

**23P407**

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Name: .....

Reg.No: .....

**FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2025**

(CBCSS - PG)

(Regular/Supplementary/Improvement)

**CC19P PHY4 E11 - MATERIALS SCIENCE**

(Physics)

(2019 Admission onwards)

Time : 3 Hours

Maximum : 30 Weightage

**Section A**

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

1. Distinguish between the direction of the dislocation line, the Burgers vector, and the direction of motion for both edge and screw dislocations, differentiating between positive and negative types.
2. Briefly discuss about Stacking faults as a planar surface imperfection.
3. What do you mean by Decarburization of steel?
4. Why narrow dislocations are more difficult to move than wide dislocations?
5. What do you mean by Elastomers?
6. Differentiate between top-down and bottom-up growth techniques of nanomaterials.
7. Differentiate between Ball-milling and Chemical bath deposition (CBD) process.
8. Why is spatial resolution of STM better than AFM?

**(8 × 1 = 8 Weightage)**

**Section B**

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

9. Sketch and give a detailed explanation of different types of phase diagrams of binary alloys. How the phase composition can be determined from a phase diagram?
10. Discuss about the Iron–Iron-Carbide phase diagram with a neat diagram.
11. What do you mean by ceramic phases? Explain the electromagnetic behavior of ceramics.
12. Describe, in brief, various emission and interaction processes between electron beam and the sample.

**(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. In Alclad, 20 mm thick duralumin sheets are covered on either side with 0.2 mm thick pure aluminium sheets. For retaining the corrosion resistance, the copper concentration at a depth of 0.1 mm from the outer surface should not exceed 0.4%. How long can the material be kept at 550°C, without damaging the corrosion resistance?(The diffusion coefficient of copper=  $0.25 \times 10^{-4}$ .)

The Error Function

| $z$  | $\text{erf}(z)$ |
|------|-----------------|
| 0.85 | 0.7707          |
| 0.9  | 0.797           |
| 0.95 | 0.8209          |
| 1    | 0.8427          |

15. Show that the resolved shear stress reaches a maximum value, when  $\phi_1 = \phi_2 = 45^\circ$ .
16. Explain Griffith's criterion for the propagation of a pre-existing crack in a brittle material.
17. Differentiate between Thermosets and Thermoplasts.
18. Describe the basic working principle of an STM.
19. Explain how AFM can be used in probing the material samples.

**(4 × 3 = 12 Weightage)**

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