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First/Second Semester B.E. Degree(CBCS)Examination

Engineering Physics

Time: 3 hrs.

Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.

2. Physical Constants: Velocity of light, $c = 3 \times 10^8 \text{ m/s}$, Planck's constant, $h = 6.625 \times 10^{-34} \text{ JS}$; Mass of electron $m = 9.1 \times 10^{-31} \text{ kg}$; Boltzmann constant, $k = 1.38 \times 10^{-23} \text{ J/K}$; Avagadro number, $N_A = 6.02 \times 10^{26} / \text{K mole}$

Module-1

1. a. State Planck's law of black body radiation. Show that Planck's law reduces to Wien's law and Rayleigh Jeans law at lower and higher wavelength limits respectively. (07 Marks)
- b. Based on Heisenberg's uncertainty principle, show that electrons cannot exist within the nucleus. (05 Marks)
- c. Calculate the de Broglie wavelength of an electron moving with a K.E. of 50 Kev. (04 Marks)

OR

2. a. What is phase velocity and group velocity? Show that group velocity is equal to particle velocity. (05 Marks)
- b. Obtain the solution of Schrodinger's time independent wave equation for a particle in a one dimensional potential box of infinite height. (07 Marks)
- c. X-rays of wavelength $0.75 \text{ \AA}$ are scattered from a target at an angle of 45° . Calculate the wavelength of scattered X-rays. (04 Marks)

Module-2

3. a. What is Fermi level? Describe the variation of Fermi factor with temperature. (05 Marks)
- b. What is Meissner effect? Write a note on Type – I and Type – II super conductors. (07 Marks)
- c. For intrinsic gallium arsenide, the room temperature electrical conductivity is $10^{-6} \text{ ohm}^{-1} \text{ m}^{-1}$. The electron and hole mobilities are respectively $0.85 \text{ m}^2/\text{Vs}$ and $0.04 \text{ m}^2/\text{Vs}$. Calculate the intrinsic carrier concentration at room Temperature. (04 Marks)

OR

4. a. Explain the BCS theory of super conductivity. (05 Marks)
- b. State law of mass action. Obtain an expression for the intrinsic carrier density. (07 Marks)
- c. Calculate the probability of finding an electron at an energy level 0.02 eV above Fermi level at 300K . (04 Marks)

Module-3

5. a. Explain the construction and working of carbon dioxide Laser. (08 Marks)
- b. Obtain an expression for the numerical aperture of an optical fiber. (04 Marks)
- c. The average power output of a laser beam of wavelength $6500 \text{ \AA}$ is 10 mw . Find the number of photons emitted per second by the laser source. (04 Marks)

OR

6. a. What is holography? Explain the principle and method of recording an image on a hologram. (06 Marks)
- b. Explain the different types of optical fibers. (06 Marks)
- c. An Optical signal propagating in a fiber retains 85% of input power after travelling a distance of 500 m in the fiber. Calculate the attenuation coefficient. (04 Marks)

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