

SEMESTER IV- PAPER IX – CRYSTAL GROWTH AND THIN FILMS PHYSICS

UNIT I: FUNDAMENTALS OF CRYSTAL GROWTH

Single crystals – Thermodynamics – Nucleation – Concept of formation of the critical nucleus – Spherical and cylindrical shapes of nucleus-Equilibrium phases diagrams and phase rules.

UNIT II: CRYSTAL GROWTH TECHNIQUES

Slow temperature solution growth: solubility diagrams – slow cooling method – slow evaporation method-Gel growth method structure and property of gel-different methods. Melt Growth Bridgeman method Czochralski method-Growth of vapor: Basis of vapor growth-Chemical vapor-Transport method.

UNIT III: THIN FILM TECHNOLOGY: PREPARATION OF THIN FILMS

Chemical methods-Chemical vapor deposition (CVD)-Chemical solution deposition (CSD)-Electrochemical deposition (ECD)-Spray pyrolysis method-physical methods-Vacuum evaporation-Sputtering-Reactive sputtering – RF sputtering – Magnetron sputtering.

UNIT IV: CHARACTERIZATION OF THIN-FILMS

Thickness measurement-Electrical methods-Microbalance methods-Optical interference methods-Structural studies X-ray and SEM studies mechanical properties-Stress, adhesion of films Electrical properties – Resistance – Hall effect and magnetoresistance.

UNIT V: THIN FILM SENSOR PRINCIPLES AND APPLICATIONS

Introduction-Classification of sensor devices-Ideal sensor Characteristics- Thermal Micro-sensors-Basic definitions – Electrical and Non-electrical thermal sensors – Mechanical sensors-Measurands – Displacement, Velocity, Force, Pressure and strain Micro-sensors. –Magnetic Micro-sensor-Hall Devices – Magneto-resistors-SQUIDS – Chemical sensors – Basics – Chemoresistors - Chemotransistors-SAW devices.

BOOKS FOR STUDY AND REFERENCE:

- 1) Crystal Growth Processes, J.C.Brice, John Wiley and sons, New York, 1966.
- 2) The Growth of crystals from Liquids, J.C.Brice, North Holland Publishing Co., Amsterdam.
- 3) Crystals in Gel and Liesegang Rings. H.R. Henison Cambridge University Press, Cambridge. 1986.
- 4) Hand Book of Thin Film Technology, L.T.Maissel and R.Glang. McGraw Hill Book Company, New York, 1983.
- 5) Semiconductor Devices and Integrated Electronics, A.G.Milnes, CBS Publishers & Distributors, New Delhi, 1987.
- 6) Microsensors Principles and Applications, Julian W. Gardiner, John Wiley & Sons, New York (1994).