05P1WPH111 Thin Films

Subject Code	**05P1WPH111**	
Subject Name	**Thin Films**	
Credits	3	**Contact Hours: 03**

Module No.	**Subtitle of the Module**	**Topics**
1.	Vacuum (Artificial, Natural)Applications	importance, Production of low pressure, Vacuum pumps(Principle, Parameters), Mechanical pumps, Vapour pumps, Ion pumps, Sorption pumps, Cryopumping, Gettering, Pumping by dilution, Measurement of pumping speed, thermal conductivity gauges (Pirani, thermocouple, Mc-leod Pirani, Penning), High vacuum Technology, criterion for selection of materials, Cleaning techniques, sealing techniques, Leak detection, rules for operating vacuum systems
2.	Thin film	basics and introduction, nature, kinetic theory, Deposition technology thermal evaporation(resisitive heating, electron beam, flash sputtering (dc, RF,cathodic, gow discharge, magnetron, reactive, ion assisted, ion sources, ion etching), chemical vapour deposition (reaction types, boundaries and flow) (LPCVD, PECVD, LECVD, MOCVD), chemical bath deposition(electrodeposition, Anodic oxidation, electrolysis plating, deposition by chemical reaction, chemical displacement), Molecular beam epitaxy)
3.	Kinetics	Fick's Laws, Diffusion coef, Arrhenius, Nucleation and Growth: Homogeneous nucleation, critical radius, nucleation rate, Film formation, Introduction, Trapping, Capillarity model (heterogeneous nucleation), Effects of super saturation, temperature, lattice strain, impurity, surface imperfections, Coalescence, incorporation of defects, impurities in films, Film formation, Growth modes, island growth, zone models, columnar growth, Deposition parameters and their effects on film growth
4.	Substrate surface and thin film nucleation	substrate cleaning, atomic view, film structure, morphololgy, film thickness and its control, structural characterization, chemical characterization, defects and imperfections, Temperature of discontinuity, Stabilisation of film, preparation of specimen
5.	Semiconducting Films	Introduction, Intrinsic and extrinsic semiconductors, impurity energy level (Doping, alloying, surface states, recombination centres, traps), Transport properties and basic parameters (conductivity , resistivity, Activation energy, band gap, hall coefficient, mobility of charge carriers, carrier concentration, magneto resistance, Seebeck effect, thermoelectric power, size effect), Semiconductor surface and space charge effect, metal semiconductor contact

6.	Experimental Techniques	film property measurements, film thickness (optical method-interfreometry, mechanical method), Structural Thin film analysis-diffraction Atomic scattering factor, kinetic theory of scattering, Electron diffraction techniques (HEED, LEED,) electron microscopy, SEM, TEM, FEM, EPMA, EIM, AES, XPES(ESCA) , Mass spectroscopy

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)	
1.	Vacuum technology by A. Roth, Elsevier, 1990
2.	Thin Film Fundamentals by A Goswami, New Age International 2005
3.	Thin Films Phenomenon by K.L. Chopra, Krieger, 1985
4.	Material Science of Thin Films, by Milton Ohring, Elsevier 2002
5.	Handbook of Vacuum science and technology, Dorothy M. Hoffman, Academic Press (1997)
6.	Physical Vapor Deposition of Thin Films, John E. Mahan, John Wiley & Sons (2000)