

**Solve any three**

Q.1 a. Define following dimensionless numbers and state their significance

i) Reynolds number and ii) Mach numbers

b. An oil of specific gravity 0.92 and viscosity 0.03 poise is to be transported at the rate of 2500 liters/sec through a 1.2 m diameter pipe. Tests were conducted on a 12 cm diameter pipe using water at 20 °C. If the viscosity of water at 20 °C is 0.01 poise. Find: i) Velocity of flow in the model; ii) Rate of flow in the model (3)

Q.2 a. Explain briefly the different type of similarities that must exist between a prototype and model. (2)

b. The characteristics of the spillway are to be studied by means of a geometrically similar model constructed to the scale ratio of 1: 10. i) If the maximum rate of flow in the prototype is 28.3 cumecs, what will be the corresponding flow in the model? ii) If the measured velocity in the model at a point on the spillway is 2.4 m/s, what will be the corresponding velocity in prototype? iii) If the hydraulic jump at the foot of the model is 50mm high, what will be the height of jump in prototype? iv) If the energy dissipated per second in the model is 3.5 Nm, what energy is dissipated per second in the prototype? (3)

Q.3 a. Find the expression for the force exerted by a jet of water on moving curved plate in the direction of jet when jet is striking a moving curved plate tangentially at one tip and leaving at the other. (2)

b. A jet of water of 60 mm diameter strikes a curved vane at center with a velocity of 18 m/s. The curved vane is moving with a velocity of 6 m/s in the direction of jet. The jet is deflected through an angle of 165°. Assuming the plate to be smooth find:

i) Force on the plate in the direction of jet, ii) Power of the jet, and iii) Efficiency of jet. (3)

Q.4 a. Derive an expressions for force and workdone per second by the jet when it strikes inclined flat plate moving in the direction of the jet and away from the jet. (2)

b. A jet of water 75 mm diameter having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 45° to the axis of the jet. Find the normal pressure on the plate,

i) when the plate is stationary; ii) when the plate is moving with a velocity of 15 m/s in the direction of jet, away from the jet. (3)

**Solve any three questions**

Q.1a Explain the terms: Distorted model & Undistorted model (2) ①

b. A 7.2 m height and 15 m long spillway discharges  $94 \text{ m}^3/\text{s}$  discharges under a head of 2 m. If a 1: 9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and model discharge. If model experiences a force of 7500 N, determine the force on prototype (3) ②

Q.2 a Discuss the classification of turbines based on various criteria (2)

b. A jet of water moving at 12 m/s impinges on vane shaped to deflect the jet through  $120^\circ$  when stationary. If the vane is moving at 5 m/s, find the angle of jet so that there is no shock at inlet. What is absolute velocity of the jet at exit in magnitude and direction and the work done per second per unit weight of water striking per sec?. Assume that the vane is smooth (3)

Q.3a Derive the expression for the force exerted by jet of water on inclined fixed plate in the direction of jet (2)

b. Explain with sketch the components and working of Pelton wheel turbine (3) ②

Q.4 a Define and explain Reynolds number and Mach number (2) ①

b. A jet of water of diameter 50 mm having velocity 20 m/s strikes a curved vane which is moving with a velocity of 10 m/s in the direction of jet. The jet leaves the vane at an angle of  $60^\circ$  to the direction of motion of vane at outlet. Determine:

(i) The force exerted by the jet on the vane in the direction of motion

(ii) Work done per second by the jet (3)