B.E. INSTRUMENTATION AND ELECTRONICS ENGINEERING EXAM. - 2018

First year Second Semester

Subject: Physics-IIA   Time: 3 hours   Full Marks: 100

Answer any five questions.

$$20 \times 5 = 100$$

1. i) Write down the Gauss's law in electrostatics in integral form.

   ii) Find the field due to a uniformly charged sphere of radius a at the point outside and inside of the sphere. Draw the the variation of the field with distance from the centre of the sphere.

   iii) An infinite plane carries a uniform surface charge σ. Find its electric field.

   iv) Find the capacitance of a parallel plate capacitor consisting of two metal surface of area A held a distance d apart.

   $$3+(4+3)+5+5 = 20$$

2. i) Write down the general expression for magnetic field due to a steady volume current.

   ii) Then, find out the divergence and curl of magnetic field.

   iii) From the curl of magnetic field find the Ampere's law in integral form.

   iv) Find out the magnetic field at points inside and outside of a very long solenoid consisting of N closely wound turns per unit length on a cylinder of radius R and carrying a steady current I.

   $$2+(4+4)+4+6 = 20$$

3. i) Write down the Faraday's law in integral form, and then find out its differential law.

   ii) An infinitely long straight wire carries a slowly varying current $I(t)$. Determine the induced electric field.

   iii) Find the general expression for the electric field and potential due to an electric dipole at point far away from the dipole.

   $$(3+4)+6+7 = 20$$

4. i) Find the energy levels of hydrogen atom from Bohr's postulates.

   ii) Write down the energy and momentum conservation relations for Compton scattering.

   iii) Then, calculate the wavelength shift of scattered light.

   iv) Find the mathematical expression for Bragg's law of X-ray diffraction with proper diagram.

   $$6+5+5+4 = 20$$

5. i) The ground state energy of H-atom is 13.6 eV. Using the uncertainty principle estimate the size of the atom.

   ii) What do you mean by de Broglie wave?

iii) Calculate the de Broglie wavelength of the electron in the H-atom.

iv) Then, calculate the de Brogle wavelength of a metal ball of mass 10 gm moving with speed 100 cm/s. Will it execute wave nature? Explain.

$$5+3+6+(4+2) = 20$$

6. i) What do you mean by temporal coherence? ii) Show that dark and bright fringes produced in Young's double slit experiment are equally spaced.

iii) Find the condition for constructive interference due to a thin film.

iv) Then, find the expression of the radius of n-th ring of in Newton's ring experiment.

v) Is the central spot dark or bright when viewed from top? Explain.

$$2+3+5+8+2 = 20$$

7. i) Distinguish Fraunhoffer and Fresnel diffractions.

ii) Find out the expression for intensity due to a single slit diffraction.

iii) What do you mean by polarized light? Write Brewster's law of polarization.

iv) How ordinary light is produced? Is ordinary light polarized? Explain.

$$4+6+(3+4)+3 = 20$$