FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2017

(CUCSS)

Physics

PHY 4E 11—MATERIAL SCIENCE

(2012 Admissions)

Time : Three Hours   Maximum : 36 Weightage

Section A

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

1. Compare edge and screw dislocations.

2. Explain monotectic and syntactic reactions.

3. What factors affect the diffusion rate in metallic crystals ?

4. What is Lever rule ?

5. Determine the degrees of freedom of a system with two components three, when the number of phases is one and four.

6. What is Fick's law of diffusion ?

7. Describe Kirkendall Effect.

8. Explain the mechanism involved in ductile fracture formation.

9. What are the properties common to most ceramic materials ?

10. What is sintering and its advantages ?

11. What are the advantages of Atomic Force Microscopy in analyzing nanomaterials ?

12. Classify various types of carbon nanotubes.

(12 × 1 = 12 weightage)

Section B

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

13. Explain in detail the Fick's first and second law of diffusion and its application.

14. Describe and illustrate the chain, island and sheet like silicate structures and their properties and applications.

15. Describe the preparation of nanomaterials by chemical vapour deposition.

16. Describe the basic principle and working of a STM and its application in analyzing nanomaterials.

(2 × 6 = 12 weightage)

Turn over

Section C

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

17. Describe in detail the classification of nanomaterials based on their dimensions and their properties and applications with relevant examples.

18. Describe the synthesis of ceramics by sol-gel technique with examples and the advantage of this technique over other methods.

19. Describe the factors responsible for the non-crystallinity of long chain polymers.

20. At the surface of a steel bar there is one carbon atom per 20 unit cells of iron. At 1 mm. behind the surface, there is one carbon atom per 30 unit cells. The diffusivity at 1000°C is 3×10^{-11} m²/s. The structure is fcc at 1000°C (a = 0.365 nm). How many carbon atoms diffuse through each unit cell per minute ?

21. Describe the various types of invariant reactions with diagrams.

22. Describe in detail the basic principle and functioning of a TEM and compare it with SEM in the analysis of nanomaterials.

(4 × 3 = 12 weightage)