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Paper ID & Roll No. to be filled in your Answer Book

Roll No.

B.Tech. (Civil) (IV Semester)

End Semester Examination 2015

HYDRAULIC AND HYDRAULIC MACHINES

Time: 3.00 Hours] *[Total Marks: 100*

Q1. Attempt any four questions:

(a) Explain positive & negative surges and sluice gate by sketches.

(b) Define term speed ratio, flow ratio & jet ratio.

(c) Define prismatic channel, hydraulic mean depth, steady, uniform & laminar flow.

(d) Derive an expression for the discharge through a channel by chezy's formula.

(e) Find the bed slope of trapezoidal channel of bed width 6 m, depth of water 3 m and side slope of 3 horizontal to 4 vertical, when the discharge through the channel is $30 m^3/s$. Take Chezy's constant, C=60.

(f) Define hydraulic jump or standing wave & length of hydraulic jump.

Q2. Attempt any four questions:

(a) What is the essential difference between gradually varried flow and rapidly varied flow? Illustrate with neatly drawn sketch.

(b) What is a mobile bad channel?

(c) Distinguish between deep & shallow water waves.

(d) Differentiate between rigid & alluvial channel.

(e) Determine the maximum discharge of water through a circular channel of diameter 1.5 m when the bed slope of the channel is 1 in 1000. Take C = 60.

(f) What is specific energy? Discuss its relation with depth.

Q3. Attempt any two questions:

(a) Water is flowing through a circular channel at the rate of 400 litres/s, when the channel is having a bed slope of 1 in 9000. The depth of water in the channel is 8.0 times the diameter. Find the diameter of the circular channel if the value of manning's N=0.015.

(b) An impeller of inside diameter 15 cm and outside diameter 40 cm having width at inlet 4 cm and width at outlet 2 cm is running at 1440 rpm. The inlet and outlet blade angles are 25^0 and 15^0 respectively. The whirl velocity at inlet is zero. Find: (a) flow rate (b) power of impeller and (c) absolute velocity at outlet.

(c) The internal & external diameter of an inward flow reaction turbine are 40 cm & 80 cm. The width of the runner at inlet is 20 cm. The velocity of flow through the runner is 2 m/s and it is constant from inlet to exit. The guide blade at inlet is 10^0 to the tangent of the runner. Assuming the discharge through the runner is radial, draw the inlet and outlet

velocity triangles and find out the following if runner is running at 2000 rpm.

(i) V_1, Vr_1 & Vw_1

(ii) runner blade angles

(iii) width of the runner at outlet

(iv) flow quantity through the turbine and head at the inlet of the turbine.

(v) Power & efficiency

Q4. Attempt any two questions:

(a) A hydraulic jump forms on a sloping rectangular channel. Derive the relation for the sequent depth.

(b) Enumerate and explain with neat sketches classification of flow profile in different slopes of the channel.

(c) A pelton wheel is to be designed for a head of 50 m when running at 200r.p.m. The pelton wheel develops 95.6475 KW shaft power. The velocity of the buckets=0.45 times the velocity of the jet, overall efficiency = 0.85 and co-efficient of the velocity is equal to 0.98.

Q5. Attempt any two questions:

(a) Show that the percentage saving in work due to air vessels in a reciprocating is

(i) 84.8% for single acting pump

(ii) 39.2% for double acting pump.

(b) A kaplan turbine develops 24647.6 kw power at an average head of 39 metres. Assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an oveall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine.

(c) Design a francis turbine runner with the following data. Net head 68 m, speed 750 rpm, power output 330 kw, hydraulic efficiency 94%, overall efficiency 85%, flow ratio 0.15, ratio of breath of diameter 0.1, inner diameter of the runner is ½ outer diameter of the runner, 6% of circumferential area of the runner is occupied by the thickness of the vanes. Assume velocity of flow remains constant and flow is radial at exit.

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