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**R 3163**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Fourth Semester

(Regulation 2004)

Civil Engineering

CE 1253 — APPLIED HYDRAULIC ENGINEERING

(Common to B.E. (Part-Time) Third Semester — Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between subcritical and super critical flows.
2. Distinguish between gradually varied flow and rapidly varied flow.
3. State the conditions for critical flow.
4. What is meant by normal depth?
5. Distinguish between backwater curve and draw down curves.
6. What is meant by positive and negative surges?
7. Define specific speed of a turbine.
8. What is meant by governing of turbines?
9. What is meant by multistage pump?
10. What is negative slip? When it occurs?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Show that the relation between alternate depths  $y_1$  and  $y_2$  in a rectangular channel can be expressed by

$$\frac{2y_1^2 y_2^2}{(y_1 + y_2)} = y_c^3 \text{ where } y_c \text{ is the critical depth of flow.} \quad (8)$$

- (ii) For a constant energy of 2.4 N-m/N, calculate the maximum discharge that may occur in a rectangular channel 4 m wide. (8)

Or

- (b) For the purpose of discharge measurement, the width of a rectangular channel is reduced gradually from 3 m to 2 m and the floor is raised by 0.3 m at a given section. When the approaching depth of flow is 2 m, what rate of flow will be indicated by a drop of 0.15 m in the water surface elevation at the contracted section? (16)

12. (a) (i) Derive Chezy's formula for uniform flow in open channels. (8)
- (ii) Show that for a trapezoidal channel of given area of flow, the condition for maximum flow requires that hydraulic mean depth is equal to one half the depth of flow. (8)

Or

- (b) A circular sewer 0.6 m inside diameter has a slope of 1 in 400. Find the depth when the discharge is 0.283 m<sup>3</sup>/sec. Take Chezy's C = 50. (16)

13. (a) (i) Derive the dynamic equation for gradually varied flow stating the assumptions made. (8)
- (ii) Explain direct step method for computing the length of the water surface profile. (8)

Or

- (b) (i) State the applications of hydraulic jump. (4)
- (ii) A partially open sluice gate discharges water at 10 m/sec. with 1 m depth in a horizontal rectangular channel of width 5 m. can a hydraulic jump occur. If so find the sequent depth and energy loss. (12)

14. (a) (i) Classify hydraulic turbines. (6)
- (ii) A Pelton wheel has to work under a head of 60 m while running at 200 rpm. The turbine is to develop 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. (10)

Or

- (b) A Kaplan turbine while working under a head of 35 m develops power of 20,000 kW. Assume flow ratio of 0.6, speed ratio of 2, the diameter of boss is 0.35 times the diameter of the runner and overall efficiency is 85%. Find the diameter, speed and specific speed of the turbine. (16)
15. (a) (i) Define manometric efficiency and Net Positive Suction Head (NPSH). (4)
- (ii) A centrifugal pump works against a net head of 20 m at a speed of 1200 rpm. The vane angle at outlet is  $30^\circ$ . The impeller diameter and width at outlet are 40 cm and 6 cm respectively. Find the discharge. Take manometric efficiency as 95%. (12)

Or

- (b) (i) Explain the working of a single acting reciprocating pump with air vessels. (6)
- (ii) A single acting reciprocating pump running at 30 rpm has a stroke length of 40 cm and piston diameter of 20 cm. The suction head is 3.0 m and length and diameter of suction pipe are 6 m and 10 cm respectively. Take  $f = 0.02$  and  $H_{atm} = 10.3$  m of water. Find the absolute pressure head inside the cylinder at the beginning, middle and end of suction stroke. (10)