Birla Institute of Technology and Science, Pilani, Rajasthan
First Semester 2022-2023
Midsem Examination (Closed Book)

Course Title: **Thin Film Technology**   Course No. **PHY F379**

Time: 90 mins   01-11-2022   Total marks: 90

➢ Each symbol has its usual meaning
➢ Answer to the point

---

1. **There are 6 parts in this question, answer all of them. Each part carries 5 marks**. **[30]**

i) What is a refractory metal? Give two examples. Where they are used and why?
ii) What is a Langmuir monolayer (LM)? Draw a schematic diagram of LM.
iii) Why is it impossible to detect hydrogen using conventional XPS?
iv) What are polaritons? Name any two types of polaritons.
v) What is pulsed laser ablation? Draw a schematic diagram of PLA.
vi) Sketch density of states as a function of energy for a thin film and bulk material.

2. If an electron is subjected to 1260 V, what will be its speed and deBroglie's wavelength? **[5+5].**

3. What are the differences between SEM and TEM and explain their usefulness in obtaining morphological information of thin films. **[10].**

4. Explain the SPR phenomenon in Kretschmann configuration with a proper schematic diagram. (i) Calculate the SPR wavevector (K_{spr}) using the data provided to you: relative dielectric permittivity of metal and dielectric are 6.9 and 1.6 respectively for a wavelength of source of 630 nm. **[7+5]**

5.(i) Label the different regimes of operation of AFM by sketching the force versus tip to sample separation distance. (ii)With the help of a schematic diagram of STM explain the working principle of STM **[6+8].**

6. Name the three basic PVD techniques and explain each of them in one or two sentences. Calculate the (i)Change in Gibbs free energy during an evaporation process using the following data provided to you. **[6+8].**

Surface tension of melt=1300 mN/m
Particle density=4.5×10^4 mol/m^3
Temperature=1000°C
Degree of supersaturation of metal= 10^6

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

_____All The Best_____