BACHELOR OF COMPUTER SC. ENGINEERING EXAMINATION, 2018

(1st Year, 1st Semester)

PHYSICS - I

Time : Three hours | Full Marks : 100

Answer *any five* questions.

1. (a) Convert a vector from Cartesian co-ordinate system to Cylindrical Polar co-ordinate system.

(b) Find $\nabla\varphi$ if (a) $\varphi = \ln\left|\frac{\rightarrow}{r}\right|$, (b) $\varphi = \frac{1}{\vec{r}}$

(c) Find the constants a, b, c so that the vector $\mathbf{V} = (x+2y+az)\mathbf{i} + (bx-3y-z)\mathbf{j} + (4x+cy+2z)\mathbf{k}$ is irrotational. Where **i**, **j**, **k** are unit vectors along x, y and z direction. [10+6+4]

2. (a) Write down and solve the differential equation for damped vibration explaining how it is obtained. Discuss over damped, critically damped and under-damped motions.

(b) An underdamped oscillator has its amplitude reduced to (1/10)th of its initial value after 100 oscillations. If time period is 2 seconds. calculate damping constant. [15+5]

3. (a) Show that, in rotatory motion, moment of inertia plays the same role as mass does in linear motion.

(b) What is radius of gyration? What is its physical significance?

(c) Obtain an expression for the moment of inertia of a solid sphere about (i) a diameter (ii) a tangent. [6+4+10]

4. (a) Distinguish the streamline flow and turbulent flow of a liquid.

(b) From Bernoulli's principle obtain the equation of pressure in hydrostatics.

(c) Derive the Poiseulli's equation for the flow of incompressible fluid. What are the assumptions made? [4+6+10]

5. (a) State the basic assumptions for kinetictheory of gases.

(b) Show that the kinetic pressure of an ideal gas is $\frac{2}{3}$ of its kinetic energy per unit volume.

(c) Calculate root mean square velocity of H_2 gas (Molecular weight 2) at NTP.

[8+10+2]

6. (a) Deduce Vander Walls' equation of state for real gases, explaining the proper corrections.

(b) Define critical constants and find their values in terms of Vander Walls' constants.

(c) Show, at critical temperature, the departure of Vander Walls' gas law from the perfect gas $p_C V_C/T_C$ measures 62.5%.

[6+10+4]

7. (a) State and explain first law of thermodynamics. Deduce Joule's law from the first law.

(b) For adiabatic process show that $TV^{\gamma-1} =$ constant, where symbols have their usual meanings.

(c) For a diatomic gas show that $\gamma = 1.4$.

(d) One mole of ideal gas expands from volume V_i to volume V_f quasistatically and adiabatically. If the corresponding pressures are P_i and P_f, show that the work done by the gas is $\frac{1}{\gamma-1}[P_iV_i - P_fV_f]$.

[5+5+5+5]

8. (a) Describe Carnot's reversible cycle and its operation with a *p-V* diagram.

Show that the efficiency of the cycle operating between a source (of temperature T_1) and a sink (of temperature T_2) is $1 - T_2/T_1$

(b) State 2nd law of thermodynamics in two different languages.

(c) What is entropy?

10 gms of ice melts at 0°C to water. Find out the change in entropy. [The latent heat for melting of ice is 80 Cal/gm]

[12+4+4]