

B.E. Computer Science and Engineering
1st YEAR 1st SEM EXAMINATION, 2019 (OLD)

PHYSICS I

Time : Three hours

Full Marks : 100

Answer *any five questions*. All questions carry equal marks

1. (a) Show that $\nabla r^n = nr^{n-2} \vec{r}$ where symbols have their usual meaning.

(b) Show that the following vector field is conservative and find its scalar potential

$$\vec{F} = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$$

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

[4+6+10]

2. (a) Explain what do you understand by Simple Harmonic Motion? Distinguish between free and forced vibrations.

(b) Write down and solve the differential equation for damped vibration explaining how it is obtained. Discuss over damped, critically damped and under-damped motions. [5+15]

3. (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 Poiseuille's equation for the flow of incompressible fluid. What are the assumptions made? [4+6+10]

4. (a) Derive the relation between torque and angular momentum.

(b) Explain parallel and perpendicular axis theorem.

(c) Obtain an expression for the moment of inertia of a cylinder about (i) its own axis (ii) an axis passing through its centre and perpendicular to its own axis (iii) diameter of one of its faces.

[4+5+11]

5. (a) Write down the basic assumptions of Kinetic theory of gases. Deduce the kinetic pressure of an ideal gas.

[Turn over

(b) Obtain Avogadro's Hypothesis from the expression of pressure.

(c) What is 'root mean square' (rms) velocity? At NTP, the density of air is 0.00129 gm/cc.

Find its 'rms' velocity?

[12+4+4]

6. (a) What is the degree of freedom?

(b) Explain qualitatively Maxwell's velocity distribution law of gas particles with diagram.

Hence find out the most probable velocity.

(c) Find out the values of critical constants for a real gas in terms of Vander Waals' constants 'a', and 'b'. [2+10+8]

7. (a) State and explain 1st law of thermodynamics.

(b) Define C_p and C_v . Show that for an ideal gas $C_p - C_v = R$ (where the symbols have their usual meanings).

(c) Distinguish between isothermal process and adiabatic process.

(d) One mole of ideal gas expands from volume v_i to volume v_f quasistatically and adiabatically. Find out the work done by the gas. [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]