BACHELOR OF CIVIL ENGINEERING SUPPLEMENTARY EXAMINATION 2018
1st YEAR, 1st SEMESTER

Subject: PHYSICS 1C   **Time: Three Hours**   **Full Marks: 100**

Answer any *five* questions.

1. (a) What is the molecular theory of surface tension? Derive an expression for the excess pressure inside a spherical air bubble in water.
   (b) Write down Bernoulli's theorem for incompressible fluid flow and explain each term.
   (c) Water is flowing through a horizontal pipe line. At two points A and B, the diameters are 0.6 m and 0.2 m. The pressure difference between the points A and B is 1 meter column of water. Calculate the volume of water flowing per second.
   (d) Define surface energy. Show that the surface energy per unit area is numerically equal to the surface tension per unit length.

   $[(3+4)+3+4+(2+4)]$

2. (a) What do you mean by coherence of light? What are the different methods of obtaining two coherent sources? Discuss clearly the necessary conditions for the sustained interference of light.
   (b) Explain the formation of Newton's ring. Obtain the expressions for the diameter of the bright and dark rings of Newton's ring due to reflected light.

   $[(2+4+4)+10]$

3. (a) Explain the theory of plane transmission grating and hence obtain the expression for primary and secondary maxima and minima. Plot the grating intensity profile.
   (b) A 10 μm transparent plate when placed in the path of one of the interfering beams of a double slit experiment [λ= 5800 Å], the central fringe shifts by a distance equal to ten fringes. Calculate refractive index, μ of the plate.
   (c) Find the half angular width of the central bright maximum in the Fraunhoffer diffraction when a slit of width 120 μm is illuminated by a light of wavelength 6000 Å.

   $[(8+2)+5+5]$

4. (a) What are X-rays and what is its wavelength range? Discuss the properties of X-rays.
   (b) What are the origins of continuous and sharp peaks in an X-ray spectrum? Find the shortest wavelength present in the radiation from an X-ray machine whose accelerating potential is 20,000 V?
   (c) The K_α line from molybdenum has a wavelength of 0.7078 Å. Calculate the wavelength of K_α line of copper. Atomic number of molybdenum = 42 and Atomic number of copper = 29.

   $[(4+4)+(4+4)+4]$

5. (a) What is Gauss' law? Derive Coulomb's law from Gauss law in case of a single point charge. How is Gauss' law modified in presence of a dielectric?

    (b) Find the expression for the electric field due to an infinite plane sheet of charge (of uniform surface charge density, σ) and show that it is independent of the distance fromthe sheet.

    (c) Using Gauss's law find the electric field inside a parallelplate capacitorkept in vacuum, whereA is the plate area and d is theseparation between the plates.

    [(3+3+4)+5+5]

6. (a) State Zeroth, First and Second laws of thermodynamics. What are their significance?

    (b) Deduce the expression for work done by an ideal gas in adiabatic, isobaric and isochoric process.

    (c) A Carnot engine has the same efficiency between 1000° K and 500° K and between X° K and 1000° K. Calculate X.

    [10+5+5]

7. (a) Deduce and expression for the magnetic field at a pointdistant 'r' from a long straight conductor carrying a current'i', using Biot Savart's law.

    (b) State Ampere's circuital law and show how it leads to thesame result as obtained above case.

    (c) What are the laws of electromagnetic induction ? Define co-efficient of self-inductance? Deduce an expression for the self-inductance of a circular coil ofradius 'a' with 'n' number of turns.

    [5+(2+3)+(3+2+5)]

8. Write short notes (any two) :

    (a) Fresnel Biprism experiment.
    (b) Matter waves and de- Broglie hypothesis.
    (c) Hydrogen spectra
    (d) Carnot reversible engine

    [10 x2]