SEMESTER - III

Paper - IV : Surface Modification and Characterization Techniques

Max. Marks: 55
Time: 3 Hrs.

Note: Nine questions will be set and students will attempt 5 questions. Question No. 1 will be compulsory consisting of 4 parts based on the conceptual aspects of the whole syllabus. The answers should not be in yes/no. In addition to Question No. 1 there will be four Units in the question-paper each containing two questions belonging to four Units in the syllabus. Students will select one question from each unit.

UNIT - I

Ion Implantation: Introduction, Ion implantation process, Basic Features of an ion implanter, Radiation Damage and Ion Ranges, Channeled ion ranges, Ion beam mixing, microstructure of irradiated surfaces, change in mechanical, electrical and optical properties of metals and semiconductor materials due to ion irradiation

UNIT - II

Rutherford back scattering spectrometery (RBS): Principle, Kinematics of elastic collision, Scattering crosssection and impact parameter, the energy width in backscattering, Shape of the backscattering spectrum, Depth Profiles with Rutherford Scattering,
Electron energy loss spectroscopy (EELS): Principle, Spectrum yield, Influence of thin film morphology on electron attenuation, Layer by layer attenuation, single layer plus islanding.
Atomic Force Microscope (AFM): Basic principle, Tip and cantilever, tapping mode operation, Some typical applications of AFM

UNIT - III

Low energy electron diffraction (LEED): Principle, Schematic of low energy electron diffraction, Leed pattern applications,
Glancing angle X-ray diffraction, Basic concept, Seeman - Bohlin X-ray diffractometer, instrumentation and applications
Scanning electron Microscope (SEM): Principle, Instrumentation, Electron optics, Magnification, Application,

Transmission Electron Microscopy (TEM): Principle, Instrumentation and Applications
Scanning Tunnling Microscope (STM), Principle, Sample scanner, computer interface,

UNIT - IV

Aüger Electron spectroscopy (AES): Principle, Nomenclature, Schematic of the energy level, Instrumentation, Aüger spectrometer, Scanning Auger Microprobe (SAM). Composition analysis, Detection limits, Application of AES in study of ion irradiated samples, depth profile,
X-ray photoelectron spectroscopy (XPS) or ESCA: Principle, Photoemission process, Schematic of the energy level, Instrumentation, Experimental consideration, Electron multiplier, Photoelectron energy spectrum, Chemical shift, Oxidation state, Quantitative analysis and Applications.
Secondary Ion mass Spectroscopy (SIMS): Basic principle, instrumentation, working and applications.

References

1. Ion Implantation by G. Dearnally
2. Ion implantation technology by J. W. Mayers
3. Fundamentals of surface and thin film analysis - Leonard C, Feldman and James W. Mayer, North Holland.
4. Instrumental Methods of Analysis - Willard et al CBS Publishers.
5. Methods of Surface Analysis - Technique and application.
6. Principles of Instrumental Analysis, Douglas A Skoog et al Saunders Golden Sunbrust series.
7. Electron spectroscopy : Theory, techniques and application - C.R. Brundee and A.D. Baker eds. Academic Press.