

# SECOND SEMESTER 2019 - 2020

Course Handout Part II

06.01.2020

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 Instructor - in - charge : B. Harihara Venkataraman

**Course Description:** This course provides an overview of thin film technology - Basics of vacuum deposition systems, Thin film deposition techniques, Kinetics and diffusion mechanisms, Surface nucleation and film growth, Structure and morphology of thin films, Ferroelectric and magnetic properties of thin films and their applications.

# Scope & Objective:

* The course introduces the concepts in vacuum deposition techniques, nucleation and growth of thin films.
* Techniques to characterize thin films and a discussion on some of the physical properties of thin films.

**Text Book:** There is no single textbook exists to cover the learning objectives of this course. Lecture notes will be provided for all the topics to be covered in the handout.

# 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:

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| --- | --- | --- | --- |
| ***Lecture***  ***No.*** | ***Learning Objectives*** | ***Topics to be covered*** | ***Chapter in the Text Book*** |
| 1 - 3 | A review of Materials | Structure, Defects in Solids, Bonds and | Lecture notes as |
|  | Science | Bands in Materials, Thermodynamics of | well as relevant |
|  |  | Materials, Kinetics and Nucleation. | portions from the |
|  |  |  |
| 4 - 8 | Thin film deposition | Different CVD and PVD techniques, brief | listed reference |
|  | techniques | differences between CVD and PVD | books |
|  |  | techniques, evaporation rate processes, |  |
|  |  | evaporation of multielement materials and |  |
|  |  | alloys, discussion on vacuum deposition |  |
|  |  | systems. |  |

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| --- | --- | --- | --- |
| 9 - 13 | Film thickness uniformity and purity | Thickness measurement techniques, deposition geometry, thickness uniformity. |  |
| 14 - 20 | Nucleation and growth of thin films | Thermodynamic aspects of nucleation and growth - capillarity theory of heterogeneous nucleation, atomistic theory, growth modes. |
| 21 - 28 | Characterization of thin films | Structural techniques (XRD), imaging techniques (SEM/TEM) / chemical  techniques. |
| 29 - 34 | Physical Properties of  thin films | Dielectric, ferroelectric and  magnetic/mechanical properties. |
| 35 - 40 | Applications of thin  films | Sensors, solar cells & multiferroics. |

**Evaluation Scheme:**

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| --- | --- | --- | --- | --- | --- |
| **EC**  **No.** | **Evaluation Scheme** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of**  **Component** |
| **1.** | Midsem Examination | 90 min | 35 % | 6/3 1.30 -3.00 PM | Closed Book |
| **2.** | Quiz/Seminar | 30 - 40 min | 20 % |  | Open Book |
| **3.** | Comprehensive Examination | 3 hours | 45 % | 13/05 FN | Closed Book |

**Notices:** Notices for the course will be displayed on **Physics** notice board.

**Make-up Policy:** Make up will be granted only for serious medical emergencies. No make-up for Quiz / Seminar.

**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