

B TECH
(SEM II) THEORY EXAMINATION 2018-19
ENGINEERING PHYSICS

Time: 3 Hours

Total Marks: 80

Note 1. Attempt all sections equally and give the answers suitably.

SECTION A

1. **2 x 8 = 16**

- a. Write the properties of matter waves.
- b. Derive an expression for the wavelength of matter waves.
- c. Give Physical significance of wave function.
- d. Define nanoscience and nanotechnology.
- e. Distinguish between para, dia and ferromagnetic materials.

(For Mechanical)

- f. What are Bravais lattices? Illustrate them
- g. Explain the term internal energy of a system.
- h. What are ultrasonic waves?

(For EC/EI/EN)

- f. Define Hall Effect.
- g. Define mean free path.
- h. What are connectors and couplers

(For CS & IT)

- f. Explain Positive and Negative Environmental Impacts of Solar cell.
- g. State two applications of it.
- h. Differentiate between RAM and ROM
What is a spatial filtering?

SECTION B

2. Attempt any three of the following: **8 x 3 = 24**

- a. Calculate the energy difference between the ground state and first excited state for an electron in one-dimensional rigid box of length 1\AA , mass of electron $=9.1 \times 10^{-31}$ kg and $h=6.626 \times 10^{-34}$ J-s.
- b. For a specimen of superconductor, the critical fields are 1.4×10^5 and 4.2×10^5 A/m respectively for temperature 14K and 13K respectively. Calculate the transition temperature and critical fields at 0K and 4.2K
- c. The following data refers to a dielectric material $\epsilon_r=4.94$ and $n^2=2.69$ where n is the index of refraction. Calculate the ratio between electronic and ionic polarizability for this material.

(For Mechanical)

- d. X-rays of wavelength $\lambda =0.3\text{\AA}$ are incident on a crystal with lattice spacing 0.5\AA . Find the angles at which second and third Bragg's diffraction maxima are observed.
- e. Calculate the mean free path of the molecules of a gas in a chamber of 10^{-6} mm of mercury pressure, assuming the molecular diameter to be 2\AA . Take the temperature of the chamber to be 273 K and Boltzmann constant $k=1.38 \times 10^{-23}$ J/K.

(For EC/EI/EN)

- d. Find the value of $f(E)$ for $E-E_f=0.01\text{eV}$ at 200K.
- e. A platinum thermometer has a resistance of 100Ω at 25°C . (a) Find its resistance at 65°C if the platinum has a resistance temperature co-efficient of $0.00392/^\circ\text{C}$ (b) If the temperature has a resistance of 150Ω , calculate the temperature.

(For CS &IT)

- d. Hall voltage of 1.0mV is found to be developed when a sample carrying a current of 10.0mA is placed in a transverse magnetic field of 0.3T . Calculate the charge carrier concentration of the sample, given the thickness of the sample along the direction of magnetic field is 0.3mm .
- e. In a N-type semiconductor, the Fermi level is 0.3 eV below the conduction band at 300K . If the temperature is increased at 330K find the new position of Fermi level.

SECTION C

3. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) Derive Schrodinger time independent and time dependent wave equations.
- (b) Find an expression for the energy state of a particle in one dimensional square well potential.
4. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) Give salient features of BCS theory. Describe briefly the formation of Cooper pairs.
- (b) What is buckyball? How buckyballs can be created? State few applications of buckyballs.
5. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) Obtain an expression for the internal field seen by an atom in infinite array of atoms subjected to an external field.
- (b) Discuss Langevin's theory of diamagnetism. Derive an expression for change of magnetic moment.

(For Mechanical)

6. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) What do you mean by interplanar distance? Derive a relation between interplanar distance and cube edge.
- (b) Obtain Bragg's law for X-ray diffraction in crystals. Show how it can be experimentally verified.
7. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) What do you mean by Joule-Thomson expansion? Obtain an expression for the cooling produced due to this effect.
- (b) Describe and explain the working of the Cenco-Hyvac rotary pump.

(For EC/EI/EN)

6. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) What do you mean by Fermi level? Prove that the Fermi-level in a intrinsic semiconductor lies midway in the forbidden band i.e $E_F = E_C + E_V / 2$
 - (b) What is photovoltaic effect? Explain the principle of a photovoltaic cell.
7. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) What is refrigerant? Describe the cooling produced by vapour absorption machine.
 - (b) Describe the structure of PIN photodiode. Explain its principle and working.

(For CS & IT)

6. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) What is Hall effect? Derive an expression for Hall angle
 - (b) What is a solar cell? Discuss in detail their construction, working and applications.
7. **Attempt any one part of the following:** **8 x 1 = 8**
- (a) What is pattern recognition? Give the different stages in pattern recognition.
 - (b) What is quantum computing? Explain the difference between classical and quantum computing.

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