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Question Paper Code : 80200

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Civil Engineering

CE 6403 — APPLIED HYDRAULIC ENGINEERING

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define open-channel flow.

2. Compute the hydraulic mean depth of a small channel 1 m wide, 0.5 m deep with water flowing at 2 m/s.

3. Define uniform flow in channels.

4. Distinguish between normal depth and critical depth.

5. What is backwater curve?

6. Indicate the usefulness of hydraulic jump.

7. What are the types of casing in centrifugal pump?

8. Define negative slip.

9. Draw typical velocity triangles for inlet and outlet of pelton wheel.

10. What are the causes of cavitation?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A 3 m wide rectangular channel conveys 12 m^3/ Sec of water at a depth of 2 m. Calculate

(1) Specific energy of flowing fluid

(2) Critical depth, critical velocity and the minimum specific energy

(3) Froude Number and state whether the flow is sub critical or super critical. (10)

(ii) What do you understand by the critical depth of an open channel when the flow in it is not uniform? (6)

Or

(b) (i) Calculate the specific energy of 12 m^3/s of water flowing with a velocity of 1.5 m/s in a rectangular channel 7.5 m wide. Find the depth of water in the channel when the specific energy would be minimum. What would be the value of critical velocity as well as minimum specific energy? (10)

(ii) Derive an expression for critical depth and critical velocity. (6)

12. (a) (i) A V-shaped open channel of included angle 90° conveys a discharge of 0.05 m^3/s when the depth of flow at the center is 0.225 m. Assuming that C = 50 in the Chezy's, equation calculate the slope of the channel. (8)

(ii) Calculate the dimensions of the rectangular cross-section of an open channel which requires minimum area to convey 10 m^3/s The slope being 1 in 1500. Take the Manning's 'n' as 0.013. (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) Write the Gradually varied flow (GVF) equation in an open channel flow. Deduce the equation for a wide rectangular channel using Manning's and Chezy's equation. (10)

(ii) Explain with a neat diagram the surges produced when (1) a sluice gate is suddenly raised and (2) sluice gate suddenly lowered. (6)

Or

(b) (i) Explain the classification of hydraulic jumps. (6)

(ii) A spillway discharges a flood flow at a rate of 7.75 m^3/s per metre width. At the downstream horizontal apron the depth of flow was found to be 0.5 m. What tail water depth is needed to form a hydraulic jump? If a jump is formed, find its type, length, head loss and energy loss as a percentage of the initial energy. (10)

14. (a) (i) A jet of water 75 mm diameter with a velocity of 20 m/s strikes normally a flat smooth plate. Determine the force exerted on the plate if,

(1) The plate is at rest

(2) The plate is moving in the same direction as the jet with a velocity of 6 m/s. Also determine the work done per unit time on the plate. (8)

(ii) A jet of water of diameter 100 mm moving with a velocity of 30 m/s strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected though an angle of 120° at the outlet of the curved plate. (8)

Or

(b) (i) Distinguish between impulse and reaction turbines. (6)

(ii) A pelton wheel is required to develop 8825 kW when working under a head of 300m the speed of the pelton wheel is 540 r.p.m. the coefficient of velocity is 0.98 and the speed ratio is 0.46. Assuming jet ratio as 10 and overall efficiency as 84%, determine

(1) The number of jets

(2) The diameter of the wheel

(3) The quantity of water required. (10)

15. (a) What is a reciprocating pump? Describe the principle and working of a reciprocating pump with a neat sketch. (16)

Or

(b) (i) With the help of neat sketches, explain the features of a volute type and a diffusion type centrifugal pump. (8)

(ii) A centrifugal pump delivers salt water against a net head of 15 m at a speed of 100 rpm. The vanes are curved backward at 30° with the periphery. Obtain the discharge for an impeller diameter of 30 cm and outlet width of 5 cm at a manometric efficiency of 90%. (8)

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