

T 8089

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Fourth Semester

Civil Engineering

CE 1253 — APPLIED HYDRAULIC ENGINEERING

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

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between steady uniform flow and unsteady non-uniform flow.
2. Define Specific energy.
3. What are subcritical and supercritical flows?
4. What is the significance of most economical section?
5. What are the flow profiles possible in mild sloped channels?
6. State the uses of hydraulic jump.
7. Classify turbines based on head.
8. What are the functions of draft tube?
9. What is meant by manometric head with regard to a centrifugal pump?
10. What is an air vessel? What are its functions?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw the specific energy curve and explain. (6)
- (ii) For a constant specific energy of 1.8 N.m/N calculate the maximum discharge that may occur in a rectangular channel 5.0 m wide. (10)

Or

- (b) A trapezoidal channel has a bottom width of 6 m and side slopes of 2H to 1V. If the depth of flow is 1.2 m at a discharge of $10\text{ m}^3/\text{sec}$, compute the specific energy and the critical depth. (16)
12. (a) Prove that for the maximum discharge in a circular channel, the depth of flow is equal to 0.95 times the diameter of the channel. (16)

Or

- (b) A trapezoidal channel having bottom width 6 m and side slopes 2H to 1V is laid in a bottom slope of 0.0016. If it carries a uniform flow of water at the rate of $10\text{ m}^3/\text{sec}$, compute the normal depth and the mean velocity of flow. Take Manning's n as 0.025. (16)
13. (a) A rectangular channel 10 m wide carries a discharge of $30\text{ m}^3/\text{sec}$. It is laid at a slope of 0.0001. If at a section in this channel, the depth is 1.6 m, how far upstream or downstream from the section will the depth be 2.0 m. Take Manning's n as 0.015. (16)

Or

- (b) (i) Show that the head loss in a hydraulic jump formed in a rectangular channel may be expressed as

$$\Delta E = \frac{(V_1 - V_2)^3}{2g(V_1 + V_2)} \quad (8)$$

- (ii) A horizontal rectangular channel 4 m wide carries a discharge of $16\text{ m}^3/\text{sec}$. Determine whether a jump may occur at an initial depth of 0.5 m or not. If jump occurs determine the sequent depth to the initial depth. (8)
14. (a) (i) Distinguish between impulse and reaction turbines. (4)
- (ii) Derive an expression for specific speed of a turbine. (6)
- (iii) Prove that the maximum efficiency is only 50%. When a liquid jet strikes a series of flat vanes mounted on the periphery of a wheel. (6)

Or

- (b) A reaction turbine works at 450 rpm under a head of 120 m. The diameter at inlet is 120 cm and the flow area is 0.4 m^2 . The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Find (i) discharge (ii) power developed and (iii) hydraulic efficiency. Assume velocity of whirl at outlet is zero.

- (a) The inlet and outlet diameters of the impeller of a centrifugal pump are 25 cm and 50 cm respectively. The velocity of flow at outlet is 2.5 m/sec and the vanes are set back at angle of 45° at the outlet. Find the minimum starting speed if the manometric efficiency is 0.8.

Or

- (b) (i) What is meant by negative slip? When it occurs? (4)
- (ii) A single acting reciprocating pump is installed 3.5 m above the water level in the sump. The suction pipe is 20 cm in diameter and 10 m in length. The piston is of 30 cm diameter and has 50 cm stroke. Determine the speed at which separation may take place. Take $H_{\text{atm}} = 10.3$ m of water and $H_{\text{sep}} = 2.5$ m of water absolute. (12)