

AH - I

(OLD COURSE)

QP Code : 3699

(Three Hours)

100 Marks

N.B. (i) Question No. 1 is compulsory

(ii) Attempt any Four Questions out of Six Questions

(iii) Illustrate with figures whenever necessary

(iv) Assume suitable data if necessary and state it clearly

1 Write a short note on

[20]

- Dimensional homogeneity
- Jet propulsion
- General layout of hydroelectric power plant
- Draft tube
- NPSH

2 (a) A pipe 300 mm diameter conveying  $0.30 \text{ m}^3/\text{s}$  of water has a right angled bend in a horizontal plane. Find the resultant force exerted on a bend if the pressure at inlet and outlet of bend are  $24.525 \text{ N/cm}^2$  and  $23.544 \text{ N/cm}^2$  [10]

2 (b) A lawn sprinkler with two nozzles of diameter 4 mm each is connected across a tap of water 20 cm and 30 cm apart from centre of tap. The rate of flow of water through tap is  $120 \text{ cm}^3/\text{s}$ . The nozzle discharge water in the downward direction. Determine the angular speed at which the sprinkler will rotate free. [10]

3(a) A jet of water of 30 mm diameter strikes a hinged square plate at its centre with a velocity of  $20 \text{ m/s}$ . The plate is deflected through an angle of  $200^\circ$ . Find the weight of plate. If the plate is not allowed, to swing, what will be the force required at the lower edge of the plate to keep plate in vertical position. [10]

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

- The force exerted by the jet on the vane in the direction of motion
- Work done per second by jet [10]

4 (a) A pelton wheel is to be designed for the following specifications: [10]

Shaft power =  $11772 \text{ kW}$ ; Head =  $380 \text{ metres}$ ; speed =  $750 \text{ rpm}$ ; Overall efficiency =  $86\%$ ; Jet diameter is not to exceed one-sixth of the wheel diameter. Determine:

- The wheel diameter
  - The number of jets required, and
  - Diameter of jet
- Take  $K_{u1} = 0.985$  and  $K_{u2} = 0.45$

- 4(b) A Kaplan turbine runner is to be designed to develop 9100 kW. The net available head is 5.6m. If the speed ratio = 2.09, flow ratio = 0.68, overall efficiency = 86% and the diameter of boss is  $\frac{1}{3}$  the diameter of the runner. Find the diameter of runner, its speed and the specific speed of turbine. [10]
- 5(a) A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 cumecs. If the efficiency is 90%, determine the performance of the turbine under a head of 20 meters. [10]
- 5(b) Differentiate between Impulse turbine and reaction turbine [10]
- 6(a) Centrifugal pump delivers water against a net head of 14.5 m and a design speed of 1000 rpm. The vanes are curved back to an angle of  $30^\circ$  with the periphery. The impeller diameter is 300 mm and outlet width is 50mm. Determine the discharge of the pump if manometric efficiency is 95% [10]
- 6(b) Define specific speed of a centrifugal pump. Derive an expression for the same. [10]
- 7 Explain with the help of neat sketch the principle and working of the following hydraulic devices [20]
- Hydraulic lift
  - Hydraulic Crane
  - Hydraulic Ram
  - Hydraulic Accumulator