Ref. No.: Ex/CE/Ph/T/1C/114/2019(Old)

BACHELOR OF CIVIL ENGINEERING OLD EXAMINATION 2019
1st YEAR, 1st SEMESTER

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

Answer any **five** questions.

1. (a) Derive an expression for the excess pressure inside a spherical air bubble in water.
   (b) If a liquid drop of radius R breaks into n number of small similar drops. Find the loss of energy. Surface tension of liquid = T.
   (c) Write down Bernoulli's theorem for incompressible fluid flow and explain each term.
   (d) What do you understand by angle of contact? What are the factors on which the angle of contact of a liquid depends?
   (e)What do you mean by capillary action? What is its physical significance?

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

2. (a) What do you mean by wavefront and hence state and explain Huygen's principle. 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.
   (c) In a Newton's ring experiment, the diameter of the 10^{th}dark ring changes from 1.40 cm to 1.27 cm when a liquid is introduced between the lens and the plate. Calculate the refractive index of the liquid.

   [(2+2+4)+8+4]

3. (a) Explain polarization by reflection and hence explain Brewster's law. At what angle will the light traveling in air will be completely polarized horizontally when reflected from i) water and from (ii) glass?[Given:μ_{water}=1.33, and μ_{glass}=1.52]
   (b) A 10 μm transparent plate when placed in the path of one of the interfering beams of a double slit experiment [λ = 6000 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.

   [(5+5)+5+5]

4. (a) What are X-rays and what is its wavelength range? What is Compton Effect and hence discuss it significance.
   (b) What are the origins of continuous and characteristics X-ray? Find the shortest wavelength present in the radiation from an X-ray machine whose accelerating potential is 50 kV? Calculate the corresponding frequency.
   (c) Which element has a K_αx-ray line whose wavelength is 0.180 nm?

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

5. (a) What is Gauss' law? Derive Coulomb's law from Gauss law in case of a single point charge. How Gauss' lawis 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 from the sheet.
(c) Using Gauss's law find the electric field inside a parallel plate capacitor kept in vacuum, where A is the plate area and d is the separation between the plates.

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

6. (a) What is Entropy? Discuss it's physical significance.
(b) Deduce the expression for work done by an ideal gas in adiabatic, isobaric and isochoric process.
(c) Using first law of thermodynamics, prove the relation $C_p - C_v = R$, where the symbolshave their usual meaning.
(c) A Carnot engine has the same efficiency between 1000° K and 500° K and between X° K and 1000° K. Calculate X.

[5+5+5+5]

7.(a) Deduce an expression for the magnetic field at a point distant '*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 the same 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 of radius 'a' with 'n' number of turns.

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

8. (a) The wavelength of the first member of the Balmer series in hydrogen spectrum is 6563 Å. Find the wavelength of the second member of the Lyman series in the same spectrum.
(b)What do you mean by soft and hard X-rays? What are their uses?
(c) State and explain Heisenberg uncertainty principle?
(d) What do you understand by matter-waves? What was de-Broglie's hypothesis regarding matter waves?
(e) A typical atomic nucleus is about 5.0×10^{-15} m in radius. Use the uncertainty principle to place a lower limit on the energy an electron must have if it is to be a part of a nucleus.

[4+4+3+4+5]