2E2003

Roll No. Total No of Pages: 3

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B. Tech. II Sem. (Main/Back) Exam., May - 2019

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.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT- I

Q.1 (a) Discuss the Compton theory of scattering. Derive the relations for Compton shift, the direction and energy of scattered electron. [8]

(b) Define the terms normalization and orthogonality of a wave function. [2+2=4]

(c) A photon of energy 1.02 MeV is scattered through 90° by Compton scattering. Calculate the energy of photon and electron after interaction. [4]

OR

Q.1 (a) Write down the time independent and time dependent Schrödinger equation for a free particle. Solve time independent Schrödinger equation for a particle confined in 1-D box and show that energy spectrum is discrete. [2+8=10]

(b) Determine the expectation value of position and momentum for a particle trapped in 1-D box of side 'a'. [6]

UNIT- II

Q.2 (a) Explain quantum mechanical tunneling with suitable diagram and theory. Give one example of quantum mechanical tunneling. [6+2=8]

(b) Define degeneracy of an energy level. What is degeneracy of second excited state for a particle trapped in a cubical box? [2+2=4]

(c) Electrons of Energy 2eV are incident on a potential barrier of height 5eV and width 5Å. Find transmission probability of these electrons. [4]

OR

Q.2 (a) Write the basic postulates of Sommerfield free electron gas model. Obtain an expression for density of states for a Fermi gas and hence explain Fermi Energy Level. [8]

(b) Calculate the Fermi energy in Copper assuming that each Copper atom contributes one free electron to electron gas. Given density of Copper 8.94×10^{-3} kg/m^3 and atomic mass of Copper is $63.5\times1.67\times10^{-27}$ kg. [8]

UNIT- III

Q.3 (a) Define Coherence and explain temporal and spatial coherence. How size of source relate to Spatial Coherence? Explain. [4+4=8]

(b) The Spectral line width of red Cadmium light of wavelength 694.3 nm is 0.001 nm. Calculate spectral purity factor, Coherence length and Coherence time. [8]

OR

Q.3 (a) What is an optical fiber? Explain Numerical Aperture and maximum acceptance angle for an optical fibre. Find an expression of numerical aperture for step index fibre. [4+4+4=12]

(b) The refractive index of core of an optical fibre is $\eta_1 = 1.45$ and the refractive index difference is 0.01. Find the numerical aperture and maximum acceptance angle. [4]

UNIT- IV

Q.4 (a) Explain the construction and working of He-Ne Laser with neat and labelled diagram. What is role of He in this Laser? [8]

(b) Explain the basic properties of a laser light. [4]

(c) Find the population density of the excited states of a laser material which produces light of wavelength 6328Å at 3000 K. Population density of the lower state is 10^{20} atoms per unit volume. [4]

OR

Q.4 (a) Describe briefly construction and reproduction of a hologram. [8]

(b) What do you understand by Q-switching and mode locking of a laser? [6]

(c) State the applications of holography. [2]

UNIT- V

Q.5 (a) Explain dead time of a GM counter. How problem can be solved in GM counter? [4]

(b) Explain with neat diagram construction and working of a proportional counter. [8]

(c) Find the number of ion pairs by 10 MeV proton. The multiplication factor of proportional counter is 10^3, current pulse duration is 10μs and resistance between electrodes is $10^4\Omega$, find pulse height. The amount of energy required to produce one ion pair is 34 eV. [4]

OR

Q.5 (a) Describe principle, construction and working of a scintillation counter. [8]

(b) A GM counter reads 5000 counter per minute. If the dead time of the counter is 300μs, then find actual count rate. [8]
