

## ANDHRA KESARI UNIVERSITY ::ONGOLE DEPARTMENTOFPHYSICS

#### Ph.D. Part –I Couse structure

#### With effect from Academic Year 2024-2025

Papers	Paper	Title of the paper	Marks	Credits
	Code			
Paper -I	PHY1.0	Research Methodology	100	4
Paper -II	PHY2.0	Advances in Physics	100	4
Paper – III	PHY3.0	Glass Science	100	4
Paper - IV	PHY4.0	Seminar	100	2

1. A candidate to have passed if he/she gets a minimum of 40% marks in each paper and 50% aggregate in one attempt. Paper wise pass (supplementary) candidates should get a minimum of 50 marks in each paper.

# ANDHRA KESARI UNIVERSITY



Department of PHYSICS

## Pre.Ph.D. Part-I Examination in PHYSICS

### SYLLABUS

Paper-I- RESEARCH METHODOLOGY (General), (Common to all)

## Unit-I

**Research Methods:** Introduction to research, definition and characteristics of research, types of research, research methods and research methodology, importance of research, research process, criteria of good research, research ethics and plagiarism.

## Unit-II

**Literature Review:** Uses of literature review, sources of information using internet, organization information, importance of literature survey.

## Unit-III

**Uses of internet in research works:** Use of internet in searching research materials. (research papers, books, etc.), paper downloading, and submission of papers in arXiv, use of SPRIES database, various websites for journals, knowledge of impact factor, citation of research paper.

## Unit-IV

**Scientific report writing and presentation:** Significance of report writing, different steps of it, type of reports, seminar presentations: oral and poster, abstract writing, thesis writing: its characteristics and format, references or bibliography.

## Unit-V

**Statistical and graphical packages:** MS Excel, MATLAB, Microcal Origin/Sigma plot, gnu plot, xmgr – Key Features: Developing algorithms and applications, Tex.

### Books:

- 1. C R Kothari and Gourav Garg, Research Methodology Methods and Techniques (New age International)
- 2. Ranjit Kumar, Research Methodology, a step-by-step guide for beginners (3<sup>rd</sup> edition), SAGE publications.
- 3. Jan Jonker and Bartjan Pennink, The Essence of Research Methodology-A Concise
- 4. Fundamentals of Research Methodology and Statistics, Y.K. Singh, New Age, 2006
- 5. Research Methodology: The Aims, Practices and Ethics of Science, P. Pruzan, Springer, 2016
- **Note:** Question paper contains **FIVE** questions with internal choice have to be set from each unit. Each question carries **20 marks**.

## ANDHRA KESARI UNIVERSITY



**Department of PHYSICS** 

**Pre.Ph.D. Part-II Examination in PHYSICS** 

#### **SYLLABUS**

#### **Paper-II- Advances in Physics**

#### Unit-I

**DIELECTRICS:** Microscopic description of the static dielectric constant, the static electronic and ionic polarizabilities of molecules. Orientational polarization, the static dielectric constants of gages. The internal field according to Lorentz. The static dielectric constant of solids. The complex dielectric constant and dielectric losses. Dielectric losses and relaxation time and Cole-Cole plots.

#### Unit-II

**FERROECECTRICS AND PIEZOELECTRICS:** General properties of ferroelectric materials. Classification and properties of representative ferroelectrics, the dipole theory of ferroelectricity objections against dipole theory. Ionic displacements and the behavior of BaTiO<sub>3</sub> above the Curie-Temperature. The theory of spontaneous polarization of BaTiO<sub>3</sub>. Thermodynamics of ferroelectric transitions . Ferroelectric domains Piezo electric effects ultrasonic wave propagation in solids. Preparation of Ferroelectric and Piezoelectric materials. The structure of ferrites. The saturation magnetization, Elements of Neel's theory. Preparation of Ferrites.

#### Unit-III

**MAGNETIC PROPERTIES & SUPERCONDUCTIVITY:** Quantum theory of Dia, Paramagnetism and Ferromagnetism. Ferromagnetic domains Historical survey of super conductivity and recent advance. Messiner effect Type I and II super conductors – Elements of B.C.S. Theory D.C. and A.C Josephson effects – Applications of super conductivity preparation of high Te super conductors.

#### Unit-IV

**PREPARATION OF MATERIALS: Introduction:** Classification of Materials : Types of materials, Metals, Ceramic (glasses), Polymers, composites. **Nanomaterials:** Origin of Nano materials – Zero, one and two dimensional Nano materials, physical and chemical properties, synthesis of Nano materials, Bottom-up and Top-down approaches, **Liquid Crystals:** Mesomorphism of anisotropic, systems, different liquid crystalline phases and phase transitions, few applications of liquid crystals. **Biomaterials:** Implant materials: Stainless steels and its alloys, Ceramic implant materials : Hyderoxyapatite glass ceramics.

#### Unit-V

**CHARACTERIZATION THECHNIQUES:** X-ray diffraction, data manipulation of diffracted X-rays for structure determination, FTIR, Raman spectra, Scanning Probe microscopy, Scanning Electron microscopy, Transmission Electron Microscopy, Optical absorption and photoluminescence techniques, DTA, TGA and DSC measurements.

#### **Books:**

- 1. Solid State Physics: Dekker
- 2. Solid State Physics: Kittel
- 3. Instrumental methods of Analysis by Willard, Merritt and Dean
- **Note:** Question paper contains **FIVE** questions with internal choice have to be set from each unit. Each question carries **20 marks**.

# ANDHRA KESARI UNIVERSITY



Department of PHYSICS

Pre.Ph.D. Part-III Examination in PHYSICS

#### SYLLABUS

**Paper-III- GLASS SCIENCE** 

#### Unit-I

**PREPARATION OF AMORPHOUS MATERIALS:** Thermal Evaporation, Glow Discharge Decomposition, Chemical Vapor Deposition, Melt Quenching, Gel Desiccation.

**Glass Transition:** Theories of glass transition, thermo dynamic phase transition, entropy, relaxation process, facts that determine the glass transition temperature, Glass forming systems and ease of glass formation. Glass structure and topology, Eutectic composition, Electronic structure.

#### Unit-II

**APPLICATIONS OF AMORPHOUS MATERIALS:** Electronic applications, electro chemical applications, optical applications and magnetic applications.

#### Unit-III

**STRUCTURE OF GLASSES:** Fundamental law of structural models. Elements of structural models for glasses: Co-ordination of the network cations, network connectivity, dimensionality, intermediate range order, morphology, interstitial/fee volume.

#### Structural models for silicate glasses:

Vitreous silica, Alkali silicate glasses, alkali/alkaline earth silicate glasses, alkali/alkaline earth alumino silicate glasses, rare earth alumino/gallio silicate glasses

#### Unit-IV

**STRUCTURAL MODELS FOR BORATE GLASSES:** Vitreous boric oxide, alkali borate glasses, alkali alumino borate glasses, alkali borosilicate glasses. Structural models for germinate glasses : Vitreous Germania, alkali germinate glasses, fluro germinate glasses. Structural models for phosphate glasses – Halide Glasses – Chalcogenide Glasses – Organic Glasses.

#### Unit-V

**TRANSPORT PROPERTIES:** Fundamentals of diffusion, ionic diffusion, ionic conductivity. Mechanical Properties : Elastic modulus – Hardness – Fracture strength: Theoretical strength of glasses, practical strength of glasses, flaw sources and removal, strengthening of glass, statistical nature of fracture of glass. Fatigue of glasses – Thermal shock – Annealing of thermal stresses.

#### Books:

- 1. S.R. Elliot Physics of amorphous materials. (Longman Scientific and technical company, Essen, 1990)
- 2. Introduction to Materials Science for Engineers by James F. Shackelford (Macmillan Co., Newyork, 1985)
- **Note:** Question paper contains **FIVE** questions with internal choice have to be set from each unit. Each question carries **20 marks**.