



**SECOND SEMESTER 2022 - 2023**

Course Handout Part II

16.01.2023

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. Harihara Venkataraman** & Prof. V. Satya Narayan Murthy

**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, 2<sup>nd</sup> 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:**

<b>Lecture No.</b>	<b>Learning Objectives</b>	<b>Topics to be covered</b>	<b>Reference (Chap/Sec)</b>
1 - 6	Vacuum technology	Mean free path; gas flow regimes; conductance; pumping speed; vacuum levels; working principles of different vacuum pumps; vacuum gauges; vacuum leak detection; vacuum seals.	Lecture notes and relevant portions from



7 - 10	Thin film deposition	Differences between CVD and PVD; PVD techniques – thermal and electron beam evaporation, sputtering, PLD, MBE; CVD techniques – APCVD, LPCVD, MOCVD, PECVD; evaporation rate; evaporation of multi element materials and alloys.	reference books.
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	Review of Materials Science, Structural techniques (XRD), Imaging techniques (SEM / TEM) & optical techniques	
29 - 34	Properties of thin films	Electrical, dielectric, ferroelectric and magnetic properties	
35 - 40	Applications	Sensors, solar cells, giant magnetoresistance, ferroelectric & multiferroics devices	

#### Evaluation Scheme:

EC No.	Evaluation Scheme	Duration	Weightage (%)	Date & Time	Nature of Component
1.	Mid Semester Examination	90 min	35	18/03 4.00 - 5.30PM	Closed Book
2.	Quizzes	30 min	25	To be announced in the class	Open Book
3.	Comprehensive Examination	180 min	40	20/05 AN	Closed Book

**\*Two quizzes will be conducted, and the best performance will be considered. No makeup for the quizzes for any reason.**

**Notices:** Notices concerning the course will be put on **CMS**.

**Makeup Policy:** Makeup requests may be considered only in case of severe medical illness leading to hospitalization with proper medical proof, and also, prior permission is required for MID - SEM and Comprehensive Examination.



**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

