

(3 HOURS)

[Total Marks: 75]

N.B. (1) Attempt any **six** questions.

(2) Note the internal options.

(3) **Maximum** marks assigned to each question are indicated against the question.

1. (a) Describe the Float Zone method of crystal growth providing suitable diagrams. (7)
 (b) With the help of a neat diagram, explain the mechanism of diffusion. (6)

OR

2. (a) What are point defects? Determine the energy required to
 (i) form a vacancy (ii) move a vacancy. (7)
 (b) Explain what is Burger vector and Burger circuit. (6)

3. What are metallic glasses? What are the different ways to produce amorphous metals? Comment on the properties of metallic glasses and suggest some applications. (12)

OR

4. (a) Write a note on the transition of liquid phases. (6)
 (b) Write a note on the polymer synthesis and structure. (6)

5. What are Langmuir-Blodgett (L-B) films? With the help of neat diagrams, explain how L-B films are prepared. What are the limitations of this method? Discuss some applications of L-B films. (13)

OR

6. (a) Compare the different methods of deposition of thin films. Which method is suitable for metal oxide thin film deposition? (7)
 (b) What are the methods adopted for thickness measurement in thin films? Describe any one in detail. (6)

7. (a) Describe any two methods for the synthesis of nanoparticles. (8)
 (b) What are carbon nanostructures? Write briefly about some applications of carbon nanostructures. (4)

OR

8. (a) What do you understand by quantum confinement of nanoparticles? What is meant by weak confinement and strong confinement? (8)
 (b) Comment on the properties of a material as it makes a bulk-to-nano-transition. (4)

9. With the help of a neat diagram, explain the working of a rotary pump (RP). With a suitable graph, show the pressure range achieved by the RP. What is the efficiency of the RP in this range? (13)

OR

10. (a) Explain the terms throughput, backing and roughing in vacuum technology. (3)
 (b) Draw a neat labeled diagram of the McLeod gauge and explain how it may be calibrated. (7)
 (c) What do you understand by the term "clean vacuum"? (3)

[TURN OVER]

11. What is X-ray photoelectron spectroscopy? With the help of a suitable diagram, describe the working of XPS. What information can be obtained from this technique? **(12)**

OR

12. With the help of suitable diagrams, compare and contrast the working of STM and AFM techniques. What information can be obtained using these two techniques? Compare the lateral resolution that may be obtained by using the two techniques. **(12)**
