2E2003

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B.Tech. (Sem.II) (Main/Back) Examination - 2014

203 Engineering Physics-II

[Total Marks : 80]

[Min. Passing Marks : 24]

[Time : 3 Hours]

Instructions to Candidates :

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Unit - I

1. (a) Give the formulation of time dependent Schrödinger's equation for a free particle. Discuss the interpretation of position, probability density and normalization of wave function. (4+2+2+2)

   (b) A quantum particle confined to one dimensional box of width 'a' is known to be in its first excited state. Determine the probability of the particle in the central half. (6)

OR

1. (a) Solve Schrödinger wave equation for a particle in one-dimensional box. Discuss the various energy states. (4+4)

   (b) X-rays of wavelength 0.2Å are scattered from a target. Calculate the wavelength of X-ray scattered through 45°. Also find the maximum kinetic energy of the recoil electron. (4+4)

Unit - II

2. (a) Explain the following :
   (i) Degeneracy
   (ii) Order of degeneracy and
   (iii) Non-degeneracy state (2+2+2)

   (b) A free particle is confined in a cubical box of side a. Write the eigen values and eigen functions for an energy state represented by $n_x + n_y + n_z = 4$. (5+5)

OR

2. (a) Define Fermi Energy. Derive an expression for fermi energy of a system of particles. (2+6)

   (b) A beam of electrons is incident on a potential barrier of height 5eV and width 0.2 nm. What should be the energy of electrons so that half of them are able to penetrate through the barrier ? (8)

Unit - III

3. (a) What is Coherence? Explain temporal and spatial coherence. For the source to be spatial Coherent, find the condition for its size. (2+4+2)

   (b) A step index optical fibre has a core radius of 30μm; $n_1 = 1.5$ and $n_2 = 1.47$. If the operating wavelength is 800 nm, find the number of modes propagating through the fibre. (8)

OR

3. (a) A fibre having a core index of n_1, cladding index n_2 used in a communication link. Prove that

   $$NA = n_1(2\Delta)^{\frac{1}{2}}, \text{ where } \Delta = \frac{(n_1 - n_2)}{n_1}.$$ (8

   (b) Calculate the temporal coherence length for
   (i) Mercury vapour lamp emitting in green portion of spectrum at wavelength of 546.1 nm with emission bandwidth of $\Delta v = 6 \times 10^8$ Hz. (4
   (ii) A helium neon laser operating at wavelength of 632.8 nm. (4

Unit - IV

4. (a) What are basic requirements of semiconductor laser? Draw its label diagram and explain its working with necessary theor Write down the applications of semiconductor laser.

   (b) What is the fundamental principle of a hologram? How is it produced and how is image constructed from it? (2+4+2 (4+

OR

4. (a) Explain the term absorption, spontaneous emission and stimulated emission and drive a relation between Einestein Coefficients. (2+2+2+

(b) What is holographic microscopy. With illustrative diagram show outlay of a holographic interferometer and explain its working. (2+2+2)

Unit - V

5. (a) Draw a labelled diagram of proportional counter and explain its use in detection of α, β, soft x-rays and γ-rays. (2+6)

(b) A G.M. counter has a plateau slop of 3% per 100 volts. If the operating point is at 1100 volts. What is the maximum permissible voltage fluctuation in the counting is not affected by more than 0.1%. (8)

OR

5. (a) Explain the principle of particle detection. Draw log n – v graph showing different regions and discuss the significant physical processes taking place in these regions. (2+6)

(b) An α – particle loses all its energy in producing $15 \cdot 10^4$ electron-ion pairs in the ionization chamber. 35ev energy is required to produce an electron-ion pair. What is the kinetic energy of the α- particle? Calculate the amount of charge collected by each plate. (4+4)

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