2E2003

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B.Tech. II Semester (Main & Back) Examination, June/July - 2016

203 Engineering Physics - II

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

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) Obtain an expression for shift in wavelength of scattered photon by Compton scattering and show that Compton shift depends only on scattering angle. What is Compton wavelength? **(8)**

   b) Derive one dimensional time dependent Schrodinger's wave equation and also explain the physical significance of wave function. **(8)**

OR

1. a) Write down the Schrodinger's time independent wave equation for a free particle confined in a one dimensional box of size 'a'. Obtain eigenvalues and normalized wave function for this particle. **(8)**

   b) Explain the followings :

      i) Why Compton Effect is not observed experimentally for visible rays?

      ii) What is the basic difference between Photoelectric effect and Compton Effect? **(4+4)**

Unit - II

2. a) What is the density of energy state in metals? Obtain the expression for density of states for free electron as in a metal and find the expression for Fermi energy. **(8)**

b) Find the lowest energy and energy of first excited state of a neutron confined in a nucleus, considering it as a 3 - dimensional cubical box of size 10^{-14} meter. **(8)**

OR

2. a) Solve 3- dimensional Schrodinger's equation for a free particle confined in an infinitely deep cubical potential well of side 'a' to obtain energy eigenvalues and eigenfunction. **(8)**

b) What do you understand by quantum mechanical tunneling? With help of suitable diagrams explain the phenomenon of quantum mechanical tunneling in α - decay process. **(8)**

Unit - III

3. a) What is coherence? Explain temporal and spatial coherence. Give example of one experiment each which demonstrate temporal and spatial coherence. **(8)**

b) In a highly stabilized He - Ne Laser, the wavelength $\lambda = 6328\,\text{Å}$ and line width $\Delta\nu = 10^3$ Hz. What is the coherence length, coherence time and quality factor for this laser? **(8)**

OR

3. a) Show that the numerical aperture of a step index fiber is given by $N.A = n_1\sqrt{2\Delta}$, where symbol have their usual meaning. **(8)**

b) A step index fiber has numerical aperture 0.16, a core refractive index of 1.42. Calculate,

I) i) The maximum acceptance angle of fiber in air.

ii) The refractive index of cladding

II) i) If the fiber is immersed in water (refractive index = 1.33), will the maximum acceptance angle change? What will be its value?

ii) Will the numerical aperture change? Explain the answer. **(8)**

Unit - IV

4. a) Explain the term absorption, spontaneous emission and derive the relation between Einstein's coefficients for laser action and discuss the results. **(8)**

b) What are the basic requirements of semiconductor laser? Draw its label diagram and explain its working with necessary theory. Write down the applications of semiconductor laser. **(8)**

OR

a) What is the fundamental principle of a hologram? How it is produced and how is image constructed from it? **(8)**

b) Explain Laser action and give the reasons for the following basic properties of a laser

i) High intensity

ii) High directionality **(8)**

Unit - V

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. (8)

b) A GM counter counts 815 counts per minute when 1000 charged particles are incident per minute on it. Find the efficiency of GM counter. **(4)**

c) Calculate the electric field at the surface of the wire of a proportional counter with wire of radius 0.1 mm and a cylinder (cathode) of radius 1cm, when 600 volt is applied between the two electrodes. **(4)**

OR

5. a) Draw a neat diagram of a Geiger - Muller counter. Show its voltage characteristics graph and label the plateau region. Explain the term Dead time, Recovery time and Paralysis time? **(8)**

b) Give construction of Photomultiplier tube. **(4)**

c) What are the advantages of proportional counter over GM counter? **(4)**
