2E2003

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**2E2003**

# B.Tech. I Year II Sem. Main / Back June-July Examination, 2015

## 203 Engg. Physics-II

*Time: 3 hours*

*Maximum Marks: 80*
*Min. Passing Marks: 26*

**Note:** 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.

1. NIL 2. NIL

UNIT-I

Q. 1 (a) What is Compton effect? Deduce an expression for shift in wavelength of scattered X-rays by Compton scattering. 2+5

(b) Derive Schrödinger time dependent wave equation. 4

(c) Find the probability that a particle in a box of width $a$ can be found between $x = 0$ and $x = a/n$ when it is in the $n$th state? 5

OR

Q. 1 (a) Write down Schrödinger wave equation for a particle enclosed in one dimensional box of size '$a$'. Solve it to get eigenvalues and eigenfunctions. 8

(b) Show that the value of energy which a photon must have so that it may transfer half of its energy to an electron at rest is about 256 KeV in a Compton scattering experiment. 8

UNIT-II

Q. 2 (a) Answer the following questions with respect to a particle in a cubic box of side '$a$':

(i) Is $n_x = n_y = n_z = 1$ state degenerate? 2

(ii) What is the order of degeneracy for $n_x + n_y + n_z = 4$? 2

(iii) What shall happen to the degeneracies for $n_x + n_y + n_z = 4$, if the box is not cubical but rectangular parallelopiped with sides $a$, $b$ and $c$ such that $a = b \neq c$. 3

(b) What is tunnel effect? Write down Schrödinger equation for potential barrier problem and steps to find out the transmission coefficient of a particle having less energy than the height of potential barrier? 2+3+4

OR

Q. 2 (a) Write down basic postulates of Summerfield's free electron gas model. Obtain a expression for the density of states for free electron gas in metal and hence fin expression for the Fermi energy. 4+4+:

(b) Consider an electron whose total energy is 5 eV approaching a barrier whose heigl is 6 eV and width is 7 Å. Find out de Broglie wavelength of incident electron an probability of transmission through the barrier. 2+

UNIT-III

Q. 3 (a) What is coherence? Explain temporal and spatial coherence. Show that visibility is measure of a degree of coherence. 2+3+:

(b) Write two prominent applications of optical fiber. 2+:

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

OR

Q. 3 (a) Describe the construction of an optical fiber. What do you mean by numerical apertur of an optical fiber? Find an expression for the numerical aperture of an optical fibe 4+2+

(b) A laser operates at wavelength of 6000 Å and it spectral line width ($\Delta V$) is $10^2$ Hz. fo this laser, calculate:

(i) Coherence length (ii) Quality factor 3+:

UNIT-IV

Q. 4 (a) Derive the relation between Einstein's coefficients and discuss the results. 5+:

(b) Explain the construction and working of a He-Ne laser. Draw necessary diagran What is the role of He in this laser? 3+4+:

OR

Q. 4 (a) Write short notes on the following: 3+:

(i) Population inversion (ii) Pumping

(b) What is holography? How it is different from photography? Explain with suitabl diagram, how a hologram is recorded and then reconstructed? 2+2+3+:

UNIT-V

Q. 5 (a) What do you mean by 'dead time' in Geiger Muller counter? Draw a neat diagram ( Geiger Muller Counter and explain its working. Mention some of its applications. 2+5+:

(b) An $\alpha$-particle is stopped in an ionization chamber in which its produces $15 \times 10^4$ io pairs. Each time the $\alpha$-particle produce an ion pair, it losses 35 eV of energy. Wh is the kinetic energy of the $\alpha$-particle? Calculate the amount of charge collected b each plate. (

OR

Q. 5 (a) Describe the construction, working and applications of Scintillation counter. 4+4+:

(b) In a Geiger Muller counter, on an average $10^8$ electron/count are collected if th count rate is 600 per minute, then find the ionization current. (