2E2003

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B. Tech. I Year II Semester (Main) Examination, 2013

203 Engineering Physics - II

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

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) Derive schrodinger's time dependent wave equation. Explain the followings.
   i) Hamiltonian
   ii) Physical significance of wave function, and
   iii) Normalized and orthogonal wave functions. (4+2+2+2)

   b) An x-ray photon is found to have doubled its wavelength on being scattered by 90°. Find the energy and wavelength of incident photon. (3+3)

OR

1. a) What is compton effect? Derive an expression for compton shift and wavelength of scattered photon. Explain why the compton shift is not observed with visible light? (2+4+2)

   b) Consider a particle confined in one dimensional box with 'a'. Find the probability that the particle is found between $x' = 0$ and $x = a/n$ when it is in the n^{th} state. (8)

Unit - II

2. a) What is tunnel effect? Write down schrodinger equation for potential barrier problem and steps to find out the transmission coefficient of a particle having less energy that the height of potential barrier. (2+2+4)

   b) There are 2.5×10^{28} free electrons per cubic meter of sodium. Calculate the,
   i) Fermi energy and
   ii) Fermi velocity. (4+4)

OR

2. a) Obtain an expression for density of states for free electron gas in a metal and find the expression for Fermi energy. **(4+4)**

b) Consider an electron of total energy 5 ev is approaching a barrier whose height is 6 ev and width 7A°. Find out deBroglie wavelength of incident electron and probability of transmission through barrier, (Mass of electron = 9.1×10^{-31} kg, Planck's constant = 6.6×10^{-34}Js) **(4+4)**

Unit - III

3. a) What is spectral purity? Derive an expression for coherence length and coherence time in terms of wavelength and frequency. **(2+4)**

b) Show that visibility is a measure of coherence. Can there be absolute coherence or absolute incoherence. **(4+2)**

c) Calculate the refractive indices of core and cladding materials of an optical fibre if its numerical aperture is 0.22 and relative index difference is 0.012. **(4)**

OR

3. a) What do you mean by spatial and temporal coherence for propagating waves? Name the types of coherence involved in biprism and Michelson's interferometer. **(4+2)**

b) How does an optical fibre function in transporting electromagnetic energy? Show that the numerical aperture of a step index fibre is given by $NA = n_1\sqrt{2\Delta}$ where symbol have their usual meanings? **(2+4)**

c) What is the coherence length of a source of $\lambda = 6\times10^{-7}m$ with a band width 10^{-11}m? **(4)**

Unit - IV

4. a) How do you produce hologram in a laboratory? How are various requirements for holography met? **(4+4)**

b) Describe the principle, construction and working of a semiconductor laser. Describe various applications of semiconductor laser. **(2+2+2+2)**

OR

4. a) In He-Ne laser, what is the function of He atoms? Explain the answer with the help of energy level diagram for He-Ne. Describe with a neat sketch the working of He-Ne laser. **(2+3+3)**

b) Compare holography and photography and discuss the construction and reproduction of a hologram. In brief, discuss applications of a hologram. (2+2+2+2)

Unit - V

5. a) Draw a labelled diagram of a GM counter and its voltage characteristics. Explain and indicate over it the followings

   i) Threshold voltage

   ii) Plateau region

   iii) Working voltage

   iv) Continuous discharge region. (2+2+2+2+2)

   b) In an air filled ionization chamber, 15 α -particle enter each micro second from 5 Mev α -particle beam. If 35.2ev energy is needed to produce an ion-pair in air. Calculate the ionization current. (6)

OR

5. a) Give the construction, working and applications of scintillation counter. (3+3+2)

   b) A GM counter with dead time $t_d = 200\ \mu s$ is used to detect radiation from a radioactive source.

   i) If the observed count rate is 1000 s^{-1}, what is the true count rate?

   ii) What would be the observed count rate if the source strength were increased by a factor of 10. (4+4)