Question Paper Code : 71250

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Civil Engineering

CE 2253/CE 44/CE 1253 A/080100020/10111 CE 404 — APPLIED HYDRAULICS ENGINEERING

(Regulation 2008/2010)

(Common to PTCE 2253/10111 CE 404 – Applied Hydraulics Engineering for B.E. (Part-Time) Fourth Semester – Civil Engineering – Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define specific energy.

2. Sketch the velocity distribution in a trapezoidal channel.

3. State the condition for maximum discharge in circular channel.

4. Differentiate between normal depth and alternate depth.

5. Define the hydraulic jump.

6. What is meant by surges?

7. What is meant by multistage pump?

8. What are the uses of air vessels?

9. Specify the impulse momentum principle.

10. Distinguish between radial flow and axial flow turbines.

11. (a) (i) Find the rate of flow and conveyance for a rectangular channel wide for uniform flow at a depth of 1.5 m. The channel is having a bed slope of 1 in 1000. Take Chezy's constant C = 50. Also state whether the flow is tranquil or rapid. (10)

(ii) What are the types of open channel flows and brief them? (6)

Or

(b) (i) Calculate the specific energy, critical depth and velocity for the flow of 10 m^3/s in a cement lined rectangular channel 2.5 m wide with 2 m depth of water. Is the given flow subcritical or super critical? (10)

(ii) Define wide open channel and also what are the important assumptions in hydraulic parameters? (6)

12. (a) (i) A canal is formed with side slopes 2:1 and a bottom width of 3.0 m. The bed slope is 1 in 4500. Using Manning's formula and assuming Manning's n as 0.025. Calculate the depth of water for a discharge of 3.0 m^3/s for a uniform flow. (8)

(ii) A trapezoidal channel with side slope 1 to 1 has to be designed to convey 10 m^3/s at a velocity of a 2 m/sec so that the amount of concrete lining for the bed and sides is the minimum. Calculate the area of lining required for one meter length of channel. (8)

Or

(b) Derive the expressions for the most economical depths of flow of water in terms of the diameter of the channel of circular cross-section:

(i) For maximum velocity and

(ii) For maximum discharge. (16)

13. (a) (i) Briefly explain the direct step method and standard step method to determine the gradually varied flow profiles. (8)

(ii) Derive the dynamic equation of gradually varied flow. (8)

Or

(b) (i) What are the assumptions made in the analysis of hydraulic jump? (4)

(ii) In a rectangular channel of 0.5 m width, a hydraulic jump occurs at a point where depth of flow is 0.15 m and Froude number is 2.5. Determine the specific energy, critical depth and subsequent depth, loss of head and energy dissipated. (12)

total head of 15 m. The ... rotating at 1400 rpm. Calculate the head, discharge and ratio of powers of a geometrically similar pump of diameter 0.25 m when it is running at 2800 rpm. (12)

(ii) Write a note on cavitation in centrifugal pump. (4)

Or

(b) (i) A single acting reciprocating pump is installed 3.5 m above the water level in the pump. The suction pipe is 20 cm in diameter and 10 m in length. The piston is of 30 cm diameter and has 50 cm stroke. Determine the speed at which separation may take place. Take H_{atm} = 10.3 m of water and H_{sep} = 2.5 m of water absolute. (10)

(ii) Define slip, percentage of slip and negative slip of reciprocating pump. (6)

15. (a) (i) Prove that the maximum efficiency is only 50%. When a liquid jet strikes a series a flat vanes mounted on the periphery of a wheel. (8)

(ii) Explain the working of radial flow turbine with neat sketch. (8)

Or

(b) (i) In an inward flow reaction turbine the head on the turbine is 32 m. The external and internal diameters are 1.44 m and 0.72 m. The velocity of the flow through runner is constant and equal to 3 m/s. The guide blade angle is 10° and the runner vanes are rigid at inlet. If the discharge at outlet is radial, determine the speed of the turbine and the vane angle at outlet of the runner. (8)

(ii) Derive an expression for specific speed of a turbine. (8)

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