Time : 1 hr   Max. Marks: 30

*This question paper has **two** printed page and **three** parts.*

PART – A

Answer any **three** of the following: (3X6=18)

1. With a neat diagram prove that for motion of a particle in space
   $\vec{v} = \dot{r}\hat{r} + r\dot{\theta}\hat{\theta} + rSin\theta\dot{\phi}\hat{\phi}$ where the symbols have their usual meanings.

2. Find the expression for acceleration of a particle w.r.t. a reference frame rotating with a uniform angular velocity w.r.t. an inertial frame.

3. Based on kinetic theory of gases deduce an expression for pressure exerted by an ideal gas.

4. Define adiabatic process and obtain the equation $PV^\gamma = Constant$

PART-B

Solve the following: (2X4=8)

5. A moving particle has co-ordinates (6t+3), 8t, 5 m in frame S at any time t. The frame S' is moving relative to S with a velocity $3\hat{\imath} + 4\hat{\jmath}$ m/s. Find the co-ordinates and velocity of particle in frame S'.

OR

The motion of a particle is described by the equation x=4Sin2t, y=4Cos2t, z= 6t. Find the velocity and acceleration of the particle.

6. The R.M.S. velocity of Nitrogen molecules at N.T.P. is 497 m/s. Calculate the R.M.S. velocity of Hydrogen molecules at N.T.P. At what temperature will the R.M.S. velocity of Nitrogen molecules be 994 m/s? Molecular weights of hydrogen and nitrogen are respectively 2 and 28.

OR

A Carnot engine has an efficiency of 50% when the sink is at 7oC. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of source be increased?

PART-C

7. Answer any **two** of the following: (2X2=4)

a. Is it possible that the resultant of two vectors be smaller than the smaller of the two vectors? Explain.

b. The apparent weight of an object increases in an elevator while accelerating upward. A pea-nut seller sells his pea-nut using a beam balance in an elevator. Will he gain more if the elevator is accelerating?

c. The density of a gas is doubled, keeping all other factors unchanged. What will be the effect on the pressure of the gas? Justify your answer.

d. Why does food get cooked faster in a pressure cooker?