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

PAPER ID : 9611 Roll No. | | | | | | | | | | |

**B.Tech.**

(SEM II) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

## ENGINEERING PHYSICS - II

*Time : 2 Hours* *Total Marks : 50*

Note : *(i) Attempt **all** questions.*

*(ii) Marks of each question are shown against it.*

*(iii) The physical constants are given at the end of the question paper.*

### SECTION – A

**1.** Attempt **all** parts. All parts **carry equal** marks. Pick the correct choice from the following: **(1x10=10)**

(a) The masses of neutron and electron are $m_n$ and $m_e$ respectively. If they have the same de Broglie wavelength, then their velocities should be in the ratio.

(i) 1 : 1 (ii) $\frac{m_e}{m_n}$ (iii) $\frac{m_n}{m_e}$ (iv) $\frac{m_e^2}{m_n^2}$

(b) The characteristics of wavefunction $\psi$ are :

(i) Real function, finite and discontinuous.

(ii) Complex single valued, finite and continuous function.

(iii) Complex infinite and discontinuous function.

(iv) Complex single valued and infinite.

(c) Compton shift is given by :

(i) $\frac{h}{m_{oc}}(1-\sin\phi)$ (ii) $\frac{h}{m_{oc^2}}(1-\cos\phi)$

(iii) $\frac{h}{m_{oc}}(1-\cos\phi)$ (iv) None of these

(d) Which of the following is not equal to the dielectric constant.

(i) $\frac{V_0}{V}$ (ii) $\frac{C_0}{V}$ (iii) $\frac{E_0}{E}$ (iv) $\frac{\epsilon_0}{\epsilon}$

(e) In an isotropic dielectric medium.

(i) D and E are pendicular to each other

(ii) D and E are inclined at 45° to each other

(iii) D and E have the same direction

(iv) D and P are perpendicular to each other

(f) Ferromagnetic substances have.

(i) High permeability and low susceptibility

(ii) Low permeability and high susceptibility

(iii) Both permeability and susceptibility low

(iv) Both permeability and susceptibility high

(g) Which of the following equipments are used for the production of ultrasonic waves ?

(i) piezoelectric generator (ii) magnetostriction oscillator

(iii) both (i) and (ii) (iv) None of the above

(h) The expression for displacement current density is.

(i) $Jd = \epsilon_0 \frac{\partial E}{\partial t}$ (ii) $Jd = \frac{1}{\epsilon_0} \frac{\partial E}{\partial t}$

(iii) $Jd = \frac{\partial E}{\partial t}$ (iv) $Jd = \frac{1}{4\pi\epsilon_0} \frac{\partial E}{\partial t}$

(i) A super conducting material exhibits.

(i) Zero resistivity and complete diamagnetism

(ii) Zero conductivity and complete diamagnetism

(iii) Zero resistivity and complete paramagnetism

(iv) Infinite conductivity and complete peramagnetism

(j) At nanoscale the surface to volume ratio is :

(i) very low (ii) very high

(iii) equal to one (iv) equal to five

## SECTION – B

2. Attempt *any three* parts. All parts carry equal marks. **(3x5=15)**

(a) Calculate the deBroglie wavelength of neutron of energy 12.8 MeV.

(b) A nucleon is confined to a nucleus of diameter $5x10^{-14}$ m. Calculate minimum uncertainty in the momentum of the nucleon. Also calculate the minimum kinetic energy of the nucleon.

(c) A particle is in motion along a line between $x=0$ and $x=a$ with zero potential energy. At points for which $x < 0$ and $x > a$, the potential energy is infinite. The wavefunction for the particle in $n$th state is given by :

$$\psi_n = A \sin \frac{n\pi x}{a}$$

Find the expression for the normalised wavefunction.

(d) A quartz crystal of thickness 0.001 m is vibrating at resonance. Calculate the fundamental frequency

Given : young modulus for quartz is $7.9\times10^{10}Nm^{-2}$ and density of quartz is $2.65\times10^{3}$ kg/m$^3$.

(e) Assuming that all the energy from a 1000 watt lamp is radiated uniformly. Calculate the average values of the intensities of electric and magnetic fields of radiation at a distance of 2 m from the lamp.

## SECTION – C

**Note :** Attempt **all** questions. All questions carry **equal** marks. **(5x5=25)**

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

(a) What is uncertainty principle ? Apply this to calculate the radius of the Bohr's first orbit.

(b) What is physical significance of wavefunction ? Derive time independent schrodinger wave equation.

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

(a) What is compton effect ? Derive an expression for the compton shift.

(b) Derive claussius - Mossotti Equation in terms of relative permittivity.

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

(a) What is hysteresis curve ? Explain residual magnetism, coercive force and hysteresis.

(b) What are ultrasonics ? Discuss applications of ultrasonics.

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

(a) Derive Maxwell's equations. Explain the physical significance of each equation.

(b) Prove that the velocity of plane electromagnetic wave in the vacuum is given by

$$C = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

Where various terms have their usual meaning.

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

(a) Discuss characteristic properties and uses of superconductors.

(b) How the carbon nanotubes are produced ? Discuss properties and uses of carbon nanotubes.

Physical constants :

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

mass of neutron $m_n = 1.67 \times 10^{-27}$ kg

Permeability of free space $(\mu_0) = 4\pi \times 10^{-7}$ T.m/A

Permittivity of free space $\epsilon_0 = 8.85 \times 10^{-12}$ $c^2/N.m^2$

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