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Reg. No. :

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

Civil Engineering

19UCE406 - Applied Hydraulic Engineering

(Regulations 2019)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. A rectangular open channel carries a discharge of 15 m^3/s when the depth of flow is 1.5 m and the bed slope is 1: 1440. What will be the discharge through the channel at the same depth if the slope would have been 1:1000?   CO2- App

   a) 21.6 m^3/s   b) 18 m^3/s   c) 14.4 m^3/s   d) 12.5 m^3/s

2. A sluice gate opening in a canal is shown in the fig. Identify the shape of water surface profiles at X, Y and Z will be respectively. (NDL = Normal Depth Line, CDL – Critical Depth Line, HJ = Hydraulic Jump)   CO3-Ana
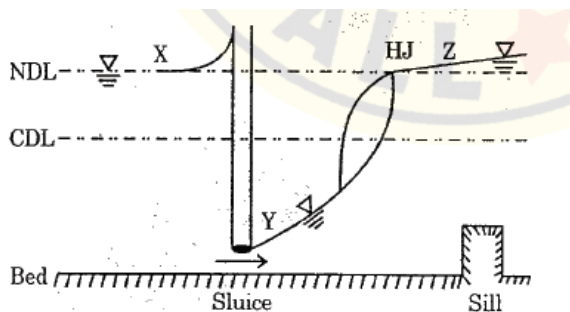
   (a) M1,M3, and M1   (b) M2.M3 and M2   (c) S1,S3and S2   (d) H2.S3 and S1

3. Hydraulic jump is used for…………..   CO1-U

   (a) increasing the depth of flow   (b) reducing the energy of flow

   (c) decreasing the velocity of flow   (d) reducing turbulence

4. Inlet velocity triangle for Pelton Wheel is   CO1-U

   (a) Right angle Triangle   (b) Equilateral Triangle

   (c) Straight line   (d) None of the above

5. A hydraulic machine which converts Mechanical energy into Hydraulic energy is called as   CO1-U

    (a) Pump   (b) Turbine   (c) Rotor   (d) Runner

<div align="center">PART – B (5 x 3= 15 Marks)</div>

6. Define Specific Energy with neat sketch   CO1- U

7. What is a drawdown curve and backwater curve?   CO1- U

8. Define impulse momentum principle.   CO1- U

9. What are reaction turbines? Give example.   CO1- U

10. Define Priming of pump.   CO1- U

<div align="center">PART – C (5 x 16= 80 Marks)</div>

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)

<div align="center">Or</div>

    (b) The discharge of water through a rectangular channel of width 8 m, is 15 m^3/s, when depth of flow of water is 1.2m. Calculate   CO2- App   (16)

         i) Specific energy of the flowing water

         ii) Critical Depth and Critical Velocity

     iii) Value of minimum specific energy

12. (a) Find differential Dynamic equation of gradually varied flow by applying the suitable assumptions   CO2- App   (16)

<div align="center">Or</div>

    (b) 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)

13. (a) The depth of flow of water at a certain section of a rectangular section 2m wide is 0.25m.The discharge through the channel is 1.8m^3 /sec. Determine whether a hydraulic jump will occur and if so, determine its height and loss of energy per Kg of water.   CO2- App   (16)

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   (b)   A spillway discharges a flood flow at a rate of 7.75 cumecs /m   CO2- App   (16)
width. At the downstream horizontal apron the depth of flow was
found to be 0.5 m. What tail water depth is needed to form a
hydraulic jump? If a jump is formed, examine its type, length,
head loss and energy loss as a percentage of the initial energy.

14.   (a)   A Pelton wheel is to be designed for the following specifications.   CO4-App   (16)
Power = 735.75 kW S.P. Head = 200m, Speed = 800 r.p.m. η_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

   (b)   A Kaplan turbine is to be designed to develop 9000KW .The net   CO4- App   (16)
available head is 5.6m.The speed ratio is 2.09 and the flow is
0.68.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.

15.   (a)   A Double acting reciprocating pump running at 40 rpm delivers   CO4- App   (16)
1 m^3/sec water. The pump has a stroke length of 400mm and
diameter of the plunger is 200 mm. The delivery and suction
head are 20 m and 5 m respectively. Determine the theoretical
discharge, slip, percentage slip, coefficient of discharge and the
power required to derive the pump.

   (b)   In an industry, it is expected to transfer high pressure liquid from   CO4- App   (16)
chamber to another in high velocity. Suggest a suitable pump
system and discuss about its principles, working with neat
sketch.

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