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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

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 gradually varied flow and rapidly varied flow.
2. Define specific energy and specific force.
3. List the factors affecting Manning's roughness coefficient.
4. What is meant by most economical section?
5. State the assumptions made in the derivation of dynamic equation for gradually varied flow.
6. Distinguish between draw down and back water curves.
7. Classify hydraulic turbines based on head and specific speed.
8. What is a draft tube? Why is it necessary for a reaction turbine?
9. List the types of impellers and casings for a centrifugal pump.
10. What is an air vessel? State its functions.

11. (a) Calculate the critical depth corresponding to a discharge of 6.0 m³/sec in
 (i) rectangular channel of width 3.0 m (ii) trapezoidal channel of
 bottom width 2.0 m and side slopes 1 H : 1 V.

Or

- (b) If y_1 and y_2 are alternate depths in a rectangular channel show that

$$y_c^3 = \frac{2y_1^2 y_2^2}{(y_1 + y_2)} \text{ and hence}$$

$$\text{specific energy } E = \frac{y_1^2 + y_1 y_2 + y_2^2}{y_1 + y_2}$$

12. (a) A rectangular channel 3.5 m wide is laid on a slope of 0.0005. Calculate the normal depth of flow for a discharge of 5.0 m³. The Manning's coefficient is 0.02.

Or

- (b) A lined rectangular channel with Manning's $n = 0.015$ is 5 m wide and has a flow depth of 2 m with bed slope of 1 in 1600. Retaining the rectangular shape of channel section and same total area of lining, to what extent can discharge be increased without changing the slope.
13. (a) At a certain section M in a rectangular channel of bed width 2 m, the depth of flow is 1.20 m. When the flow rate is 6.0 m³/sec, estimate the distance from M to another section N where the depth is 1.40 m. The bed slope is 0.002 and Manning's $n = 0.015$. Take two steps.

Or

- (b) The Froude number before the jump is 10.0 in a hydraulic jump occurring in a rectangular channel and the energy loss is 3.20 m. Estimate
 (i) the sequent depths (ii) the discharge.
14. (a) A Pelton wheel is working under a head of 45 m and the discharge is 0.8 m³/sec. The mean bucket speed is 14 m/sec. Find the efficiency if the jet is deflected by the blades through an angle of 165°. Assume coefficient of velocity = 0.985.

Or

- (b) Show that the efficiency of a free jet striking normally a series of flat vanes mounted on the periphery of a wheel never exceeds 50%.

15. (a) (i) Derive an expression for the minimum starting speed of a centrifugal pump if the outer diameter of the impeller is two times the inner diameter.
- (ii) Explain the principle of working of a jet pump.

Or

- (b) (i) What is meant by negative slip? When it occurs?
- (ii) What is an indicator diagram? Explain with a neat sketch.
- (iii) Why speed of a reciprocating pump is limited? Explain.
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