Code No: 155SB **RA**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, August - 2022
HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

1.a) Differentiate between the most efficient rectangular channel section and trapezoidal channel section.
b) Write down all the characteristics of the critical state of flow through a channel section. [9+6]

2.a) Derive an expression for the discharge through a channel by Chezy's formula.
b) In a rectangular channel, there occurs a jump corresponding to $f_r = 2.5$. Determine critical depth and head loss interms of initial depth y_1. [8+7]

3.a) Describe the characteristics of surface profiles.
b) A hydraulic jump occurs in a 90^0 triangular channel. Derive an equation relating the two depths and the flow rate. If the depths before and after the jump in the above channel are 0.5 m and 1.0 m, determine the flow rate and obtain the Froude numbers before and after the jump. [8+7]

4.a) Compare the characteristics of surface profile in Mild-Sloped channels and Steep-Sloped channels.
b) Write the two dynamic equations for representing Gradually Varied Flow (GVF) in a wide rectangular channel. [9+6]

5. Explain Buckingham's pi method of dimensional analysis with a suitable example. [15]

6. A 50 mm diameter jet having a velocity of 25 m/s, strikes a flat plate, the normal of which is inclined at 30 degrees to the axis of the jet. Calculate the normal force exerted on the plate.
a) When the plate is stationary.
b) When the plate is moving with a velocity of 10 m/s in the direction of the jet.
c) When the plate is moving with a velocity of 8 m/s parallel to itself and in the direction of the normal to its surface. Also, find the work done and the efficiency of the jet when the plane is moving. [15]

7.a) Explain the ways in which the head acting on a turbine can be defined.
b) Write in brief the expressions for the critical cavitation factor for turbines and explain how Thoma's cavitation factor can be used to reduce the cavitation in turbines. [10+5]

8. Water is pumped from a low-level reservoir through the main pipe pipeline of 0.45 m diameter and 1400 m length. The pump is located at the low-level reservoir. At a point along the main line at a distance of 450 m from the high-level reservoir, a branch line of 0.3 m diameter and 360 m length takes off to discharge 180 l/s in the atmosphere.
Level of water surface in high-level reservoir = + 30.00 m
Level of water in the open end of the 0.3 m diameter branch line = 25.50 m
Level of water in the low-level reservoir = 18.00 m
Darcy's frictional coefficient for both pipes = 0.032
Determine the flow rate into the high-level reservoir and the theoretical power of the pump assuming the delivery valve of the pump to be at + 20.00 m. [15]

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