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Question Paper Code : 80354

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

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. Define Uniform flow.

2. Write any two difference between specific energy and specific force.

3. Mention the conditions for the formation of a draw down curve.

4. What are the flow profiles possible in mild sloped channels?

5. Define hydraulic jump.

6. What is celerity in open channel?

7. Define specific speed of a turbine.

8. What is the function of draft tube?

9. Define negative slip.

10. Define NPSH of a pump.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Calculate the possible depths of flow at which a discharge of 28 cumec may be carried in a rectangular channel 3.6 m wide with a specific energy equal to 2.9 m. (5)

(ii) Water flows at a velocity of 1.5 m/s and a depth of 2.5 m in an open channel of rectangular cross section 3.5 m wide. At a certain section the width is reduced to 1.9 m and the bed is raised by 0.65 m. Will the upstream depth be affected? If so, to what extent? (8)

Or

(b) A most efficient trapezoidal section is required to give a maximum discharge of 22.5 m^3/s of water. The slope of the channel bottom is 1 in 2550. Taking C = 70 $m^{1/2}/s$ in Chezy's equation, determine the dimensions of the channel. Also determine the value of Manning's 'n', taking the value of velocity of flow as obtained for the channel by Chezy's equation.

12. (a) Describe the development of all the gradually varied flow profiles with neat sketches.

Or

(b) Explain in detail about the standard step method and direct step method with one example.

13. (a) (i) The depth and velocity of flow in a rectangular channel are 1.2 m and 1.8 m/s respectively. If the rate of inflow at the upstream end is suddenly doubled, what will be the height and absolute velocity of the resulting surge? (8)

(ii) Differentiate the positive and negative surges with neat sketch. (5)

Or

(b) (i) A rectangular channel carries a discharge of 2.5 m^3/s per meter width. If the loss of energy in the hydraulic jump is found to be 2.8 m, determine the conjugate depths before and after the jump. (8)

(ii) Determine the critical depth and head loss in terms of the initial depth y_1. In a rectangular channel there occurs a jump corresponding to $Fr_1 = 2.5$. (5)

14. (a) A reaction turbine works at 470 rpm under a head of 130 m. Its diameter at inlet is 130 cm and the flow area is 0.45 m^2. The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine (i) the volume flow rate, (ii) the power developed, (iii) Hydraulic efficiency. Assume whirl at outlet to be zero.

(5+4+4)

Or

(b) A conical draft tube having inlet and outlet diameters 1.1 m and 1.6 m discharges water at outlet with a velocity of 2.6 m/s. The total length of the draft tube is 6.5 m and 1.3 m of the length of draft tube is immersed in water. If atmospheric pressure head is 10.3 m of water and loss of head due to friction in the draft tube is equal to 0.25 times the velocity head at outlet of the tube. Find (i) Pressure head at inlet, (ii) Efficiency of the draft tube. (6+7)

15. (a) Explain the working of a single stage centrifugal pump with neat sketches.

Or

(b) Explain and draw the Indicator diagram for the reciprocating pump in the following cases.

(i) Without air vessels on both suction and delivery sides. (6)

(ii) With air vessel only on suction side. (7)

PART C — (1 × 15 = 15 marks)

16. (a) In a tidal power plant, an axial flow turbine operates a 6 MW generator at 163 rpm under a head of 5.6 m. The generator efficiency is 94% and the overall efficiency of the turbine is 90%. The tip diameter of the runner is 4.7 m and hub diameter is 2.1 m. Assuming hydraulic efficiency of 95% and no exit whirl, determine the runner vane angles at inlet and exit at the mean diameter of the vanes.

Or

(b) Design a Pelton wheel turbine for a head of 65 m when running at 220 rpm. The Pelton wheel develops 100 kW shaft power. The velocity of the buckets is equal to 0.46 times the velocity of the jet, Overall efficiency is equal to 0.87 and co-efficient of the velocity is equal to 0.99.

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