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Printed Pages : 7

EAS - 101 / EAS - 201

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 9611

Roll No.

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B. Tech.

(SEM. II) EXAMINATION, 2008-09

ENGG. PHYSICS - II

Time : 2 Hours]

[Total Marks : 50

Note : This question paper contains three sections.

SECTION - A

1 Attempt all parts. All parts carry **equal** 10×1=10 marks :

- (a) The wave nature of material particles was first proposed by _____
- (b) In Compton Effect, a photon scattered at right angle to the incident direction, the Compton shift will be _____

Pick the correct choice from following :

- (c) The quantized energy of a particle of mass m in a one dimensional box of length L is given by
 - (i) $n^2h^2/2mL^2$
 - (ii) $n^2h^2/8mL^2$



(iii) $n^2 \pi^2 h^2 / 2mL^2$

(iv) $n^2 h^2 / 8 \pi^2 mL^2$

(d) In dielectrics, the polarization is

(i) Linear function of applied electric field

(ii) Square function of applied electric field

(iii) Exponential function of applied electric field

(iv) None of the above

(e) The Clausius-Mossotti relation is

(i) $\frac{\epsilon_r - 1}{\epsilon_r + 1} = \frac{N \alpha}{3 \epsilon_0}$

(ii) $\frac{\epsilon_r + 1}{\epsilon_r - 2} = \frac{N \alpha}{3 \epsilon_0}$

(iii) $\frac{\epsilon_r + 1}{\epsilon_r - 1} = \frac{3N \alpha}{\epsilon_0}$

(iv) $\frac{\epsilon_r - 1}{\epsilon_r + 2} = \frac{N \alpha}{3 \epsilon_0}$



- (f) Ultrasonic wave can be detected by
- (i) a telephone
 - (ii) Quincke's method
 - (iii) Kundt's method
 - (iv) Hebb's method.

(g) Statement that displacement current between the plates of a capacitor

- (I) flows when charge decreasing on the plates
- (II) flows when charge increasing on the plates
- (III) flows when charge remain constant on the plates
- (IV) flows when no charge on the plates

Choose the correct **one** :

- (i) Statements (I) and (II) are correct
- (ii) Statement (II) is correct
- (iii) Statements (III) and (IV) are correct
- (iv) Statement (IV) is correct

(h) The ratio of electric field E and magnetic field H has the dimension of

- (i) Power
- (ii) Resistance
- (iii) Inductance
- (iv) Capacitance.



- (i) Hard superconductors observe
- (i) breakdown of Silsbee's rule
 - (ii) incomplete Meissner effect
 - (iii) high critical field and transition temperature
 - (iv) all the above
- (j) The Chemical Vapours Deposition is a technique in nanotechnology for
- (i) determination of the size of nanoparticles
 - (ii) identification of nanoparticles
 - (iii) characterization of nanoparticles
 - (iv) synthesis of carbon nanotubes.

SECTION - B

2 Attempt any three parts. All parts carry $3 \times 5 = 15$ equal marks :

- (a) The kinetic energy of an electron is 4.55×10^{-25} J. Calculate velocity, momentum and the wavelength of the electron.
- (b) Calculate the uncertainty in the position of a dust particle with mass equal to 1 mg if uncertainty in its velocity is 5.5×10^{-20} m/s.



- (c) The dielectric constant of helium at 0°C and 1 atmospheric pressure is 1.000074. Find the dipole moment induced in helium atom when the gas is in an electric field of intensity 100 volt/m. Number of atoms per unit volume of helium gas are 2.68×10^{27} .
- (d) The permeability, permittivity and conductivity of aluminium are $\mu_r = 1$, $\epsilon_r = 1$ and $\sigma = 3.54 \times 10^7 \text{ mho/m}$. Find the skin depth if the wave enter in aluminium with frequency of 71.56 MHz.
- (e) A superconducting material has a critical temperature of 3.7°K in zero magnetic field and a critical field of 0.0306 Tesla at 0°K . Find the critical field at 2°K .

SECTION - C

Note : Attempt all questions. All questions **5×5=25**
carry **equal** marks.

3 Attempt any **one** part of the following :

- (a) Distinguish between group velocity (V_g) and phase velocity (V_p) of a wave packet and show that $V_p V_g = C^2$.



(b) Derive time dependent Schrödinger wave equation.

4 Attempt any **one** part of the following :

(a) Describe Bragg's spectrometer and explain how it is used to study the structure of crystals.

(b) What do you mean by polarization of a substance? Write different mechanism of polarization in a dielectric.

5 Attempt any **one** part of the following :

(a) Show that the magnetic susceptibility of a diamagnetic material is negative and independent of temperature.

(b) What are ultrasonic waves? Explain how they are produced using magnetostriction method.

6 Attempt any **one** part of the following :

(a) Derive and explain Poynting theorem.

(b) Write down Maxwell's equations in free space and using these equations derive wave equations for both electric and magnetic fields.



7 Attempt any **one** part of the following :

- (a) What are type I and type II superconductors?
- Explain.
- (b) Describe buckyballs and their properties and uses.

Physical constants :

Planck's constants $h = 6.6 \times 10^{-34}$ J-s

Velocity of light in vacuum $c = 3 \times 10^8$ m/s

Rest mass of electron $m = 9.1 \times 10^{-31}$ kg

