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14PHY12/22

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Physics

Time: 3 hrs.

Max. Marks: 100

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

2. Physical constants : $h = 6.63 \times 10^{-34} \text{ JS}$; $m_e = 9.1 \times 10^{-31} \text{ kg}$; $m_n = 1.675 \times 10^{-27} \text{ kg}$,
 $C = 3 \times 10^8 \text{ m/s}$; $N_A = 6.025 \times 10^{26} / \text{k mole}$; $K_B = 1.38 \times 10^{-23} \text{ JK}$; $e = 1.6 \times 10^{-19} \text{ C}$,
 $L_{ev} = 1.6 \times 10^{-19} \text{ C}$.

Module-1

- 1 a. What is Plank's law? Show that how Plank's law reduces to Wein's law and Rayleigh – Jeans law under certain conditions. (06 Marks)
- b. Show that group velocity is equal to particle velocity. (04 Marks)
- c. State and explain Heisenberg's Uncertainty principle and show that electrons does not exist in nucleus. (06 Marks)
- d. An electron is bound in one dimensional potential well of width 0.18nm. Find the energy value in eV of the second excited state. (04 Marks)
- 2 a. What are Matter waves? Mention their characteristic properties. (05 Marks)
- b. Set up one dimensional time independent Schrodinger wave equation in case of a free particle. (07 Marks)
- c. What is Wave function? Mention important properties of wave function. (04 Marks)
- d. A particle of mass $0.5 \text{ Mev}/c^2$ has kinetic energy 100eV. Find its de-Broglie wave length , where 'C' is the velocity of light. (04 Marks)

Module-2

- 3 a. Discuss merits of quantum free Electron theory. (06 Marks)
- b. Explain Type – I and Type – II super conductors. (04 Marks)
- c. Write the expression for electron and hole concentrations in an intrinsic semiconductors and hence derive an expression for Fermi level in an intrinsic semi conductor. (06 Marks)
- d. Calculate the Fermi energy in eV for a metal at 0^0 K if it has 5.86×10^{28} conduction electrons per cubic metre. (04 Marks)
- 4 a. What is Hall effect? Derive expression for Hall voltage in terms of Hall coefficient. (07 Marks)
- b. Define the terms Fermi level, Fermi factor and Fermi – Dirac statistics. (04 Marks)
- c. Explain Density of states. (04 Marks)
- d. Describe in brief BCS theory of super conductivity. (05 Marks)

Module-3

- 5 a. Derive an expression for energy density of radiation in terms of Einstein's coefficients. (07 Marks)
- b. Explain Propagation mechanism of light in an optical fiber and hence obtain expression for critical angle. (05 Marks)
- c. Discuss Point – to – Point communication system using an optical fiber with block diagram. (04 Marks)
- d. The average output power of laser source emitting a laser beam of wavelength 633nm is 5mw. Find the number of Photons emitted per second by the laser source. (04 Marks)

- 6 a. Explain the construction and working of carbon dioxide laser with energy level diagram and illustrate modes of vibration of CO₂ molecules. (08 Marks)
- b. Define Acceptance angle and Numerical aperture and derive an expression for NA in terms of refractive indices of core and cladding. (06 Marks)
- c. Describe the recording of holographic image. (03 Marks)
- d. The angle of acceptance of an optical fiber is 30°, when kept in air, what will be the angle of acceptance when the same is kept in a medium of Refractive index 1.33. (03 Marks)

Module-4

- 7 a. Explain in brief Seven Crystal Systems, with neat diagram. (07 Marks)
- b. Explain briefly the Principle and working of Liquid crystal display. (06 Marks)
- c. Calculate the atomic packing factor of BCC and FCC. (04 Marks)
- d. Derive Bragg's law. (03 Marks)
- 8 a. Describe how Bragg's X – ray spectrometer is used for determination of crystal structure. (07 Marks)
- b. What are Miller indices and explain the procedure to find Miller indices. (04 Marks)
- c. Explain the terms Polymorphism and Allotropy with examples. (04 Marks)
- d. X – rays of wavelength 0.82Å⁰ undergo first order Bragg reflection from a crystal of cubic lattice with lattice constant 3Å⁰ at a glancing angle of 7.855°. Identify the Possible Planes which give rise to this reflection in terms of their Miller indices. (05 Marks)

Module-5

- 9 a. Explain the terms i) Mach number ii) Acoustic iii) Ultrasonic and iv) Shock wave. (04 Marks)
- b. Explain the construction and working of Reddy's shock tube. (06 Marks)
- c. What is Carbon nano tube? Discuss important properties and explain how it is synthesized using Pyrolysis method. (07 Marks)
- d. Mention three applications of SEM. (03 Marks)
- 10 a. Derive the Normal shock relationship using Rankine – Hugonit equations. (06 Marks)
- b. Explain the Principle, Construction and Working of Scanning Electron microscope. (07 Marks)
- c. Explain Synthesis of Nano materials using Ball Milling method. (04 Marks)
- d. Mention three Properties of Shock Waves. (03 Marks)

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