

VACATIONAL M.Phil. COURSE I PHYSICS I

NORTH MAHARASHTRA UNIVERSITY, JALGAON

RESEARCH METHODOLOGY

SYLLABUS :

1. SOLID STATE MATERIALS :
 - Metals : Cu, Ag, Au and Al with its electrical properties.
 - Alloys : Cu-Ni, Sn-Pb and its electrical properties.
 - Solid solutions : Phase transformations, Effect of addition of small impurities of various elements like Fe, Al, Ag, Sn, Cr, Pb, P etc. on the electrical resistivity of Cu.
 - Semiconductors : Ge, Si structure and its electrical properties.
 - III-V compounds - GaSb, AlSb, InSb, InAs, InP
 - II-VI compounds - CdS, CdSe, CdTe
 - IV-VI compounds - PbS, PbSe, PbTe
 - Preparation, electrical properties and applications.
2. INTRODUCTION TO ANALYTICAL METHODS :
 - Introduction, General considerations in Analysis, Analysis of solids.
3. HIGH ENERGY ELECTRON DIFFRACTION (HEED) :
 - Introduction, Theory of Electron diffraction, Applications and limitations, Electron diffraction data and interpretations and Modifications.
4. LOW ENERGY ELECTRON DIFFRACTION : (LEED) :
 - Introduction, Theory, Operational considerations, Selected examples.
5. ELECTRON MICROPROBE :
 - Introduction, Theory of method, Applications and limitations, Data and its interpretation.
6. OPTICAL MICROSCOPY :
 - Introduction, Optical Microscope, Use of optical microscope for determination of crystalline phase, crystal imperfection and textural analysis.
7. SCANNING ELECTRON MICROSCOPY :
 - Introduction, Instrumentation, Principles & conclusions.
8. THERMAL ANALYSIS :
 - Introduction, Principle of Thermogravimetry (TG), Shape of the TG curve and method of evaluation, Factors affecting TG measurements, Principle of Differential Thermal Analysis (DTA), Instrumentation, Basic factors affecting DTA.

9. MAGNETIC PROPERTIES :

Introduction, Classification of magnetic substances, Determination of magnetic susceptibility (Gouy Method), Discussion of the results.

10. THIN FILM MEASUREMENTS :

Measurement of Thickness of thin film ; Two Beam and Multiple Beam Interferometry, Airy formula in transmittance, Various types of fringe systems-Fizeau fringes and FECD, Tolansky's technique and white light fringes- Experimental set up and measurements.

Ellipsometry - Polarisation Spectroscopy- δ () and ψ () parameters, Drude's theory of ellipsometry- Experimental set up and determination of δ and ψ parameters.

11. NUCLEAR MAGNETIC RESONANCE SPECTROMETRY :

Introduction, Theory, Instrumentation, measurement procedure and analysis of materials.

12. SOLAR ENERGY :

Solar energy as an optional source of energy, its nature, availability, spectral distribution of solar radiation (solar spectrum), measurement of solar radiation.

Solar devices- Photothermal and photovoltaic devices, Solar cooker, distillation liquid flat plate collector, Air heaters, Performance evaluation of liquid flat plate collector at steady state and transient condition.

Solar cell, Photovoltaic effect, P-N junction solar cell, I-V characteristics of solar cell under dark and illuminated condition.
