysis, Saunders Co Pub

Research Methodology-I

PH-612

Full Marks: 100 (4 Cr)

Unit: I Scope of Research and Ethics

(10 lectures)

Introduction and Scope, Research problem: Identification, Selection, Formulation of research objectives,

Research design: Components, Types and Importance, Research ethics, Institutional ethics committee, Plagiarism – Pitfall

Unit: II Technical writing

(10 lectures)

Types of technical documents: Full length research paper, Short/Brief communications, Letters to editor, Book chapter, Review, Conference report, Project proposal, Components of a full length research paper: Title/Topic statement, Abstract/key words, Aims and objectives, Hypothesis building, Rationale of the paper, Work plan, Materials and methodology, Results and discussion, Key issues and arguments, Acknowledgement, Conflict of interest statement, bibliography, Technical Resumes & Cover Letters

Components of a research proposal: Project summary, Key words, Origin of the proposal, Major Objectives, Methodology, Instrument facility available in the PI's department, Overview of status of Research and Development in the subject, Importance of the proposed project in the context of current status, Bibliography.

Unit: III Scientometrics

(10 lectures)

How to cite and how to do referencing, Literature search technique: using SCOPUS, Google Scholar, PUBMED, Web of Science, Indian Citation Index, and RG Styles of referencing: APA, MLA, Oxford, Harvard, Chicago Annotated bibliography
Tools for citing and referencing: Grammarly, Endnote etc.

Unit: IV Presentation and Communication skills

(10-12 lectures)

Tables, Figures and Pictures using Excel PowerPoint slide preparation
Preparation of Posters Electronic submission of manuscripts, Communication skills, oral and poster.

Research Methodology-II

PH-613

Full Marks: 100 (4 Cr)

Unit: I IPR and Cyber Law

(8-10 lectures)

Patents

Patent laws, process of patenting a research finding

Intellectual property (IP), Intellectual property right (IPR)

Copyright, Trademarks, GI

Cyber laws

COPE

Unit: II Quantitative Data Analyses

(10-12 lectures)

Types of data, Data collection - Methods and Tools

Hypothesis testing

Normal and Binomial distributions and their property

Tests of significance: Student *t*-test, *F*-test, *Chi-square* test

Correlation and Regression

ANOVA – One-way and Two-way, Multiple-range test

Unit: III Computer Fundamentals

(10-12 lectures)

Introduction to MS-Office software: MS-Word (Track change)

MS-Excel

MS-Power Point

MS-Access

Features for Statistical data analysis using computers and software, Microsoft Excel Data

Analysis ToolPak, SPSS

Unit: IV Advanced Tools & Techniques in Physics

(8-10 lectures)

X-ray Diffraction (Powder Diffraction, Single Crystal X-ray Diffraction), Neutron Diffraction, Scanning Electron Microscopy, X-ray Absorption Spectroscopy, Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM), Transmission electron microscope (TEM).

Complex Impedance Spectroscopy Technique, Rietveld Refinement Technique

References:

- [1] Mastering Internets - Coleman P and Dyson P
- [2] How the Internet Works - Gralla P
- [3] Inside Microsoft Office Professional - Cassel P *et al.*
- [4] Microsoft Office 2003 All in One, Microsoft Office 2010 In Depth - Habraken J
- [5] Microsoft 2007: Introductory Concepts and Techniques - Shelly GB, Vermaat ME, Cashman TJ
- [6] Statistical Methods - Snedecor GW & Cochran WG
- [7] Computers: Concepts & Uses - Sumner M
- [8] How Computers Work - White R
- [9] Cyber Law Simplified - Sood V
- [10] Cyber Law - Kumar Anupa P
- [11] Plagiarism: Why it happens, How to prevent it? - Gilmore B
- [12] Perspectives on Plagiarism and Intellectual Property in a Post-Modern World- Buranen L and Roy AM
- [13] Biostatistical Analysis - Zar JH
- [14] Research Methodology - R Panneerselvam
- [15] Research Methodology: Methods & techniques, 2008 - CR Kothari
- [16] A.Guinier, W.H.Freeman., X-ray diffraction, SanFrancisco (1963).
- [17] H.P. Klung, L.B. Alexander, X-ray Diffraction Procedures, Wiley, New York, 1974 p. 687.
- [18] J. R. Macdonald, "Impedance Spectroscopy Emphasizing Solid materials and Systems". John Wiley and Sons, New York (1987).
- [19] J. R. Carvajal, FULLPROF, A Rietveld Refinement and Pattern matching Analysis Program, Laboratoire Leon Brillouin (CEA-CNRS) France.
- [20] R. A. Young, "The Rietveld Method" International Union of Crystallography, (New York, Oxford University Press 1996).
- [21] M.N. Rahaman., "Sintering of Ceramics", CRC Press/Taylor and Francis Group, Boca Raton, 55 (2008).
- [22] S.J.L.Kang., "Sintering-Densification", Grain Growth and Microstructure, Amsterdam: Elsevier, 10 Edit. 39 (2005).
- [23] J.R. Macdonald, Impedance Spectroscopy: Emphasizing Solid State Materials and Systems, Wiley, New York, 1987 (Chapters 2 and 4).

Teaching Assignment and Assessment (Seminar = 50, Assignment = 50)

PH-614

Full Marks: 100 (4 Cr)

SEMESTER-II

Dissertation (200)

(Written – 150, Presentation – 25 and Viva Voce - 25)

PH-621

Full Marks: 200 (8 Cr)