46 + 26 + 10

24-11-14

TE Civil CBGS.-V
A-H-I

QP Code :14843

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question no. **1** is **compulsory**.
(2) Attempt any **three** questions from remaining **five** questions.
(3) Assume any **suitable** data if **necessary** and state it very **clearly**.

1. Solve any **four** :— **20**
   (a) Explain Unit Quantities of turbine.
   (b) Explain Jet Propulsion of Ships.
   (c) State Buckingham's Pi theorem and list the rules for repeating variables.
   (d) Define Moment of Momentum Equation.
   (e) Write a short note on Hydraulic crane.
   (f) Write a short note on Multistaging of Pumps.

2. (a) A twin jet unequal arm lawn sprinkler delivers a total discharge of 1.5 lps. Taking jet diameter as 0.9 cm and the distance from the axis of rotation to jets 15 cm and 30 cm and neglecting friction, find the speed of sprinkler and torque to keep the sprinkler stationary if both jets are in the same direction **10**
   (b) A 360 lit/s of water is flowing in a pipe. The pipe is bent by 120°. The pipe bend measures 360 mm x 240 mm and volume of bend is 0.14 m^3. The pressure at the entrance is 73 KN/m^3 and the exit is 2.4 m above the entrance section. Find the force exerted on the bend. **10**

3. (a) Discharge Q over rectangular weir depend on head over weir H, acceleration due to gravity g, length of weir L, height of weir crest above channel bottom Z, mass density p, and dynamic viscosity μ of liquid. By dimensional analysis, find Q in terms of dimensionless parameters, making the use of Buckingham's Pi theorem **10**
   (b) Calculate for a model of 1/20 of a spillway. **10**
      (i) Prototype velocity corresponding to model velocity of 2 m/s.
      (ii) Prototype discharge per m width corresponding to Qm of 0.25 $m^3/s/m$.
      (iii) Pressure head in prototype corresponding to Pm of 6 cm of mercury.
      (iv) Power dissipated in prototype corresponding to Pm = 0.028 watts.

4. (a) A Jet water having a velocity of 40 m/s. Impinges on a series of vanes moving with a velocity of 20 m/s. The jet makes an angle of 30° to the direction of motion of vanes, when entering and leaves at an angle of 120°. Draw the velocity triangles at inlet and outlet and Determine : **10**
      (i) The inlet and outlet vane angles, so that water enters and leaves without shocks.
      (ii) The work done per N of water entering the vanes.
      (iii) The efficiency of the system.

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(b) A pelton wheel is to be designed for the following specifications : 10
Shaft power = 12000 kW, head = 350 m, speed = 750 rpm; overall efficiency = 86%; jet diameter is not to exceed one-sixth of the wheel diameter. Determine
(i) Wheel diameter.
(ii) Number of jets required.
(iii) Diameter of jet.
Take coefficient of velocity is 0.985 and speed ratio 0.45

5. (a) An inward flow reaction turbine has internal and external diameters as 0.45 m and 0.9 m respectively. The turbine is running at 200 rpm and width of turbine at inlet is 200 mm. The velocity of flow through the runner is constant and is equal to 1.8 m/s. The guide blades make an angle of 10° to the tangent of the wheel and the discharge at the outlet of the turbine is radial. Draw the inlet and outlet velocity triangles and determine : 10
(i) The absolute velocity of water at inlet of runner,
(ii) The velocity of whirl at inlet,
(iii) The relative velocity at inlet,
(iv) The runner blade angles,
(v) Width of the runner at outlet,
(vi) Mass- of water flowing through the runner per second,

(b) A Kaplan turbine runner is to be designed to develop7357.5 kW shaft power. The net available head is 5.5 m. Assume that the speed ratio is 2.09 and flow ratio is 0.68 and the overall efficiency is 60 %. The diameter of the Boss is 1/3 of the diameter of the runner. Find the diameter of the runner, its speed and its specific speed. 10

6. (a) Find the power required to drive a centrifugal pump which delivers 0·05 m^3/s of water to a height of 20 m through a 15 cm pipe and 100 m long. The overall efficiency of the pump is 70 % and coefficient of friction = 0.15 in the formula $4\ fL\ V^2/2gD$. 10

(b) Write a short note on :— 10
(i) Hydraulic Ram.
(ii) Hydraulic crane.
