

ELE-501. Thin Film Technology

**Instruction : (1) Attempt all questions
(2) Symbols used have their usual meanings**

1. (a) Discuss the creation of low pressure with the help of a rotary pump.
What is back streaming? [07]

OR

- (a) Explain the construction, working and application of a penning gauge. [07]
(b) Explain the working of a diffusion pump. [07]

OR

- (b) Write a note on different requirements for substrate holding and deposition monitoring. [07]

2. (a) Define sputtering and sputtering yield. Explain the basic process of sputter deposition and explain how the use of RF increases the deposition rate. [07]

OR

- (a) Explain chemical vapour deposition technique. [07]
(b) In case of structural consequences of the thin film, explain (1) role of surface diffusion and binding energy of the substrate (2) role of substrate temperature and deposition rate. [07]

OR

- (b) Write various growth stages of thin films and explain the growth of a continuous thin film on a well cleaned substrate. [07]

3. (a) With diagrams, explain the Low Energy Electron Diffraction (LEED) technique. [07]

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OR

(a) Explain grazing incidence X-ray diffraction method. Write its uses. [07]

(b) Explain the interaction of energetic incident electron with matter. Using schematic diagram, explain transmission electron microscopy. [07]

OR

(b) Which techniques are used for chemical analysis of thin films ? Explain the concept and working of Auger electron spectroscopy. [07]

4. (a) List desired properties of materials used for thin film resistors. (TFR). Explain the designing considerations of TFR. [07]

OR

(a) Define sheet resistivity. Explain van der Pauw method to find the sheet Resistivity and bulk resistivity of arbitrary shaped sample. [07]

(b) How thin film diode is realized? Explain the processing steps and $I-V$ characteristics of a typical thin film Schottky diode. [07]

OR

(b) Give schematic of co-planar type thin film transistor (TFT). Discuss the designing of TFT. [07]

5. Answer the following in brief : [14]

- i. Write the names of vacuum pump to create UHV.
- ii. What is the limit of vacuum measurement using Pirani gauge ?
- iii. Write methods of thin film deposition that make use of PVD.
- iv. Name method/s of thin film deposition that rely on removal of material without melting it
- v. Define ECR sputtering.
- vi. Write the principle of flash evaporation.
- vii. State the principles of pressure measuring instruments.
- viii. Draw schematic of RHEED.
- ix. Why electron diffraction is better suited over XRD for thin films ?
- x. Compare EDAX with ESCA.
- xi. Can LEED be employed as *in-situ* technique? Why ?
- xii. Draw the staggered electrode structure of thin film transistor.
- xiii. Draw the schematic of a Schottky diode.
- xiv. Write down Gain-Bandwidth product of at least two different TFTs.