## SIXTH SEMESTER B. Sc. DEGREE EXAMINATION, APRIL 2024
### (Supplementary - 2018 Admission)
### B.Sc. PHYSICS
### APHY6E03T: MATERIALS SCIENCE

Time: 3 Hours.                                      Maximum Marks: 80

**SECTION A: Short Answer Questions: Answer *all* questions. Each carries *one* mark.**

1. What are smart materials? What are their components.

2. Differentiate between primary and secondary bonding.

3. Explain polymorphism using an example.

4. What do you mean by an abrasive ceramic?

5. What is meant by self-interstitials?

6. Why Aluminium is used as interconnect in IC instead of copper.

7. What are fullerenes?

8. How to estimate the grain size?

                                                        **(8 × 1 = 8 Marks)**

**SECTION B: Paragraph Questions: Answer any *six* questions. Each carries *four* marks.**

9. Discuss the formation of van der waal bonding in solids.

10. Write a short note on the different types of refractory ceramics.

11. Using a schematic diagram explain an X-ray diffractometer.

12. Distinguish between thermosetting and thermoplastic polymers.

13. What are composites? Explain its properties.

14. Distinguish between vacancy diffusion and interstitial diffusion.

15. Explain viscoelastic deformation of polymers.

16. What is stress-strain behaviour of ceramics?

17. Write a short note on Scanning Electron Microscopy.

                                                        **(6 × 4 = 24 Marks)**

**SECTION C: Problems: Answer any *eight* questions. Each carries *four* marks.**

18. Obtain packing fraction in BCC structure.

19. Find the interplanar spacing for the lattice planes of Miller indices (111) and (220) for a cubic lattice with a=5.62 Å. What is the corresponding first order Bragg angle for these planes if diffraction is carried with Cu - Kα radiation of wavelength 1.54 Å ?

                                                        **(PTO)**

20. With schematic diagram, explain the working of Scanning Probe Microscopy.

21. Find the equilibrium concentration of vacancies in aluminium at 0 K and 300 K. The energy for vacancy formation is 0.70 eV/atom.

22. Explain in detail factors that influence diffusion and derive an expression for diffusion coefficient.

23. Calculate the radius of palladium atom, given that Pd has an FCC crystal structure, a density of 12.0 g/cm$^3$ and the atomic weight of 106.4 g/mol.

24. Explain different allotropes of carbon structure with examples.

25. Explain (a) single crystalline material (b) polycrystalline materials (c) amorphous solids.

26. Briefly explain classification of materials.

27. Distinguish between edge and screw dislocation.

28. Explain how to estimate molecular weight of the polymer (number averaged molecular weight $(\overline{M_n})$ and weight averaged molecular weight $(\overline{M_w})$.

29. Describe rotating crystal method for X-ray diffraction.

**(8 × 4 = 32 Marks)**

## SECTION D: Long Answer Questions: Answer any *two* questions. Each carries *eight* marks.

30. Describe the nature and origin of various forces existing between the atoms of a crystal. Explain the formation of a stable bond using the potential energy versus interatomic distance curve and force curve.

31. Explain various types of point defects in crystal? Briefly explain each.

32. How are ceramic materials classified? Explain each with their properties and applications.

33. Using suitable schematics, explain Transmission Electron Microscope. Mention any two limitations of TEM.

**(2 × 8 = 16 Marks)**