21P410 (Pages: 2) Name: ……………………..

Reg. No……………………..

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2023

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P PHY4 E17 – ADVANCED CONDENSED MATTER PHYSICS

(Physics)

(2019 Admission onwards)

Time: Three Hours   Maximum: 30 Weightage

Part A

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

1. What are plasmons?

2. How are alloys classified according to the ordering of atoms?

3. Which are the various microscopic fracture profiles?

4. Write a short note on fatigue of materials.

5. State Fick's laws of diffusion.

6. Explain the density of states function for quantum wires with respect to energy.

7. How does microstructure affect thin film growth process?

8. Differentiate between co-sputtering and reactive sputtering.

(8 × 1 = 8 Weightage)

Part B

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

9. Discuss the vibrational modes of a lattice with two atoms per primitive cell.

10. Explain the physics of alloying phenomenon.

11. Explain the three dimensional bulk material with its properties in detail.

12. Explain the various physical and chemical vapour deposition techniques.

(2 × 5 = 10 Weightage)

Part C

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

13. Derive the basic Hamiltonian of a solid.

14. Obtain an expression for Fermi energy.

15. What is the composition in atom percentage of an alloy that contains 33g of copper and 47g of zinc?

16. Calculate the activation energy for the diffusion of nickel in iron from the following data:

    $D_1 = 2.2 \times 10^{-15}$ m^{2}s^{-1} at 1473K.

    $D_2 = 4.8 \times 10^{-14}$ m^{2}s^{-1} at 1673K.

17. Calculate the energy for vacancy formation in silver, given that the equilibrium number of vacancies at 800^0c is 3.6×10^{13} cm^{-3}. The atomic weight and density at 800^0C for silver are 107.9 g/mol and 9.5 gcm$^{-3.}$

18. Explain in detail about carbon nanotubes.

19. Enumerate the optoelectronic applications of thin films.

(4 × 3 = 12 Weightage)

****