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Question Paper Code : 70350

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fourth Semester

Civil Engineering

CE 8403 – APPLIED HYDRAULIC ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate pipe flow and open channel flow.

2. Give the relationships between Chezy's 'C' and Manning's 'n'.

3. Formulate the Dynamic equations of gradually varied flow.

4. Differentiate afflux and backwater curve.

5. Describe the uses of formation of hydraulic jump in a channel.

6. What is the cause of surge to occur in a flow?

7. Classify the turbines according to inlet energy and head.

8. Define cavitation in turbine.

9. Draw various types of casing in centrifugal pump.

10. Write the functions of air vessel in reciprocating pump.

PART B — (5 × 13 = 65 marks)

11. (a) A 8 m wide channel conveys 15 cumecs of water at a depth of 1.2 m. Determine Specific energy of the flowing water, Critical depth, Critical velocity, Minimum Specific energy, Froude number and also state whether the flow is sub critical or super critical.

Or

(b) Prove that half of the top width of a most economical trapezoidal section is equal to the length of the one of the side slopes.

12. (a) Categorize the flow profile by various numerical method.

Or

(b) Find the slope pf the free water surface in a rectangular channel of width 20 m, having depth of flow 5m. The discharge through the channel is 50 cumecs. The bed slope of the channel is 1 in 4000. Assume Chezy's constant C as 60.

13. (a) A rectangular channel carrying a supercritical flow is to be provided with a hydraulic jump type of energy dissipater. Energy loss required in the hydraulic jump is 5 m and inlet Froude number is 8, determine the sequent depths.

Or

(b) A rectangular channel 2 m wide has a flow with a velocity 2 m/sec and depth of flow 1.25 m. The rate of flow at the downstream end is suddenly decreased. Such that the depth of flow is increased to 2 m. Find the absolute velocity (celerity) 'c' of the resulting surge and new discharge.

14. (a) The three-jet Pelton turbine is required to generate 1000 kW under a net head of 400 m. The blade angle at outlet is 15 degrees and the reduction in the relative velocity while passing over the blade is 5%. If the overall efficiency of the wheel is 80%, Cv = 0.98 and speed ratio = 046, then find

(i) The diameter of jet

(ii) Total flow in m^3/sec and the force exerted by a jet on the buckets. (6+7)

Or

(b) Francis turbine designed to develop 160kw working under a head 10 m and running at 200 rpm. The hydraulic losses in turbine are 15% of available energy. The overall efficiency of turbine is 80%. Assume flow ratio = 0.94 and speed ratio = 0.25. Calculate :

(i) Guide blade angle and runner vane angle at inlet and

(ii) Diameter and width at inlet. (6+7)

15. (a) Explain the parts of reciprocating pump and derive the condition for work done.

Or

(b) The inlet and outlet diameter s of the impeller of a centrifugal pump are 25 cm and 50 cm respectively. The velocity of flow at outlet of flow is 2.5 m/s and the vanes are set back at an angle of 45° at the outlet. Find the minimum starting speed if the manometric efficiency is 0.8.

PART C — (1 × 15 = 15 marks)

16. (a) The impeller of centrifugal pump is 1 m in diameter and rotates at 1500 rpm. The blades are curved backward and make an angle of 30° to the tangent at the periphery. Calculate the power required if the velocity of flow at outlet is 20 m/s. Determine the head to which water can be lifted when a diffuser casing reduces the outlet velocity to 60%.

Or

(b) A single acting reciprocating pump discharges 5 lit / Sec with cylinder bore diameter 200 mm and its stroke length 300 mm. The pump runs at 350 rpm and lifts water through a height of 25 m. The delivery pipe is 30m long and 100 mm in diameter. Find the theoretical discharge and theoretical power required to run the pipe and determine the percentage slip and also determine the delivery head due to acceleration at beginning, middle and end.

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