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Question Paper Code : 31202

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fourth Semester

Civil Engineering

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

(Regulation 2008/2010)

(Common to PTCE 2253 — Applied Hydraulics Engineering for B.E (Part-Time)
Fourth Semester – Civil Engineering – Regulation 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define open channel flow.
2. Define critical depth.
3. Write the Bazin's formula for the discharge in the canal.
4. Define uniform and non-uniform flow in channels.
5. Define hydraulic jump.
6. Define surges.
7. What is an indicator diagram in a reciprocating pump?
8. Note on slip and negative slip in reciprocating pump.
9. What is priming in a centrifugal pump?
10. Write the classification of turbines based on specific speed.

PART B — (5 × 16 = 80 marks)

11. (a) A trapezoidal channel having a cross sectional area A_1 , wetted perimeter P_1 , Manning's co-efficient 'n' and laid to a slope S , base width b , carries a certain discharge Q_1 at a depth of flow equal to 'd'. To increase the discharge, the base width of the channel is widened by 'x', keeping all other parameters viz., S , d , side slope and n are same. Q_2 is the new discharge in the channel. Prove that,

$$(Q_2/Q_1)^3 (1 + (x/P_1))^2 = (1 + (xd/A_1))^5 \quad (16)$$

Or

- (b) (i) Based on specific energy concept how the flows are classified? (8)
(ii) A rectangular channel 3.5 m wide has a specific energy of 2.5 m when carrying a discharge of 7.52 m³/s. Calculate the alternate depths and corresponding Froude numbers. (8)
12. (a) Show that the hydraulic radius is half the flow depth for the most economic trapezoidal channel section. (16)

Or

- (b) Find the rate of flow of water through a V-shaped channel with depth of flow 5 m and having angle of 30°. Take the value of Bazin's constant $m = 0.21$ and slope of the bed as 1 in 2500. (16)
13. (a) A rectangular channel 8.5 m wide has a uniform depth of flow of 2.5 m and has a bed slope of 1 in 3000. If due to weir constructed at the downstream end of the channel, water surface at a section is raised by 0.8 m, determine the water surface slope with respect to horizontal at this section. Assume Manning's $n = 0.02$. (16)

Or

- (b) State and discuss the assumptions made in the derivation of the dynamic equation for gradually varied flow. Starting from first principles, derive equations for the slope of the water surface in gradually varied flow with respect to
(i) Channel bed,
(ii) Horizontal. (16)

14. (a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5. m/s. The vane are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm. Determine :

- (i) Vane angle at inlet
(ii) Workdone by impeller on water per second and
(iii) Manometric efficiency.

Or

- (b) Draw the ideal indicator diagram and include the acceleration head and frictional head during the different strokes. And also write down the total work done during the suction stroke and the middle of the delivery stroke.
15. (a) A Pelton wheel is required to develop 8575 kW when working under the head of 250 m. The speed of the Pelton wheel is 500 rpm. The co-efficient of velocity is 0.98 and the speed ratio is 0.46. Assuming jet ratio as 10 and overall efficiency as 82%, Determine :
- (i) The number of jets
 - (ii) The diameter of the wheel
 - (iii) The quantity of water required. (16)

Or

- (b) What are the characteristic curves in turbines? List the types. Explain in detail with neat curves. (16)
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