B.Tech II Year II Semester (R15) Regular Examinations May/June 2017

HYDRAULICS & HYDRAULIC MACHINERY

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What are prismatic and non-prismatic channels?
(b) In a sub-critical flow how does the depth and velocity of flow will be related to critical depth and critical velocity?
(c) Mention any four channel bottom slopes.
(d) Define hydraulic jump.
(e) A jet of water 60 mm diameter having a velocity of 18 m/s strikes normally a flat smooth plates which is moving in the same direction as the jet with a velocity of 5 m/s. Find the work done and the efficiency of the jet.
(f) Name any four efficiencies of a hydraulic turbine.
(g) Give the definition for specific speed of a turbine.
(h) State the difference between a closed, semi-closed and open impeller.
(i) Give any two limitations of distorted models.
(j) What are streamlined and bluff bodies?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Explain the variation of velocity in an open channel.
(b) Find the value of hydraulic mean depth interms of depth of flow for a trapezoidal section to be hydraulically efficient.

OR

3 Explain the terms specific energy of a flowing liquid, minimum specific energy, critical depth, critical velocity and alternate depths as applied to non-uniform flow.

UNIT – II

4 Find the slope of the free water surface in a rectangular channel of width 20 m having depth of flow 5 m. The discharge through the channel is 50 m^3/s. The bed of the channel is having a slope of 1 in 4000. Take the value of Chezy's constant as 60.

OR

5 A sluice gate discharges water into a rectangular channel with a velocity of 10 m/s with 1 m depth of flow. Find the depth of water after the hydraulic jump and the loss of total head of water.

UNIT – III

6 A 50 mm diameter jet having a velocity of 25 m/s strikes a flat plate, the normal of which is inclined at 30° to the axis of the jet. Calculate the normal force exerted on the plate.
(i) When the plate is stationary and
(ii) When the plate is moving with a velocity of 8 m/s parallel to itself and in the direction of the normal to its surface. Also find the work done and efficiency of the jet when the plate is moving.

OR

7 An inward flow turbine (reaction type with radial discharge) with an overall efficiency of 80% is required to develop 150 kW. The head is 8 m, peripheral velocity of the wheel is $0.96\sqrt{2gH}$, the radial velocity of the flow is $0.36\sqrt{2gH}$. The wheel is to make 150 rpm and the hydraulic losses in the turbine are 22% of the available energy. Find the angle of the guide blade at inlet, the wheel vane angle at inlet, the diameter of the wheel and the width of the wheel at inlet.

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UNIT – IV

8 What are unit quantities? Derive the expressions for unit discharge, unit speed and unit power.

OR

9 A four-stage centrifugal pump has impellers 380 mm diameter and 19 mm wide at outlet. The outlet vane angle is 45° and the vanes occupy 8% of the outlet area. The manometric efficiency is 84% and the overall efficiency is 72%. Find the head generated by the pump when running at 900 rpm and discharging 59 lps. Also determine the power required to drive the pump.

UNIT – V

10 For laminar flow in a pipe show that the drop in pressure $\Delta P = \left(\mu v/_{d}\right).\phi\left(l/_{d}\right)$ where μ = viscosity of fluid, v = mean velocity of flow, d = diameter of pipe and l = length of the pipe. Use Rayleigh's method.

OR

11 What is meant by separation of boundary layer and how do you control the same?

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