BTS (C) – V – 05 – 064 (E)

B. Tech Degree V Semester Examination, November 2005

CE 505 (A) FLUID MECHANICS II

(2002 Admissions onwards)

Time : 3 Hours Maximum Marks:100

I. (a) For a hydraulically efficient trapezoidal channel section, prove that each sloping side is equal to bed width. (10)

(b) An open channel has a U – Section, with a semicircular bottom with vertical sides and is 1.2 m wide. Calculate the depth of the stream when the discharge is 0.7 m^3/sec and the bed slope is 1 in 2500. Assume Chezy's constant C as 53. (10)

OR

II. (a) Derive an expression for hydraulic exponent for uniform flow computation. (6)

(b) What is meant by conveyance of a canal cross section. (4)

(c) A trapezoidal channel having bottom width 5 m and side slope 1:1 carries a discharge of 12 m^3/sec. Compute the critical depth and critical velocity. If manning's, n = 0.02, determine the bottom slope required to maintain the critical depth. (10)

III. (a) With a neat sketch, obtain a relation between water surface slope and channel bottom slope. (6)

(b) Differentiate between M – curves and S – curves. (6)

(c) A rectangular channel 8 m wide has a normal depth of 2.2 m and has a bed slope of 1 in 2900. If the water surface at a section is raised by 1 m due to the construction of a dam at the downstream end of the channel, determine the water surface slope with respect to horizontal at this section. Assume Manning's, n = 0.02. (8)

OR

IV. (a) Explain the direct integration method to compute the length of flow profile (with sketches). (6)

(b) A wide rectangular channel conveys a discharge of 5 m^3/sec per metre width with a bed slope of 1 in 3600 and Manning's, n = 0.02. If the depth at the section is 3.5 m, determine how far upstream or downstream of the section the depth would vary with in 5% of the normal depth. (14)

V. (a) What are the characteristics of Rapidly Varied Flow? (8)

(b) A rectangular channel carries a discharge of 3 m^3/sec per metre width. If the loss of energy in the hydraulic jump is found to be 3.2 m, determine the conjugate depths before and after the jump. (12)

OR

VI. (a) How the tail water conditions will affect the design of stilling basin? (6)

(b) Briefly explain *any two* typical designs of stilling basin. (4)

(c) A rectangular channel has sides 2.5 m high and conveys water at a depth of 1.6 m at a velocity of 1.9 m/sec. The channel is 1200 m long. If the flow is suddenly stopped by closing a gate at the down stream end of the channel, determine whether water will spill over the sides as a consequence of the surge produced. Find also the interval of time required for the surge to reach the upstream end of the channel. (10)

(Turn Over)

VII. (a) Show that the efficiency of a free jet striking normally a series of flat plates mounted on the periphery of a wheel never exceeds 50%. (8)

(b) A Francis turbine with an overall efficiency of 75% is required to produce 150 KW at the power shaft. It is working under a head of 8 m. The peripheral velocity = $^{0.26}\sqrt{2gH}$ and the radial velocity of flow at inlet is $^{0.96}\sqrt{2gH}$. The wheel runs at 150 rpm and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine (i) the guide blade angle (ii) the wheel vane angle at inlet (iii) diameter of the wheel at inlet, and (iv) width of wheel at inlet. (12)

OR

VIII. (a) Write short notes on (i) draft tubes (ii) surge tanks and (iii) penstocks. (9)

(b) The runner of a Kaplan turbine is 4 m in diameter and the hub is 2 m in diameter. The turbine works under a head of 22 m and develops 13980 KW of shaft power. The overall efficiency is 85% and the hydraulic efficiency is 90%. At the extreme edge of the runner if the guide blade angle is 40°, find the runner vane angles at inlet and outlet. Find also the speed of the turbine. Assume that the discharge is radial at outlet. (11)

IX. (a) Explain (i) Impeller power (ii) Manometric efficiency (iii) Mechanical efficiency (iv) Over all efficiency as applicable to a centrifugal pump. (8)

(b) A centrifugal pump running at 1450 rpm discharges 110 litres per second against a head of 23 m. If the diameter of the impeller is 250 mm and its width is 50 mm, find the vane angle at the outer periphery. The manometric efficiency of the pump is 75%. (12)

OR

X. (a) With a neat sketch, explain the working principle of a double acting reciprocating pump. (12)

(b) In a single acting reciprocating pump, prove that there will be no flow into or from the air vessel, when the crank angle is 18° 34'. (8)

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