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2E1023

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2E1023

B. Tech. IInd Semester (Main) Examination, June - 2010

Physics - II

Common to all branches of Engineering

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

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt overall **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 may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit - I

1. i) What is tunnel effect? Discuss the Alpha decay as an example of tunnel effect. Prove that tunnelling increases on decreasing the height and width of the barrier. **(2+2+4)**

ii) Write down basic postulates of summerfield free electron gas model. Show that the number of energy states per unit energy range is given by

$$g(E)=\frac{4\pi V}{h^3}(2m)^{3/2}E^{1/2}$$ **(4+4)**

OR

i) Discuss the degeneracy of energy states. Solve the Schrödinger equation for a free particle in three dimensional box and find the eigen values and eigen function of free particle. **(2+4+2)**

ii) Describe in brief the formation of energy bands in solids and hence explain how it helps to classify the solid in to conductors and insulators. **(2+2)**

iii) Calculate the Fermi energy in *ev* for silver at $0\cdot K$, given that the density of silver = 10500 kg/m^3, atomic weight = 107.9, and it has one conduction per atom. **(4)**

Unit - II

2. i) What is basic requirement of semiconductor laser? Draw its label diagram and explain its working with necessary theory. Write down the applications of semiconductor laser. **(2+2+2+2)**

ii) Discuss construction and reproduction of hologram. In brief discuss applications of a hologram. **(2+2+2)**

iii) Find the intensity of laser beam of 20 mw and diameter 1.5 mm. Assume the intensity to be uniform throughout the beam. **(2)**

OR

i) What is holographic microscopy? With illustrative diagram show out lay of holographic microscope and its working. **(2+3+3)**

ii) Write short notes on Q-switching and mode Locking. **(2+2)**

iii) Explain the terms :

a) Spontaneous emission

b) Optical pumping. **(2+2)**

Unit - III

3. i) What is index fibre? How you define the modes in an optical fibre? Give a relation between core diameter and numerical aperture. **(2+3+3)**

ii) Explain coherence length and coherence time. **(2+2)**

iii) An optical fibre has an NA of 0.20 and a cladding refractive index of 1.59. Determine the acceptance angle for the fibre in water which has a refractive index of 1.33. **(4)**

OR

i) How optical fibres can be used in medical and communication fields? **(2+2)**

ii) Define coherence and explain temporal and spatial coherence. Show that visibility is a measure of coherence. **(2+2+2+2)**

iii) Calculate the temporal coherence length lc for mercury vapour lamp emitting in green portion of spectrum at wavelength 546.1nm with emission band width of $\Delta\nu = 6 \times 10^8$ Hz. **(4)**

Unit - IV

4. i) What do you mean by dead time in GM counter? Draw a neat diagram of GM counter and explain its working. Mention some of its applications. **(2+4+2)**

ii) Write short notes on

a) Electric dipole and dipole moment

b) Dielectric constant and

c) Polarisation of dielectrics. **(4+2+2)**

OR

i) What is dielectric break down? Explain briefly the various factors contributing to break down in dielectrics. **(2+4)**

ii) Describe the principle, construction and working of a Scintillation counter. **(2+2+2)**

iii) A GM counter with a dead time of 300 μs records 16000 counts/min. What is the dead time loss in the counting rate? **(4)**

Unit - V

5. i) Deduce the Maxwell's equations for free space and prove that the electromagnetic waves are transverse. **(4+4)**

ii) What do you mean by divergence of a vector field? Explain its physical significance. **(2+2)**

iii) A closed surface S encloses a volume V. Calculate the value of div $\vec{F}$ and $\iint_S \vec{F}.\vec{ds}$ for a vector field $\vec{F} = 3x\hat{i} + 4y\,\hat{j} + 2z\,\hat{k}$. **(2+2)**

OR

i) State and derive boundary conditions of electric and magnetic fields at the interface of two media. **(3+3)**

ii) State and prove Poynting theorem. Explain the term Poynting vector. **(4+2)**

iii) If $\vec{A} = x^2 z\,\hat{i} - 2y^3 z^2\,\hat{j} + x y^2 z\,\hat{k}$, find the values of (a) div $\vec{A}$, (b) curl $\vec{A}$, at a point (2, 2, 2). **(2+2)**
