2E1023

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B. Tech. (Sem. II) (Main/Back) Examination, June/July - 2012
Common for All Branch
203 Physics - II

Time : 3 Hours] [Maximum Marks : 80
[Min. Passing Marks : 24

*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

1 (a) What is tunnel effect ? Write down Scrödinger equations 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+2+4

(b) Calculate the probability of transmission that an electron with energy 1.0 eV will penetrate a potential barrier of 4.0 eV when barrier width is 4.0 $\mathring{A}$.

8

OR

1 (a) What do you mean by 'Band theory of solids' ? Explain conductor, semiconductor and insulator on the basis of this theory.

2+2+2+2

(b) For potassium, fermi energy is 2.14 eV and the density of electron is $1.4 * 10^{28}/m^3$. Find the electron density of a metal for which fermi energy is 4.7 eV.

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UNIT - II

2 (a) Explain the principle of laser. What are the essential requirements of a laser ? Explain how these requirements are achieved.

2+3+3

(b) Laser action occurs by stimulated emission from an excited state to a state of energy 30.5 eV. If the wavelength of laser light emitted is 690 nm, what is the energy of the excited one.

8

OR

2 (a) What is a hologram ? Explain with suitable diagrams hiow a hologram is recorded and then reconstructed.

2+3+3

(b) The pulse width of laser of wavelength 1064 nm is 25 ms. If the average power output per pulser is 0.8 W then
(i) What is the energy released per pulse ?
(ii) How many photons does each pulse contain ?

8

UNIT - III

3 (a) How can you experimentally distinguish between coherent and non-coherent light ? Why is the concept of coherence is of central importance in the study of interference ?

4+4

(b) A laser beam has a power of 50 mW. It has an aperture of $5 * 10^{-3}$ and wavelength 7200 $\mathring{A}$. A beam is focussed with a lens of focal length 0.1 m. Calculate the area and the intensity of the image.

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OR

3 (a) Explain how light is propagated in a variable index fibre. Define numerical aperture and acceptance angle. Derive expressions for the same.

4+2+2

(b) For a step index fibre having core index 1.43 and cladding index 1.4. Calculate :

(i) Critical angle

(ii) Critical propagation angle

(iii) Numerical aperture.

3+3+2

UNIT - IV

4 (a) How will you differentiate between three types of gas detectors viz. ionization chamber, proportional counter and GM counter ?

3+3+3

(b) An ionization chamber exposed to a beam of α-particle registers a current of 4.8×10^{-13} ampere. On the average 20 α-particles enter the chamber per second. Assuming that **in producing ion pairs 35 eV per ion pair energy** is needed, **calculate the energy of the α-particle.**

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OR

4 (a) Describe construction and working of Geiger-Muller counter. Explain the terms dead time and quenching.

2+2+2+2

(b) The efficiency of a GM counter is 90%. If it counts maximum 6000 counters/minute then calculate the paralysis time of counter.

8

UNIT - V

5 (a) Prove that $\vec{\nabla}\cdot\left(\vec{A}+\vec{B}\right)=\vec{\nabla}\cdot\vec{A}+\vec{\nabla}\cdot\vec{B}$ where $\vec{A}$ and $\vec{B}$ are differentiable vector functions.

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(b) Obtain Maxwell's equations and deduce an expression for the velocity of propagation of a plane electromagnetic wave in a medium of dielectric constant ε and relative permeability μ.

2+6

OR

5 (a) Obtain the electromagnetic wave equations, using Maxwell's equation, in an isotropic dielectric medium and show that the speed of wave is less than its speed in vacuum.

4+4

(b) Define poynting vector. Derive an expression for it and explain its physical significance for electromagnetic wave in free space.

2+4+2