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Question Paper Code : 50266

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fourth Semester

Civil Engineering

CE 6403 – APPLIED HYDRAULIC ENGINEERING

(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. Derive the dimension of constant 'C' in Chezy's formula.
2. Find the critical depth and critical velocity of a water flowing through a rectangular channel of width 5 m, when the discharge is 15 m^3/s.
3. Sketch the different zones of water surface profiles in a critical and mild sloped channels.
4. Differentiate afflux and backwater curve.
5. What is meant by negative surge ?
6. List the assumptions made in the analysis of hydraulic jump using the momentum equation.
7. What is meant by breaking jet in a Pelton wheel turbine ?
8. Define the term specific speed of a turbine.
9. What is meant by double acting reciprocating pump ?
10. List the functions of air vessel in reciprocating pumps.

PART – B (5×13=65 Marks)

11. a) Show that the friction factor of the Darcy's Weisbach equation and the Manning's roughness factor 'n' are interrelated by $f = 78.5n^2/(R^{1/3})$.

(OR)

b) Prove that half of the top width of a most economical trapezoidal section is equal to the length of the one of the side slopes and derive the hydraulic mean depth as half of the depth of the flow.

12. a) A rectangular channel 10 m wide carries a discharge of 30 m^3/s. 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.

(OR)

b) Derive the dynamic equation of the Gradually Varied Flow.

13. a) Show that the head loss in a hydraulic jump formed in a rectangular channel may be expressed as $E = \frac{(V_1 - V_2)^3}{2g(V_1 + V_2)}$.

(OR)

b) The depth and velocity of flow in a rectangular channel are 0.90 m and 1.5 m/s respectively. If a gate at the downstream end of the channel is abruptly closed, what will be the height and absolute velocity of the resulting surge ? If the channel is 950 m long, how much time will be required for the surge to reach the upstream end of the channel ?

14. a) Discuss in detail the various classification of turbines and explain the components and velocity triangle for Pelton wheel turbine.

(OR)

b) 200 litres of water per second are suppled to an inward flow reaction turbine. The head available is 11 m. The wheel vanes are radial at inlet and the inlet diameter is twice the outlet diameter. The velocity of flow is constant and is equal to 1.85 m/s. The wheel makes 350 rpm. Find the guide vane angle, inlet and outlet diameter of wheel, width of wheel at inlet and exit. Neglect the thickness of vanes and assume discharge is radial. Take speed ratio as 0.7.

15. a) Derive an expression for the pressure head due to acceleration of the piston of a reciprocating pump, assuming motion of the piston to be SHM.

(OR)

b) The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 350 mm. The pump runs at 60 rpm and lifts water through 25 m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and power of the pump. If actual discharge is 4.2 lps, find the percentage of slip. Also determine the acceleration head at the beginning and middle of the delivery stroke.

PART – C (1×15=15 Marks)

16. a) Show that the pressure rise in the impeller of a centrifugal pump is given by $[V_f^2 + u_1^2 - V_{f1}^2 \operatorname{cosec}^2 \varphi]/2g$ provided the frictional and other losses in the impeller are neglected.

(OR)

b) A Kaplan turbine produces 60000 kW under a net head of 25 m with an overall efficiency of 90%, velocity ratio as 1.6 and speed ratio as 0.5 and the hub diameter as 0.35 times the outer diameter, find the diameter and speed of the turbine .
