

Roll No.

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UG (CBCS) IIIrd Year Annual Examination
2997

B.Sc. PHYSICS

(Solid State Physics and Electronics)

(DSE-1A)

Paper : PHYS 302 TH


Time : 3 Hours]

[Maximum Marks : 50

Note :- Attempt *five* questions in all, selecting *one* question each from Sections-B, C, D and E. Section-A is compulsory.

Section-A

(Compulsory Question)

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1. (i) BCC lattice is reciprocal lattice of
- (ii) What is the cause of directional nature of covalent bonds ?
- (iii) Discuss the physical meaning of fermi energy.

- (iv) Differentiate between LED and LCD.
- (v) Are emitter and collector interchangeable in a transistor ? Give the reason.
- (vi) The voltage gain of an amplifier is 100. On applying negative feedback with $\beta = 0.03$, its gain will reduce to :
 - (a) 70
 - (b) 25
 - (c) 99.97
 - (d) 3
- (vii) Why db is used as logarithmic unit ? 2×7=14

Section-B

- 2. (a) Obtain Laue's equation of X-ray diffraction by crystals. How Bragg's diffraction condition can be obtained from them ?
- (b) Find the packing fraction of face centred cube. 6,3
- 3. (a) Obtain an expression for specific heat of solid on the bases of Debye's theory.
- (b) Explain the concept phonon. Derive its expression for its momentum. 6,3

Section-C

4. (a) Discuss Kronig-Penney model in solids. Show how it explains the allowed and forbidden energy bands.
- (b) Differentiate between Type-I and Type-II superconductors. 7,2
5. (a) Explain the concept of Fermi energy and its variation with temperature. Show that the average kinetic energy of a 3D free electron gas at absolute zero is :
- $$E_0 = \frac{3}{5} E_{F_0}$$
- where E_{F_0} is the fermi energy at 0K.
- (b) Give assumptions of free electron gas model of metals. 7,2

Section-D

6. (a) Distinguish between avalanche breakdown and zener breakdown. Show that it can be used as voltage stabiliser.
- (b) Explain the circuit diagram and working of a bridge rectifier. Find ripple factor and peak inverse voltage. 3,6

7. (a) What are different types of MOSFET ? Sketch the structure of a n -channel depletion type MOSFET and explain its working.

(b) Define α and β -parameters of a transistor. 7,2

Section-E

8. (a) Describe the working and analysis of an emitter follower.

(b) Explain RC coupled transistor amplifier. Give expressions for low and high frequency cut off. 3,6

9. (a) Derive an expression for frequency of oscillation and condition for sustained oscillations in a phase shift oscillator.

(b) What is OP-AMP ?

7,2