

B 208

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Fourth Semester

Civil Engineering

CE 238 — APPLIED HYDRAULIC ENGINEERING

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the differences between pipe flow and open channel flow? (give two points).
2. Mention three characteristics of a super critical state of open channel flow.
3. What is the limit slope of an open channel?
4. Write down the dynamic equation for a gradually varied flow in terms of y_c and y_n , assuming to use Manning's formula for evaluating y_n .
5. What is spatially varied flow? Give an example.
6. What is the nature of flow after the formation of hydraulic jump?
7. Why do Pelton wheel buckets have a notch at the centre of their outer periphery?
8. Why do draft tubes have enlarging passage area in the direction of flows?
9. What are the function of a foot valve and a strainer in any pump installation?
10. Acceleration head is considered while calculating pressure head but not while calculating power. Why?

PART B — (5 × 16 = 80 marks)

11. (i) Calculate the critical specific depth, critical velocity and critical specific energy for a flow $12 \text{ m}^3/\text{s}$ in a rectangular channel of width 3.5 m and energy coefficient 1.1. What is the state of flow when the depth is 0.9 m. Find the Froude number at this depth. (8)
- (ii) Prove that $y_c^3 = \frac{2y_1^2 + y_2^2}{y_1 + y_2}$ for flow in a rectangular channels. y_c is critical depth and y_1 & y_2 are alternate depth. (8)

12. (a) Briefly explain the following methods to determine the gradually varied flow profiles.

(i) Direct stop method

(ii) Standard step method.

(8 × 2 = 16)

Or

(b) (i) Derive the condition for most economical trapezoidal channel section. (10)

(ii) Determine the longitudinal slope of a triangular channel carrying 1.2 m³/s for a normal depth of flow 0.75 m and a side slope 2:1. Take Chezy's C = 45. (6)

13. (a) (i) Derive an expression for loss of head in a Hydraulic Jump. (8)

(ii) The depth and velocity of flow of water at the foot of a spillway in a wide rectangular channel with a horizontal floor at 0.75 m and 16 m/sec respectively. Say whether a hydraulic jump occurs. If so find the Froude Number after jump and also efficiency of the jump. (8)

Or

(b) Write brief note on discharge measurement using

(i) Venturiflume with out hump

(ii) Standing wave flume without hump.

(2 × 8 = 16)

14. (a) (i) Determine the speed of a pelton wheel, its diameter, number of jets required and the size of each jet if it develops 13,800 MHP under a head of 430 m. Its specific speed is 42. Assume necessary suitable values. (12)

(ii) Write a brief note on Thoma's Cavitation Number for a hydraulic turbine. (4)

Or

(b) (i) Derive an expression for specific speed of a centrifugal pump. (8)

(ii) Discuss about operating characteristics of a centrifugal pump. (8)

15. (a) Write a brief note on air vessels being fitted to the suction and delivery pipes of a reciprocating pump (single acting). When does the flow enter or leave the vessel during suction and delivery strokes? (16)

Or

- (b) (i) Compare centrifugal pump and reciprocating pump. (atleast 10 points). (10)
- (ii) Calculate the slip, percentage slip, coefficient of discharge and input power of a double acting reciprocating pump with the following data : Piston diameter = 15 cm, Stroke = 30 cm, $N = 40$ rpm, Total head = 25 m, Actual discharge = 400 lpm of water, overall efficiency 75%. (6)
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