B.E. INSTRUMENTATION AND ELECTRONICS ENGINEERING EXAM. (OLD) - 2019

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 Bohr's postulates and then derive the expression for energy levels of Bohr atom.
   ii) Write down the energy and momentum conservation relations for Compton scattering.
   iii) Then, calculate the wavelength shift of scattered light.
   iv) The ground state energy of H-atom is 13.6 eV. Using the uncertainty principle estimate the size of the atom.

2. i) Find the mathematical expression for Bragg's law of X-ray diffraction with proper diagram.
   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 ball of mass 0.5kg moving with speed 100 m/s. Will it execute wave nature? Explain.

3. i) Write down the Coulomb'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.

4. i) Write down the general expression for magnetic field due to a steady volume current.
   ii) Show that divergence of magnetic field is zero. What are the consequences when divergence of a vector is zero?
   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.

5. i) Show that dark and bright fringes produced in Young's double slit experiment are equally spaced.
   ii) What do you mean by polarized light? Write Brewster's law of polarization.
   iii) How ordinary light is produced? Is ordinary light polarized? Explain.

6. i) What do you mean by spatial coherence?

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

   iii) Find the expression of the radius of n-th ring of in Newton's ring experiment.

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

7. i) Write down the Maxwell's equations in electrodynamics.

   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.