

**20P406**

(Pages: 2)

Name: .....

Reg. No.....

**FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2022**

(CBCSS - PG)

(Regular/Supplementary/Improvement)

**CC19P PHY3 E11 - MATERIALS SCIENCE**

(Physics - Elective Course)

(2019 Admission onwards)

Time: Three Hours

Maximum: 30 Weightage

**SECTION A**

Answer *all* questions. Each question carries 1 weightage.

1. Draw edge and screw dislocations. Give the direction of Burger vector in each of the dislocations
2. State Gibb's Phase rule. What are the degrees of freedom of a system of two components when the number of phases is one, two, and three?
3. Discuss the strengthening effect of precipitate particles in a solid solution.
4. What is creep? List the different Mechanisms of creep.
5. What is meant by fatigue fracture? How can we improve the fatigue life of a material?
6. Styrene is polymerized to a DOP of 10,000. Calculate its molecular weight.
7. Distinguish between lithographic and non-lithographic synthesis techniques of nanomaterials.
8. What are the different types of carbon nanotubes?

**(8 × 1 = 8 Weightage)**

**SECTION B**

Answer any *two* questions. Each question carries 5 weightage.

9. Discuss the different types of phase diagrams of binary alloys. Explain how the phase composition can be determined from a phase diagram.
10. Describe the plastic deformation by slip and based on the model, compare the shear strength of perfect and real crystals. What are whiskers?
11. Describe the types of silicate structures in ceramics and mention their peculiarities and applications.
12. Explain the instrumentation and working principle of Atomic Force Microscopy. List its advantages and disadvantage

**(2 × 5 = 10 Weightage)**

### SECTION C

Answer any *four* questions. Each question carries 3 weightage.

13. Show that the number of Frenkel defects in equilibrium at a given temperature is proportional to  $(N N_i)^{1/2}$ , where  $N$  is the number of atoms and  $N_i$  be the number of interstitials.
14. The eutectic phase diagram of a binary system of A and B has a three phase equilibrium at  $220^\circ\text{C}$ , with the compositions of  $\alpha$ , liquid and  $\beta$  phases equal to 10%, 55% and 95%B. Just below  $220^\circ\text{C}$ , find the compositions at which the proeutectic phase is 1.5 times the eutectic mixture.
15. Explain any two applications based on Fick's second law of diffusion.
16. A sample of glass has a crack length of  $2\mu\text{m}$ . The Young's modulus of the glass is  $70\text{GNm}^{-2}$  and the specific surface energy is  $1\text{Jm}^{-2}$ . Estimate its fracture strength and compare it with its Young's Modulus.
17. Write short notes on (a) thermoplastic and thermosetting resins (b) Elastomers
18. Describe the preparation of nanomaterials by Chemical Vapour Deposition
19. Explain the different specimen interactions that makes electron microscopy possible.

**(4 × 3 = 12 Weightage)**

\*\*\*\*\*