B. Tech.

(SEM. II) THEORY EXAMINATION 2010-11

ENGG. PHYSICS–II

Time : 2 Hours   *Total Marks : 50*

Note : Attempt all questions.

SECTION—A

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

    (a) If the momentum of a particle is increased to four times, then the de-Broglie wavelength will become :

        (i)   Twice   (ii) Four Times

        (iii) Half   (iv) One-fourth.

    (b) The Compton shift depends on :

        (i)   Energy of incident radiation

        (ii) Frequency of incident radiation

        (iii) Angle of scattering

        (iv) Material of target.

    (c) According to uncertainty principle which of the following particle can not exist in the nucleus :

        (i)   Electron   (ii) Proton

        (iii) Neutron   (iv) Alpha-particle.

(d) For a given dielectric, as the temperature increases, the ionic polarizability :

    (i)   Increases

    (ii)   Decreases

    (iii) First increases then decreases

    (iv) Remain unchanged.

(e) Above curie temperature, the hysteresis loop of a ferroelectric material merges into :

    (i)   Parabola   (ii)   Straight line

    (iii) Ellipse   (iv)   Point.

(f) Magnetic field can be produced due to :

    (i)   Moving charge

    (ii)   Time varying of electric field

    (iii) Current

    (iv) All the above

(g) The energy per unit time, per unit area transported by the electromagnetic fields is expressed as :

    (i) $\vec{S} = \dfrac{1}{\mu_0}(\vec{E} \times \vec{B})$ (ii) $\vec{S} = \mu_0(\vec{E} \times \vec{B})$

    (iii) $\vec{S} = (\vec{E} \times \vec{B})$ (iv) $\vec{S} = \varepsilon_0(\vec{E} \times \vec{B})$

(h) The property of the material which dose 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) The energy band gap of a superconductor is highest at :

    (i)   0 K   (ii)   Transition temperature

    (iii) Room temperature   (iv)   None of the above

(j) Armchair, zig-zag and chiral are the classifications of :

    (i)   Buckyballs

    (ii) Multiwalled nanotubes

    (iii) Doublewalled nanotubes

    (iv) Singlewalled nanotubes

SECTION—B

2. Attempt any **three** parts of the following :   **(3×5=15)**

  (a) Calculate the wavelength of an electron that has been accelerated in a particle accelerator through a potential difference of 100 volt.

  (b) A beam of gamma radiation having photon energy 510 keV is incident on an aluminium foil. Calculate the wavelength of scattered radiation at 90°.

  (c) If a *NaCl* crystal is subjected to an electric field of 1500 V/m and the resulting polarization is 4.3×10^{-8} C/m^2, calculate the relative permittivity of *NaCl*.

  (d) If the upper atmospheric layer of earth receives 1360 W m^{-2} energy from the sun, what will be the peak values of electric and magnetic fields at the layer ?

  (e) A superconducting Lead has a critical temperature of 6.2 K at zero magnetic fields and a critical field of 0.0306 Tesla at 0 K. Determine the critical field at 3.1 K.

SECTION—C

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

3. Attempt any **one** part of the following :   **(1×5=5)**

  (a) Derive the de-Broglie wavelength of a particle as function of temperature.

(b) What is Heisenberg's uncertainty principle ? Give its physical significance.

4. Attempt any **one** part of the following : (1×5=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 shift ? Explain that shift is not observable with visible light.

5. Attempt any **one** part of the following : (1×5=5)

(a) Explain briefly the different types of polarization in dielectrics.

(b) What is hysteresis curve ? Show that the area of this curve is equal to the hysteresis loss in each cycle.

6. Attempt any **one** part of the following : (1×5=5)

(a) Explain the concept of displacement current. How it makes the Ampere's law to valid for non steady state ?

(b) Write down the Maxwell equations in conducting medium and use these equations to derive wave equations.

7. Attempt any **one** part of the following : (1×5=5)

(a) What are superconductors ? Explain their classification as type I and type II superconductors.

(b) What are carbon nanotubes ? Explain the CVD technique for its synthesization.

Physical constants :

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

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

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

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

Permittivity $\varepsilon_0 = 8.854 \times 10^{-12}$ F/M