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Question Paper Code: R4105

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Civil Engineering

R21UCE405 – APPLIED HYDRAULIC ENGINEERING

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Compute the hydraulic mean depth of a small channel 1m wide, 0.5 m deep with water flowing at 2 m/s. CO2-App
2. On what condition most economical trapezoidal channel section is derived? CO1- U
3. State the assumptions made in the derivation of dynamic equation of gradually varied flow. CO1- U
4. Classify the channel bottom slopes CO1- U
5. What are the uses of formation of hydraulic jump in a channel? CO1- U
6. Write the expression for hydraulic jump? CO1- U
7. Draw typical velocity triangles for inlet and outlet of Pelton Wheel. CO1- U
8. What is a draft tube? In which type of turbines it is mostly used? CO1- U
9. What are air vessels? State their purpose. CO2-App
10. Why cavitation is considered as undesirable phenomenon in pumps? CO1- U

PART – B (5 x 16= 80 Marks)

11. (a) The most cost-effective trapezoidal channel with a side slope of 1 horizontal to 2 vertical and a bed slope of 0.0066 should be used to determine the discharge. The area is 120 m^2 in size. Find out the section's dimensions. Should C equal 50. CO2- App (16)

Or

- (b) Water flows at rate of $20 \text{ m}^3/\text{sec}$ in a rectangular channel 14 m wide at a velocity of 1.8 m/sec. Determine the specific energy of flowing water, critical velocity and minimum specific energy. Corresponding to the discharge, the Froude number and 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 2 m wide, is 1.2 m. 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 whether the second section is located downstream or upstream with respect to the first section. CO4-Ana (16)
- Or
- (b) The bed level of a short length of a 4 m wide, rectangular open channel rises at a slope of 1 in 25000 along the direction of flow. It has a $5 \text{ m}^3/\text{s}$ discharge capacity and a 0.03 Manning's roughness coefficient. This reach's flow is progressively changing. This reach's depth of flow was measured to be 0.4 meters at one point. Find the water depth's rate of change with distance at this section, dy/dx . Assume g is equal to 20 m/s^2 . CO4-Ana (16)
13. (a) The water's depth changes from 0.5 meters to 0.7 meters during an experiment on a hydraulic leap in a rectangular open channel that is 0.8 meters wide. Enumerate the head loss resulting from the development of hydraulic jumps and the discharge in the channel. CO3- App (16)
- Or
- (b) If in a hydraulic jump occurring in a horizontal rectangular channel, the Fr before the jump is 20 and the energy loss is 4 m. Estimate the i) sequent depth ii) the discharge intensity and iii) the Froude number after the jump CO3- App (16)
14. (a) A Pelton wheel is to be designed for the following specifications. Power = 735.75 kW S.P. Head = 200m, Speed = 800 r.p.m. $\eta_0 = 0.86$ and jet diameter is not to exceed one-tenth the wheel diameter. Determine i). Wheel diameter ii). The number of jets required and iii). Diameter of the jet. Take $C_v = 0.98$ and speed ratio = 0.45 CO3- App (16)
- Or

- (b) A Kaplan turbine is to be designed to develop 20000 kW .The net available head is 35 m.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. CO3- App (16)
15. (a) In an industry, it is expected to transfer high pressure liquid from chamber to another in high velocity. Suggest a suitable pump system and discuss about its principles, working with neat sketch. CO1- U (16)
- Or
- (b) What is difference between Pump head & Discharge Pressure? CO1- U (16)
How to Convert discharge pressure into head?

