Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2021 - 2022

Course Handout Part II

15.01.2022

In addition to Part I (general Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. : PHY F379
Course Title : Thin film technology
Instructors : **Prof. V. Satya Narayan Murthy** & Prof. Harihara Venkataraman

Course Description: This course gives an overview of thin film technology - Basics of vacuum science and technology, Thin film deposition techniques; Kinetics and diffusion mechanisms, Surface nucleation and film growth, Structure and morphology of thin films, Electrical and magnetic properties, Special topics on thin film application.

Scope & Objective:

- The course introduces the concepts in vacuum deposition techniques, nucleation and growth of thin films.
- Techniques to characterize the thin films and some of the physical properties of films and their applications.

Text Book: No single textbook exists. Lecture notes will be distributed.

Reference Books:

- Materials Science of Thin Films – Milton Ohring, 2nd Edition (Elsevier)
- A User's Guide to Vacuum Technology - J.F. O' Hanlan
- Thin film deposition principles and practice – Smith Donald
- Thin Film Phenomena – Kasturi L Chopra (McGraw - Hill)

Course Plan:

Lecture No.	***Learning Objectives***	***Topics to be covered***	***Chapter in the Text Book***
1 - 6	Vacuum technology	Mean free path, gas flow regimes, conductance, pumping speed, vacuum	Lecture

		levels, working principles of different vacuum pumps, vacuum gauges, vacuum leak detection, vacuum seals	notes + relevant portions from reference books
7 - 10	Thin film deposition	Differences between CVD and PVD, different PVD techniques – thermal and electron beam evaporation, sputtering, PLD, MBE, etc., evaporation rate, evaporation of multielement materials and alloys	
11 - 14	Film thickness uniformity and purity	Thickness measurement techniques, deposition geometry, thickness uniformity	
15 - 20	Nucleation and growth of thin film	Thermodynamic aspects of nucleation and growth – capillarity theory of heterogeneous nucleation, atomistic theory, growth modes	
21 - 28	Characterization techniques	Structural techniques (XRD), imaging techniques (SEM / TEM), optical techniques, chemical techniques	
29 - 34	Properties of thin films	Electrical, dielectric, ferroelectric and magnetic properties	
35 - 40	Applications	Sensors, solar cells, giant magnetoresistance, ferroelectronic effect, multiferroics	

Evaluation Scheme:

EC No.	Evaluation Scheme	Duration	Weightage (%)	Date & Time	Nature of Component
1.	Midsemester Examination	90 min.	35	15/03 9.00am to10.30am	Open Book
2.	2 Quizzes		25	Will be announced in the class	Open Book
3.	Comprehensive Examination	120 min.	40	17/05 FN	Open Book

Notices: Notices for the course will be displayed on **Physics** notice board.
Make-up Policy: Make up will be given strictly to **genuine cases only** i.e. **(i)** Sickness leading to hospitalization, **(ii)** Out of station with prior intimation & permission. No make-up for Quizzes.
Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-Charge

PHY F379