Reg. No. : | | | | | | | | | | | |

J 3729

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Annual Pattern — First Year

Civil Engineering

PH 1 X 01 — ENGINEERING PHYSICS

(Common to all branches of B.E./B.Tech.)

(Regulation 2004)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define reverberation time in Building Acoustics.

2. Draw the planes (1 1 2) and (1 1 1) in a cubic structure of lattice parameter a.

3. Review the phenomenon of double refraction in uniaxial crystals.

4. Explain stimulated emission using energy level diagrams.

5. The electrical resistivity of a metal at 27°C is 1.08×10^{-8} ohm-metre. Compute the thermal conductivity of the metal if Lorentz number is 1.181×10^{-8} W-ohm/K^2.

6. What is the physical significance of the wave functions $\psi(x, t)$ and $\psi(x)$?

7. Discuss the variation and behaviour of Fermi level in an n-type semiconductor with temperature and concentration of impurities.

8. Mention some of the uses of Hall effect study.

9. Explain what is meant by space charge polarization.

10. What are metallic glasses?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Explain how ultrasonic waves are produced? (6)

(ii) Discuss with necessary theory how the velocity of ultrasonic waves in a liquid is measured. (10)

Or

(b) (i) Explain the terms coordination number, nearest neighbour distance and packing factor in a metallic crystal falling in cubic system. (4)

(ii) Describe with a neat diagram FCC structure. Calculate the packing factor of this structure. Why FCC structure is called a closest packing structure? (8)

(iii) α-iron crystallizes in BCC structure. The nearest neighbour distance in this case is 2.5 A°. Calculate the lattice constant (4)

12. (a) (i) Discuss the production of plane, circularly and elliptically polarized light. (12)

(ii) Write a short note on photoelasticity (4)

Or

(b) (i) Describe the construction and operation of a He-Ne laser. (10)

(ii) Mention some of the unique properties of laser beam, and discuss briefly their uses in materials processing. (6)

13. (a) (i) Give the basic assumptions for discussing the classical theory of free electrons in metals. Obtain the expression for electrical resistivity of a metal subjected to an electric field. (4 + 8)

(ii) Define mobility of charge carriers. What is the unit of mobility of charge carriers? (4)

Or

(b) (i) What is meant by particle in a potential well of infinite height? (2)

(ii) Derive Schrödinger wave equation for particle in a one dimensional box of side a assuming the time dependent wave equation. Solve it to obtain the wave function associated with the particle. (10)

(iii) An electron is moving in a one dimensional box of width 10 A°. Calculate the probability of finding the electron with an interval 1 A° at the centre of the box when it is in its state of the least energy? (4)

14. (a) (i) Show that the intrinsic concentration n_i for a pure semiconductor is given by $[N_c N_v]^{1/2} \exp(-E_g/2kT)$ where the symbols have their usual meaning. (12)

(ii) What fraction of the conductivity of intrinsic silicon at room temperature is due to (1)electrons and (2) holes? The electron and hole mobilities are 0.135 m^2/V-s and 0.048 m^2/V-s respectively (4)

Or

(b) (i) Discuss the behaviour of Type I and Type II superconductors with examples. How does a superconductor differ from a normal conductor? (10)

(ii) List out the applications of superconductors and their limitations. (6)

15. (a) (i) Discuss electronic polarization in atoms. Obtain the expression for the displacement of the electron cloud in the atom under an electric field. Write down the final expression for electronic polarization. (12)

(ii) What are the important uses of dielectric materials? (4)

Or

(b) (i) Classify Biomaterials. Discuss silicon steel and heat resisting steel. Where they are used? (6)

(ii) What are nanomaterials? Discuss the methods of producing nanophase materials. What are the advantages of nanomaterials? (10)
