Ref. No.: EX/CE/Ph/T/1C/114/2018

BACHELOR OF CIVIL ENGINEERING EXAMINATION 2018

1st YEAR, 1st SEMESTER

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

Answer any **five** questions.

1. (a) What is surface energy of a liquid? What is its relation with surface tension of the liquid?
   (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) Find out an expression for the excess pressure inside a spherical soap bubble.
   (d) Write down Bernoulli's theorem for incompressible fluid flow and explain each term. Discuss the application of Bernoulli's theorem in Airflight.

   [(2+2)+4+6+6)]

2. (a) What is the superposition principle in electrostatics?
   (b) Find the electric field inside and outside of a uniformly charged solid sphere of radius R and total charge q. Show the variation of electric field with radius of the sphere graphically.
   (c) Consider a uniformly charged disk of radius $R$ and charge density $\sigma$ lying in the $xy$-plane. What is the electric potential at distance $z$ from the central axis? Show the variation of potential with distance $z$.

   [3+(7+2)+(6+2)]

3. (a) Describe Biot-Savart's law in magnetostatics. Find the magnetic field at a distance '$s$' from a long straight wire carrying a steady current '$I$' using Biot- Savart law. In case of infinite wire what should be the value of magnetic field?
   (b) State and explain Ampere's circuital law in magnetostatics. Determine the magnetic field of a long co-axial cable in the two regions: (i) in between two cables and (ii) outside both using Ampere's circuital law.

   [(3+6+2)+(4+5)]

4. (a) State and deduce Zeroth law of thermodynamics. Hence interpret the concept of temperature from this law.
   (b) What do you understand by quasi-static process? Give examples.
   (c) Using first law of thermodynamics, prove the relation $C_p$-$C_v$=R, where the symbols have their usual meaning.
   (d) A motor tyre has a pressure of 2 atm at room temperature of 27 °C. If the tyre suddenly bursts, find the final temperature.

   [(2+5+2)+2+5+4]

5. (a) Explain the operation of a Carnot engine and deduce its expression for the thermal efficiency.

(b) A reversible engine converts 1/6 th of heat input into work. If the temperature of the sink is reduced by 65 °C, its efficiency is doubled. Find the temperature of the source and the sink.

[14+6]

6. (a) What are the necessary conditions for sustained interference of light.
(b) Show that the dark and bright fringes produced in Young's double slit experiment are equally spaced.
(c) Deduce an expression for the displacement of the fringes after introducing a thin transparent sheet in one of the interfering beam's path.
(d) A thin glass sheet of refractive index 1.5 and thickness 6 μm is introduced in one of the paths of the interfering beams. If Central fringe shifts by 5 bands, find the wavelength of light.

[5+6+6+3]

7. (a) Explain the formation of Newton's ring. Obtain an expression for the diameter of dark rings in reflected system in Newton's ring.
(b) In a Newton's ring experiment, the diameter of $10^{th}$ ring changes from 1.40 cm to 1.27 cm by introduction of a liquid drop between the lens and the glass plate. Calculate the refractive index of the liquid.
(c) Show that in a diffraction grating with grating element $1.5 \times 10^{-6}$ m and light of wavelength 500 nm, the third and higher order principal maxima are not visible.

[(6+6)+4+4]

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 are soft and hard X rays?
(c) What are characteristic X-rays? How do they originate?
(d) What is Heisenberg uncertainty principle?
(e) What do you understand by matter-waves? What was de-Broglie's hypothesis regarding matter waves?
(f) An electron and a proton have the same amount of kinetic energy. Which of the two possesses greater wavelength and why?

[3+3+4+3+4+3]

9. Write Short notes (**Any Two**)

(a) Potential, intensity and their relation
(b) Time-varying fields and Faraday's law of electromagnetic induction
(c) Polarisation by reflection and Brewster's law.
(d) Entropy and its importance

[10+10]