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Question Paper Code : 10221

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Fourth Semester

Civil Engineering

CE 2253/101403/CE 44/CE 1253 A/10111 CE 404/080100020 — APPLIED HYDRAULIC ENGINEERING

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the different types of flow in open channel?

2. Define Specific Energy.

3. Distinguish between normal depth and critical depth.

4. What are the conditions for the most economical triangular channel section?

5. Write down the dynamic equation of Gradually Varied Flow.

6. Distinguish between positive and negative surges.

7. Define specific speed of a pump.

8. Draw the indicator diagram for a single acting reciprocating pump.

9. How would you classify turbines based on the direction of flow in the runner?

10. Draw typical velocity triangles for inlet and outlet of Pelton Wheel.

PART B — (5 × 16 = 80 marks)

11. (a) (i) How are the flows classified under specific energy concepts? (6)

(ii) A 8 m wide channel conveys 15 cumecs of water at a depth of 1.2 m. Determine (1) Specific Energy of the flowing water (2) Critical depth, critical velocity and minimum specific energy (3) Froude Number and state whether the flow is subcritical or supercritical. (10)

Or

(b) (i) Explain the salient features of Specific Energy curve. (8)

(ii) Determine the critical depth for a specific energy of 1.5 m in the following channels

(1) Rectangular channel

(2) Triangular channel

(3) Trapezoidal channel. (8)

12. (a) (i) Show that the hydraulic radius is half the flow depth for the most economic trapezoidal channel section. (8)

(ii) Determine the most economical section of a rectangular channel carrying water at the rate of 0.6 cumecs. The bed slope of the channel is 1 in 2000. Assume Chezy's constant C = 50. (8)

Or

(b) (i) How do you determine velocity of flow in open channels? (8)

(ii) The bed width of a trapezoidal channel section is 40 m and the side slope is 2 horizontal to 1 vertical. The discharge in the canal is 60 cumecs. The Manning's 'n' is 0.015 and the bed slope is 1 in 5000. Determine the normal depth. (8)

13. (a) (i) What are the assumptions made in the analysis of Gradually varied flow? (6)

(ii) The bed width of a rectangular channel is 24 m and the depth of flow is 6 m. The discharge in the canal is 86 cumecs. The bed slope of the channel is 1 in 4000. Assume Chezy's constant C = 60. Determine the slope of the free water surface. (10)

Or

(b) (i) What are the conditions for the formation of hydraulic jump? (4)

(ii) In a rectangular channel of bed width 0.5 m, a hydraulic jump occurs at a point where depth of flow is 0.15 m and Froude's Number is 2.5. Determine (1) The Specific Energy (2) The critical depth (3) The subsequent depths (4) Loss of head (5) Energy Dissipated. (12)

14. (a) (i) Define :

(1) Manometric Efficiency

(2) Volumetric efficiency

(3) Mechanical efficiency

(4) Overall Efficiency of Centrifugal pump. (4)

(ii) The impeller of a centrifugal pump has an external diameter of 450 mm and internal diameter of 200 mm. The speed of the pump is 1440 r.p.m. Assuming a constant radial flow through the impeller at 2.5 m/s and that the vanes at exit are set back at an angle of 25°, Determine :

(1) The inlet vane angle

(2) The angle, the absolute velocity of water at exit makes with the tangent and

(3) The work done per unit weight. (12)

Or

(b) (i) Explain the working principle of double acting reciprocating pump with a neat sketch. (8)

(ii) A single acting reciprocating pump has a plunger diameter of 250 mm and stroke length of 350 mm. The speed of the pump is 60 r.p.m. and the discharge is 0.02 cumecs of water.

Determine :

(1) The theoretical discharge

(2) Coefficient of discharge

(3) Percentage slip. (8)

15. (a) (i) Distinguish between impulse and reaction turbines. (6)

(ii) A Pelton Wheel is required to develop 8825 kW when working under the head of 300 m. 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)

Or

(b) (i) What are the various types of draft tube? (4)

(ii) A Francis Turbine is to be designed to develop 360 kW under a head of 70 m and a speed of 750 r.p.m. The ratio of width of runner to diameter of runner 'n' is 0.1. The inner diameter of the runner is half the outer diameter. The flow ratio is 0.15. The hydraulic efficiency is 95% and the mechanical efficiency is 84%. Four percent of the circumferential area of runner is to be occupied by the thickness of the vanes. The velocity of flow is constant and the discharge is radial at exit.

Determine :

(1) The diameter of the wheel

(2) The quantity of water supplied

(3) The guide vane angle at inlet and

(4) Runner vane angles at inlet and exit. (12)
