

Printed Pages : 8

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.

(Second Semester) Theory Examination, 2010-11

ENGINEERING PHYSICS-II

Time : 2 Hours]

[Total Marks : 50

Note : All questions are compulsory.

Section-A

1. Attempt *all* parts. All parts carry equal marks. $1 \times 10 = 10$
 - (a) If the wavelength associated with a proton and a photon is same, then which of the following quantities will be same for both of them ?
 - (i) Mass
 - (ii) Momentum
 - (iii) Velocity
 - (iv) Kinetic energy.
 - (b) The Compton shift is not observable with :
 - (i) X-rays
 - (ii) γ -rays
 - (iii) Visible rays
 - (iv) None of the above.

(c) If the lowest energy for a certain particle entrapped in a one-dimensional potential box is 40 eV, its next higher energy will be :

(i) 80 eV

(ii) 120 eV

(iii) 160 eV

(iv) 240 eV.

(d) The electronic polarizability α_e of a mono-atomic gas atom is :

(i) $4\pi\epsilon_0 R^3$

(ii) $4\pi\epsilon_0 R$

(iii) $\frac{4}{3}\pi\epsilon_0 R^3$

(iv) $4\pi\epsilon_0$.

(e) In a ferroelectric material, the temperature at which the hysteresis loop merges into a straight line is called :

- (i) Critical temperature
 - (ii) Fermi temperature
 - (iii) Curie temperature
 - (iv) Deby temperature.
- (f) Ultrasonic waves produced in a medium can be detected by :
- (i) Hebbs method
 - (ii) Quincke's tube method
 - (iii) Kundt's tube method
 - (iv) All the above.
- (g) The electric and magnetic field in an electromagnetic wave, going through vacuum, is described by $E = E_0 \sin(kx - \omega t)$ and $B = B_0 \sin(kz - \omega t)$, then :
- (i) $E_0 k = \omega B_0$
 - (ii) $E_0 B_0 = \omega k$
 - (iii) $E_0 \omega = B_0 k$
 - (iv) None of the above.

- (h) The property of the material which does not show an appreciable change in superconducting state as compared to normal state is :
- (i) Entropy
 - (ii) Thermal conductivity
 - (iii) Volume
 - (iv) Specific heat.
- (i) Soft superconductors observe :
- (i) Meissner effect
 - (ii) Silsbee's rule
 - (iii) Both (i) and (ii)
 - (iv) None of the above.
- (j) In nanotechnology, chemical vapour deposition is a technique for the :
- (i) characterization of nanoparticles
 - (ii) synthesis of carbon nanotubes
 - (iii) determination of the size of nanoparticles
 - (iv) identification of nanoparticles.

Section- B

2. Attempt any *three* parts of the following : $5 \times 3 = 15$
- (a) Calculate the kinetic energy of an electron if its de-Broglie wavelength equals the wavelength of sodium light (5893 \AA).
- (b) An electron has a speed of 40 m/s accurate up to 99.99% . What is the uncertainty in locating its position.
- (c) An iron rod 2.0 m long, 10 mm in diameter and of permeability 100 is placed inside a long solenoid wound with 300 turns/meter. If a current of 0.5 ampere is passed through the solenoid, find the magnetic moment of the rod.
- (d) A quartz crystal of thickness 0.005 m is vibrating in resonant condition. Calculate the fundamental frequency. The Young's modulus and the density of quartz are $7.9 \times 10^{10} \text{ Newton/m}^2$ and 2650 kg/m^3 respectively.

- (e) If the upper atmospheric layer of earth receives 1.38 kWm^{-2} energy from the sun, what will be the peak values of electric and magnetic fields at the layer?

Section-C

Attempt *all* questions of this Section. All questions carry equal marks.

3. Attempt any *one* part of the following : $5 \times 1 = 5$
- (a) What do you understand by phase and group velocities? Establish a relation between them
- (b) Explain Heisenberg's uncertainty principle and discuss one application of this principle.
4. Attempt any *one* part of the following : $5 \times 1 = 5$
- (a) Derive time independent Schrödinger wave equation for a particle. What happens if the particle is free?

(b) What do you mean by Compton effect ? Derive an expression for the Compton shift.

5. Attempt any *one* part of the following : $5 \times 1 = 5$

(a) Derive Clausius-Mossotti equation for non-polar dielectrics.

(b) What is hysteresis loss ? How this loss is explained by hysteresis curve ?

6. Attempt any *one* part of the following : $5 \times 1 = 5$

(a) What was inconsistency in Amperes law before Maxwell and how Maxwell makes it consistent ? Also explain the role of displacement current.

(b) Write down the Maxwell equations in conducting medium and use these equations to derive differential equations for electric and magnetic fields in this case.

7. Attempt any *one* part of the following: $5 \times 1 = 5$

(a) What are superconductors ? How does superconducting transition temperature vary with magnetic field ?

(b) What are carbon nanotubes ? Give some important properties and uses of carbon nanotubes.

Physical constants :

Speed of light $c = 3.0 \times 10^8 \text{ m/s}$

Planck's constant $h = 6.62 \times 10^{-34} \text{ J-s}$

Mass of electron $m = 9.1 \times 10^{-31} \text{ kg}$

Permeability of free space $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$

Permittivity of free space $\epsilon_0 = 8.854 \times 10^{-12} \text{ F/M.}$