

**Birla Institute of Technology and Science, Pilani, Rajasthan**

**First Semester 2023-2024**

**Mid-Sem Examination (Closed Book)**

Course Title: **Thin Film Technology**

Course No. **PHY F379**

Time: 90 mins \_\_\_\_\_ 10-10-2023

Total marks: 30

➤ Each symbol has its usual meaning

➤ Answer to the point

---

**1. There are 5 questions, answer all of them. Each question carries 2 marks. [10]**

i) Explain the importance of primary and secondary anodes in electron microscopy. Where they are placed and why?

ii) How are the thickness of a thin film and reflection coefficients related in ellipsometry? Write down the expression and explain.

iii) What is LMM auger electron? Explain with a proper schematic diagram.

iv) How is the density of states of a thin film of semiconductor is estimated using STS?

v) What is molecular beam epitaxy? Draw a schematic diagram of MBE.

2. What is the working principle on which E-beam evaporation works? Draw a schematic diagram of the basic e-beam setup and explain the mechanism of thin film deposition by E-beam process. Estimate the mean free path  $l$  of the evaporated molecules: for a molecule of 0.25 nm diameter at  $10^{-4}$  Pa and 350 K? [1+2+2].

3. What are the differences between secondary electrons and backscattered electrons? What are the factors that affect the emissions of SE and BSE. [2+2].

4. What is an isotherm of Langmuir monolayer? Explain with the help of a schematic diagram of an experimental setup how it is obtained. What are the physical parameters which can be derived using this isotherm? [2+2+1]

5.(i) What is the difference between  $\theta:2\theta$  and  $\theta:\theta$  scans of X ray powder diffractometer? Explain with the help of Bragg- Brentano geometry sketch. (ii) What is SPR phenomenon explain with the help of expressions and a schematic diagram. [2+2+2].

( $R= 8.3 \text{ Jmol}^{-1}\text{k}^{-1}$ ;  $K_B=1.38 \times 10^{-23} \text{ Jk}^{-1}$ )

\_\_\_\_\_All The Best\_\_\_\_\_