[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2064)

14615

B. Tech 2nd Semester Examination

Applied Physics-II (O.S.)

AS-1007

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five question in all selecting one question from each of the section A, B, C & D of the question paper and all subparts of the questions in Section-E. Use of non-programmable calculator is allowed.

SECTION - A

1. (a) What are Miller Indices? Derive formula for the distance between two adjacent planes in a cubic crystal. (10)

   (b) State and explain Bragg's law of X-ray diffraction. (5)

   (c) Find packing fraction of body centred cubic structure. (5)

2. (a) Derive an expression for Fermi energy and density of states of a free electron gas in three dimensions. (10)

   (b) What is free electron gas model of metals? Which properties of solids are explained by free electron gas model. (10)

SECTION - B

3. (a) Discuss Kronig-Penny model for electron energy in solids and show how it explains the forbidden bands. (12)

(b) Prove that the effective mass of an electron in an energy bend is given by $m^* = \frac{\hbar^2}{d^2E/dk^2}$ (8)

4. (a) On the basis of band theory of solids, distinguish between metals, insulators and semiconductors. (10)

(b) What are Brillouin zones. Derive an expression for Brillori zone for bcc lattice. (10)

SECTION - C

5. (a) What is photoconductivity? How does it arise? Mention a few applications of the phenomenon. (10)

(b) Define photovoltaic effect. How this effect can explain the working of photovoltaic cells. (10)

6. (a) Explain the origin of diamagnetism in materials. Obtain an expression for diamagnetic susceptibility using the Langevin's theory. (10)

(b) Give difference between type I and type II super conductors using the Meissner effect. Discuss one application of super-conductivity. (10)

SECTION - D

7. (a) What are Einstein's A and B coefficients? Show that in the optical region the number of spontaneous emission far exceeds the number of stimulated emission. (10)

(b) Write short notes on population inversion and quality factor. (5+5=10)

8. (a) What is an optical fibre? Give basic principal of optical fibre communication. How are optical fibres classified on the basis of mode and refractive index profile? (12)

(b) What are advantages of optical fibres? (8)

SECTION - E

9. Explain in Brief:

(i) What is the cause of hydrogen bonding? (1½)

(ii) In diamond crystal structure, what is the number of nearest neighbours? (1½)

(iii) Define Fermi energy. (1½)

(iv) Differentiate between thermionic emission and photoelectric emission. (1½)

(v) What do you mean by forbidden energy gap? (1½)

(vi) How does fermi energy vary with temperature? (1½)

(vii) Explain photoluminescence. (1½)

(viii) Differentiate between paramagnetism and ferromagnetism. (1½)

(ix) Define magnetisation and susceptibility. (1½)

(x) Do you think energy conservation is violated in a LASER? (1½)

(xi) Which property of a LASER beam make it useful in ICBMs? (1½)

(xii) A laser beam has a band width of 2800Hz. Find its coherence length. (2)

(xiii) What is dispersion in optical fibres? (1½)