Con. 6746-13. **LJ-11285**

(3 Hours) **[Total Marks : 100**

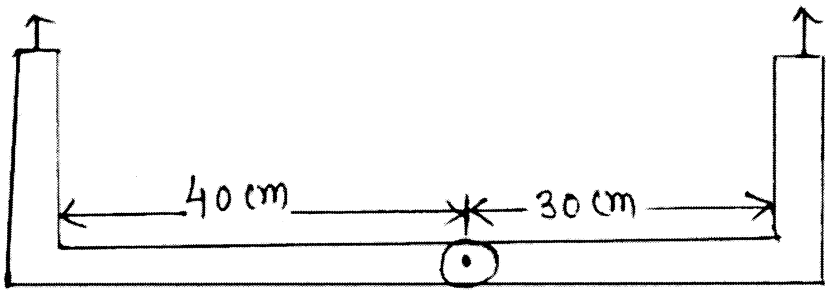
N.B. : (1) Question no. **1** is **compulsory**.
(2) Solve any **four** questions from **remaining** questions.
(3) If **required** assume **suitable** data.

1. Solve any **four** :-
   (a) Write a note on Weber model law. Also write it's applications. **20**
   (b) Compare reaction turbine and impulse turbine.
   (c) Explain impulse momentum equation.
   (d) Write a note on specific speed of turbine.
   (e) Write a note on distorted and undistorted models.

2. (a) A 1:50 spillway model has a discharge of 1.25 m^3/s. What is the corresponding prototype discharge? If flood phenomenon takes 12 hr to occur in prototype how long should it take in model? **10**
   (b) The drag force F_D on sphere in laminar flow is known to depend on it's diameter D, velocity of flow V, density of fluid ϱ and coefficient of viscosity μ. Obtain an expression for F_D. **10**

3. (a) Bend in pipeline conveying water gradually reduces from 0.6 m to 0.3 m diameter and deflects flow through angle of 60°. At larger end the gauge pressure is 171.675 kN/m^2. Determine magnitude and direction of force exerted on bend. **10**
      (i) When no flow.
      (ii) When flow is 876 l/s.

   (b) A sprinkler with unequal arms and jets of area 0.8 cm^2 facing in the same direction is shown in **figure**. A flow of 1.5 μs enters the assemly normal to the rotating arm. **10**
      (i) Assuming frictional resistance to be zero calculate it's speed of rotation.
      (ii) What torque is required to hold it from rotating.



4. (a) A water available for a Pelton Wheel is 4 m^3/s and the total head from reservior to nozzle is 250 m. The turbine has 2 runners with 2 jets per runner. All four jets have the same diameter. The pipeline is 3000 m long. The power of transmission through pipeline and nozzle is 91%. The velocity coefficient of each nozzle is 0.975 and coefficient of friction 4f for pipe is 0.0045, determine :- **14**
   (i) Power delivered by turbine.
   (ii) The diameter of jet.
   (iii) Diameter of pipeline.

   (b) Write a note on Layout of Hydroelectric plant. **6**

5. (a) A hub diameter of Kaplan turbine working under head of 12 m is 0.35 times diameter of runner. The turbine is running at 100 rpm. If Vane angle of the extreme edge of runner at outlet is 15° and flow ratio 0.6, find :- **10**
   (i) Diameter of runner
   (ii) Diameter of boss.
   (iii) Discharge through runner.

   (b) A turbine is to operate under a head of 20 m at 200 rpm. The discharge is 9 cumec. If the efficiency is 90%, determine the performance of the turbine under a head of 20 m. **10**

6. (a) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The Vane angles of impeller at inlet and outlet are 20° and 30° respectively. The water enters impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. **10**

   (b) A jet of water of 30 mm diameter moving with velocity of 15 m/s, strikes a hinged square plate of weight 245.25 N at centre of plate. The plate is uniform thickness. Find the angle through which plate will swing. **10**

7. Write a shorte notes on :- **20**
   (a) Hydraulic Ram.
   (b) Hydraulic Crane.
   (c) Buckingham's π theorem.
   (d) Jet propulsion of ship.
