****

**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 levels, working principles of different vacuum pumps, vacuum gauges, vacuum leak detection, vacuum seals | Lecture 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