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Question Paper Code : 50338

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 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. Define hydraulically best section of channel.
3. Distinguish between draw down and back water curves.
4. Sketch the different zones of water surface profiles in critical and mild slope channels.
5. Define control section.
6. Classify Hydraulic jump.
7. Define momentum equation.
8. State specific speed of a turbine.
9. Give the advantages of multistage pumps.
10. Write the functions of air vessels.

PART B — (5 × 13 = 65 marks)

11. (a) (i) A rectangular channel has a width of 2.5 m and bed slope of 1 in 400. Determine will be the depth of water if the rate of flow is 8.5m³/sec. Take C = 50. (7)

(ii) Calculate the critical depth corresponding to a discharge of 7.5m³/sec for the following cases (6)

(1) Rectangular channel of width 3 m

(2) Triangular channel of side slope 1 vertical to 1.25 horizontal.

(3) Trapezoidal channel of bottom width 2 m and side slope 1 vertical to 1.25 horizontal.

Or

(b) (i) For a channel of circular section determine the depth of flow for maximum velocity. (7)

(ii) A most economical trapezoidal section is required to give a maximum discharge if 20 m^3/s of water. The slope of the channel bottom is 1 in 1500. Taking C = 70, in Chezy's equation, determine the dimensions of the channel. (6)

12. (a) Describe the direct step method and standard step method to determine the gradually varied flow profile. (13)

Or

(b) Classify flow profiles of gradually varied flow. Explain the various salient features of various profiles. (13)

13. (a) (i) Derive an expression for the depth after the hydraulic jump. (7)

(ii) A sluice gate discharges water into a horizontal channel with a velocity of 5m/sec and depth of flow is 0.4m. The width of the channel is 6m. Determine whether a hydraulic jump will occur, and if so find the height and loss of energy per kg of water. Also determine the power lost in the hydraulic jump. (6)

Or

(b) (i) A rectangular channel 2 m wide has a flow with a velocity of 2 m/sec and a depth of flow of 1.25 m. The rate of flow at the downstream end decreases such that the depth of flow is increased to 2 m. Find the absolute velocity of the resulting surge and corresponding new discharge. (7)

(ii) Explain in detail about the classification of hydraulic jump. (6)

14. (a) (i) A 100 mm diameter jet discharging 0.45 m^3/sec impinges on a series of curved vanes moving at 20 m/sec. The direction of the jet and direction of motion of the vane are same at inlet. Each vane is so shaped that if stationary it would deflect the jet by 165°. Calculate

(1) The force exerted in the direction of motion of the vane and

(2) The power developed. (7)

(ii) A 100 mm diameter jet has an oblique impact on a stationary vane, the angle between the jet and the plate being 50°. If the force normal to the plate is 2406.6N. Find the velocity of the jet and the discharge. (6)

Or

(b) (i) Explain the main components of Kaplan turbine with a neat sketch. (7)

(ii) A pelton wheel has to work under a head of 60 m while running at 200 rpm. The turbine is to developed a power of 95.6475 kW, The velocity of buckets is 0.45 times of the velocity of jet. The overall efficiency is 0.80 and coefficient of velocity is 0.98. Design the pelton wheel. (6)

15. (a) (i) Explain about characteristic curve of the centrifugal pump. (7)

(ii) A centrifugal pump works against a net head of 20 m at a speed of 1200 rpm. The vane angle at outlet is 30° the impeller diameter and with at outlet and inlet is 40 cm and 6 cm respectively. Find the discharge. Take manometric efficiency as 95%. (6)

Or

(b) (i) Explain the working principle of single acting reciprocating pump with neat sketch. (7)

(ii) The cylinder bore diameter of a single acting reciprocating pump is 150 mm. and its stroke length is 300 mm the pump runs at 50 rpm and lifts water through a height of 25m, the delivery pipe is 22m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 litres/sec. find the Percentage slip. (6)

PART C — (1 × 15 = 15 marks)

16. (a) An 8 m wide channel conveys 15 cumecs of water at a depth of 1.2 m. Determine (i) Specific energy (ii) Critical depth, critical velocity and Minimum specific energy (iii) Froude number and state weather the flow is sub critical or super critical. (15)

Or

(b) The external and internal diameters of an inward flow reaction turbine are 1.2 m and 0.6 respectively. The head on the turbine is 22 m and velocity of flow through the runner is constant and is equal to 2.5 m/s. The guide blade angle is 10 degree and the runner vanes are radial at inlet. The discharge is radial at outlet. Determine (i) the speed of the turbine (ii) the vane angle at outlet (iii) hydraulic efficiency. (15)

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