Mechanical
Electrical

730

Total No. of Questions - 8] [Total No. of Printed Pages-3

B.E. II Semester Examination

BE-II/6(A)

216479

ENGG. PHYSICS

Course No. : BSC - 202

(New)

Time Allowed- 3Hours *Maximum Marks-100*

Note: *Attempt five questions in all selecting at least two from each section. All questions carry equal marks. Use of scientific calculator is allowed.*

SECTION - A

1. a) Define Poynting vector. Derive an expression for it and explain its physical significance for electromagnetic wave in free space. Prove the relation $\vec{E} = c\vec{B}$. (12)

   b) Evaluate $\nabla.(r^3.\vec{r})$ where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$. (8)

2. a) Differentiate between 'ψ' and $|\psi|^2$. Write down Schrodinger's wave equation for a particle in a box. Solve it to obtain the Eigen functions and show that the eigen values are discrete. (12)

   b) Find the expectation value $< x >$ of the position of a particle trapped in a box L cm wide. (8)

3. a) Explain what is meant by Ultrasonic waves. Mention the properties of Ultrasonic waves. Describe the production of ultrasonic waves using piezoelectric method. Give a brief description of some methods for the detection of ultrasonic waves. (12)

b) A quartz crystal vibrates at its natural frequency of 30kHz. Find its thickness if the density is 2650 kgm^{-3} and the young's modulus is $7.9\times10^{10}\ Nm^{-2}$ (8)

4. a) Prove the relations

i) $$\nabla\times\vec{E}=-\frac{\partial\vec{B}}{\partial t}$$

ii) $$\nabla\times\vec{B}=\mu_o\vec{J}+\mu_o\epsilon_0\frac{\partial\vec{E}}{\partial t}$$ and discuss their physical significance. (10)

b) Discuss phase and group velocities. Show that group velocity of the waves associated with a particles is equivalent to the velocity of the particle (10)

SECTION - B

5. a) Discuss the law of 'Mass action'. Distinguish between diffusion and drift currents. Derive Einstein's relation for a P-N junction. (12)

b) For an intrinsic semi-conductor with energy gap of 0.7ev, determine the position of the fermi level at 300k if $m_h=6m_e$ (8)

6. a) Distinguish between polarized and unpolarized light, plane of vibration and plane of polarization with the help of suitable figures. Explain the production of elliptically and circularly polarized light with the help of mathematical expressions (12)

b) Calculate the thickness of a quarter wave plate of wavelength 5890 A^0;

i) Given $\mu_0 = 1.55$ *and* $\mu_e = 1.50$

ii) Given $\mu_0 = 1.55$ *and* $\mu_e = 1.57$ (8)

7. a) Define the term 'LASER'. Describe the various components of a laser and discuss the principle of laser Action with suitable ray diagrams. Differentiate between a 'Laser and an 'Ordinary light'. (12)

b) Calculate the Energy and Momentum of a photon of a laser beam of wavelength 6328 A^0. (8)

8. a) Explain the term "Fermi Level". Prove that Fermi level in an intrinsic semiconductor lies midway in the forbidden band i.e $E_f = \frac{Ec + Ev}{2}$. Discuss the variation of fermi level with temperature for an n-type semiconductor. (10)

b) Differentiate between quarter & half wave plates. Explain the principle, construction and working of a Nicol prism. (10)
