C

Question Paper Code: U4106

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Fourth Semester

Civil Engineering

21UCE406-APPLIED HYDRAULIC ENGINEERING

(Regulations 2021)

Duration: Three hours   Maximum: 100 Marks

Answer All Questions

PART A - (5 x 1 = 5Marks)

1. The best hydraulic section is defined as   CO3-Ana

   (a) the section that has a maximum area

   (b) the section that has minimum area

   (c) the section that has minimum roughness coefficient

   (d) Wetted perimeter is minimum

2. The dynamic equation for the slope of water surface in a GVF is not   CO3-Ana
   valid for super critical flow

   (a) True   (b) False   (c) None of the above   (d) All of the above

3. A hydraulic jump takes place in a frictionless rectangular channel. The pre-   CO1-U
   jump depth is y_p. The alternate and sequent depths corresponding to y_p are y_a
   and y_s respectively. The correct relationship among y_p, y_a and y_s is:

   (a) $y_a < y_s < y_p$ (b) $y_p < y_s < y_a$ (c) $y_p < y_s = y_a$ (d) $y_p = y_s = y_a$

4. The overall efficiency for a Pelton wheel lies between   CO1- U

   (a) 0.65 to 0.75   (b) 0.50 to 0.65   (c) 0.75 to 0.85   (d) 0.85 to 0.90

5. Cavitation can takes place in case of   CO1- U

   (a) Pelton Wheel   (b) Francis Turbine   (c) Reciprocating Pump   (d) Centrifugal Pump

PART – B (5 x 3= 15Marks)

6. Define Specific Energy with neat sketch   CO1 - U

7. What is a drawdown curve and backwater curve?   CO2 -App

8. What is meant by surge and explain their types. CO1 - U

9. A Kaplan turbine develops 15,000 kW power at 345rpm under a head of 30m.Calculate specific speed. CO4 -App

10. What is meant by Cavitation in pumps? CO1 - U

PART – C (5 x 16= 80Marks)

11. (a) Find the discharge through the most economical trapezoidal channel has side slope of 1 horizontal to 2 vertical and the slope of the bed is 1 in 1500.The area of the section is $40m^2$.Find the dimension of the section if C = 50 CO2- App (16)

Or

(b) A 8 m wide channel conveys 15cumecs of water at a depth of 1.2m. Determine
i) Specific energy of the flowing water
ii) Critical Depth &Velocity and minimum specific energy
iii) Froude number &state whether the flow is sub critical or super critical CO2- App (16)

12. (a) The normal depth of flow of , in a rectangular channel 2m wide ,is 1.2m.The bed slope of the channel is 0.0006 and manning's roughness coefficient n=0.015.Find the critical depth .At a certain section of the same channel the depth is 0.90 while at a second section the depth is 0.85.Find the distance b/w two sections. Also find the whether the second section is located downstream or upstream with respect to the first section. CO2- App (16)

Or

(b) A trapezoidal channel with bed width of 10m and side slopes 1V: 1.5His carrying a flow of $80m^3$/s. The channel bottom slope is 0.002 and Manning's constant N is 0.015.A dam planned in such a way that the flow depth increase to 10m.Determine the depth of flow in the channel 250m,500m and 750m upstream of the dam. Use the standard step method. CO2- App (16)

13. (a) In a rectangular channel of bed width 0.5 m, a hydraulic jump occurs at a point where depth of flow is 0.15 m and Froude's number is 2.5. Calculate (i) The specific energy (ii) The critical depth (iii) The subsequent depths (iv) Loss of head (Or) Energy dissipated. CO2- App (16)

Or

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(b) A sluice gate discharges water in to a horizontal rectangular channel with a velocity of 6m/s and depth of flow is 0.4m. The width of the channel is 8m. Determine whether a hydraulic jump will occur. Find its height and loss of energy of water. Also determine the power lost in the hydraulic jump. CO2- App (16)

14. (a) A Pelton wheel is to develop 8825 kW under a net head of 300m, while running at a speed of 540 rpm. If the coefficient of the jet is 0.987, speed ratio is 0.46.Assuming the jet ratio as 10 & overall efficiency as 84%, Find Diameter of the jet, Diameter of the wheel, Discharge, Number of jets. CO4- App (16)

Or

(b) A Kaplan turbine is to be designed to develop 20000 KW .The net available head is 35m.The speed ratio is 2 and the flow ratio is 0.6.The overall efficiency is 86% and diameter of the boss is one - third the diameter of the runner .Determine the diameter of the runner, speed, and specific speed of the turbine. CO4- App (16)

15. (a) A single acting reciprocating pump, running at 60 rpm delivers 0.02 m^3/sec of water. The diameter of the piston is 200mm and stroke length 300mm. The suction and delivery heads are4m and 12m respectively. Determine the theoretical discharge, coefficient of discharge, percentage of slip of the pump and power required to run the pump. CO4- App (16)

Or

(b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm 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 vanes are set back at an angle of 40^0 at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine
1) Vane angle at inlet,
2) Work done by impeller on water per second
3) Manometric efficiency CO4- App (16)

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