C 80721 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, MARCH 2020

(CUCSS)

Physics

PHY 4E 11—MATERIAL SCIENCE

(2017 Admission onwards)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*

Each question carries weightage 1.

1. Distinguish between Frenkel and Schottky imperfection.
2. At atmospheric pressure, a material of unknown composition shows four phases in equilibrium at 987K. What is the minimum number of components in the system ?
3. Discuss Nernst-Einstein relation for diffusion.
4. Distinguish between plastic deformation and creep.
5. Explain the brittle fracture of a material.
6. Using a suitable figure illustrate an unrelaxed and a relaxed edge dislocation.
7. What are linear polymers ? Give example.
8. Distinguish between top down and bottom up techniques in nanomaterials synthesis.
9. What are ceramics ? What are glass-ceramics ?
10. List the different CVD processes.
11. Distinguish between the terms resolution and magnification.
12. List the applications of STM.

(12 × 1 = 12 weightage)

Turn over

Section B

Answer any **two** *questions.*
Each question carries weightage 6.

13. Explain the phenomenon of diffusion in solids. Discuss Fick's second law for non-steady state flow and obtain its solution.

14. Explain the tensile load versus elongation and stress versus strain curve of a ductile material. Discuss the plastic deformation by slip mode.

15. Using suitable schematics, explain (a) Molecular beam epitaxy ; (b) Chemical bath deposition and ion beam deposition for the growth of nanomaterials.

16. What are the advantages of electron microscopy in materials characterization ? Discuss the principle of scanning electron microscopy.

(2 × 6 = 12 weightage)

Section C

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

17. Explain the phase diagram of Cu-Zn system.

18. Discuss the different methods of protection against fracture.

19. Explain the multiplication of dislocations during deformation. Given, the length of a dislocation line between two pinning points is on an average equal to the reciprocal of the square root of the dislocation density in a crystal. Obtain the dislocation density in copper, work hardened to a stage where slip occurs at a shear stress of 35 MN/m^2. The shear modulus of copper is 44 MN/m^2. The Burgers vector of dislocations in copper is 2.55 A^0.

20. Discuss the mechanical behavior of ceramic materials.

21. Explain the plasma arc discharge method for the growth of nanomaterials.

22. Explain the different structures of carbon nano tubes.

(4 × 3 = 12 weightage)