

**2E2003**

Roll No. \_\_\_\_\_

[Total No. of Pages : 3]

**2E2003****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  $90^\circ$ . 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  $n^{\text{th}}$  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  $2.5 \times 10^{28}$  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  $7\text{\AA}$ . Find out deBroglie wavelength of incident electron and probability of transmission through barrier, (Mass of electron =  $9.1 \times 10^{-31}$  kg, Planck's constant =  $6.6 \times 10^{-34}$  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 symbols have their usual meanings? (2+4)
- c) What is the coherence length of a source of  $\lambda = 6 \times 10^{-7} \text{ m}$  with a band width  $10^{-11} \text{ m}$ ? (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)

- b) In an air filled ionization chamber,  $15 \alpha$ -particle enter each micro second from 5 Mev  $\alpha$ -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)