F.M:-40

1. Answer any five questions :-   5*1=5
   a. Write down the necessary condition of equilibrium.
   b. What is the relation between volume and temperature in an adiabatic change ?
   c. What is an example of an adiabatic process?
   d. What is the fundamental equation of Hydrostatics ?
   e. Write down the first law of thermodynamics.
   f. Write the dimension of buoyancy.
   g. What is the vector equation of poinsot's central axis?
   h. What is the dimension of pressure?

2. Answer any five questions:-   5*2=10
   a. What is pitch?
   b. Write down Boyle's law and Charles's law.
   c. What is hydrostatics equilibrium?
   d. Define catenary of uniform strength.
   e. What do you mean by virtual work ?
   f. Write down the general Cartesian equation of Equilibrium of a string under coplanar forces.
   g. What is poinsot's central axis?
   h. Is there any difference between tension and thrust ?

3. Answer any three questions:-   3*5=15
   a. For equal heavy rods (uniform) are freely jointed so as to form a rhombus which freely suspended by one angular point and the middle points of the two upper rods are connected by a light rod so that the rhombus can not collapse. Prove that tension on this light rod 4wtanα, where w is the weight of each rod and 2α is the angle of rhombus of the point of suspension.
   b. A square frame work formed at heavy uniform rods of equal weight w jointed together is hung up by one corner. A weight w is suspended from each of the three lower corners and the shape of the square is preserved by a light rod along the horizontal diagonal. Find the thrust of the light rod.
   c. Prove that $C_p - C_v = R$. (usual notations)
   d. Prove that pv^γ= constant. (usual notations)
   e. A rhombus ABCD is formed of four equal uniform rods freely joined together and suspended from the point A; it is kept in position by a light rod joining the mid points of

BA and AD. If T be the thrust in this rod and w the weight of the rhombus , prove that $T = w\tan\frac{A}{2}$.

4. Answer any one question:-   1*10=10

a. (i) Prove that any system of coplanar forces acting on a rigid body can be reduced to a single resultant force acting at any arbitrary point in the plane, together with a single resultant couple of moment which is equal to the algebraic sum of the moment of the given forces about that arbitrary point.

(ii) OA,OB,OC are the edges of a cube and OO^{l},AA^{l},BB^{l},CC^{l} are in diagonal; along BC^{l},CA^{l},AB^{l} and OO^{l} act forces equal to X,Y,Z and R respectively, show that they are equivalent to a single resultant if $\sqrt{3}$ (YZ+ZX+XY)+R(X+Y+Z)=0.

b. (i) A force p acts along the axis of x and another force np acts along a generator of the cylinder $x^2+y^2=a^2$; show that the central axis lies on the cylinder $n^2(nx-z)^2+ (1+n^2)^2y^2=n^4a^2$.

(ii) A telegraph wire stretched between two poles at a distance 'a' feet apart, sags 'n' feet in the middle; prove that the tension at the ends is approximately $w(\frac{a2}{8n} + \frac{7}{6}n)$.