Departmental Elective – III
Fifth year of Five Years integrated M.Sc (Physics)
M.Sc. - V, Semester – IX

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MP 575 : Thin Films and Vacuum Technology

- **INTRODUCTION TO SURFACE PHYSICS** **(06 Hours)**
  Thermodynamic Potentials and the Dividing Surface, Surface Tension and Surface Energy, Surface Stress and Surface Energy, Surface Diffusion and the Boltzman Distribution. Chemical Potential and Driving Force, Thermodynamics of Vapor Pressure.
- **GROWTH OF THIN FILMS** **(08 hours)**
  Vacuum and Kinetic Theory of Gasses, Pressure and Molecular Velocity, The Molecular Density, Collision Frequency, The Mean Free Path, Gas Flow Regimes: viscous, turbulent and molecular flow, Collisions with Surfaces, Kinetics of Crystal Growth, Diffuson, Nucleation Barriers in Classical and Atomistic Models, Growth Modes: Island Growth, Clustering, Coalescence and Ripening, Monolayer Formation Times.
- **THIN FILM DEPOSITION TECHNIQUES** **(08 Hours)**
  Physical vapor deposition, thermal deposition, Electron beam deposition, Sputtering, Spin-coating, Sol-Gel technique, Epitaxy, Molecular beam epitaxy, Chemical vapor deposition.
- **INTRODUCTION TO VACUUM TECHNOLOGY** **(06 Hours)**
  Fundamental Vacuum Concepts, System Volumes, Leak Rates and Pumping Speeds, Cryopump, The Idea of Conductance, Measurement of System Pressure, Surface Preparation and Cleaning Procedures for Vacuum Systems.
- **VACUUM SYSTEM OPERATION** **(06 Hours)**
  Types of Vacuum Pumps, Rotory pump, Diffusion pump, TMP, Oil free pumps, Chambers, Tube and Flange Sizes, Valves, Choice of Materials, Pressure Measurement and Gas Composition, Pressure Measurement Gauges, Ultra high vacuum.
- **THIN FILM CHARACTERIZATION AND APPLICATIONS** **(08 Hours)**
  Properties of thin films, optical properties, electrical properties, magnetic properties, mechanical properties, Introduction to Thin film characterization techniques: Imaging Techniques, Structural Techniques, Optical Techniques, Electrical / Magnetic Techniques, Mechanical Techniques, Applications of thin films.

(Total Contact Time (Theory) : 42 Hours)

BOOKS RECOMMENDED :

1. **Smith D. L.** *Thin-Film deposition : Principle and practice* McGraw Hill 1995
2. **Goswami A.** *Thin film fundamentals* New Age International 2007
3. **Smith D. L.** *Thin-film deposition: principles and practice* McGraw Hill 1995
4. **Seshan K.** *Handbook of thin-film deposition processes and techniques: principles, methods, equipment and applications* William Andrew 2002
5. **Weissler G. L.** *Vacuum physics and technology* Academic Press 1979