Code No: 154BA **R18**

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

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

Answer any five questions
All questions carry equal marks
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1.a) Derive the relationship between Manning's and Chezy's constants.
b) A 3.6 m wide rectangular channel carries water to a depth of 1.8 m. In order to measure the discharge, the channel width is reduced to 2.4 m and a hump of 0.3 m height is provided at the bottom. Calculate the discharge if water surface in the contracted section drops by 0.15 m. Assume no losses. [7+8]

2. Explain the following:
a) Most economical sections
b) Specific energy
c) Classification of open channels. [5+5+5]

3. Explain the stepwise procedure for computing of Gradually Varied Flow (GVF) by standard step method. Show the necessary figures and tables required for the computations. [15]

4.a) Distinguish between : (i) rapidly varied flow and spatially varied flow, and (ii) Prismatic and non-prismatic channels.
b) Determine the approximate water surface slope (m/km) at a point in a rectangular channel in which the discharge is 0.84 cumec, the bed-width is 3 m, the depth of flow, and the bed slope is 0.15 m/km. Assume C in Chezy's formula as 55 and take the energy coefficient α equal to unity. [7+8]

5.a) The efficiency η of a fan depends on density ρ and viscosity μ of fluid, angular velocity ω, diameter D and discharge Q. Obtain a functional relationship for η in terms of dimensionless parameters.
b) A distorted model of a rectangular channel of best cross section is made with horizontal and vertical scale ratios L_r and D_r respectively. Show that the velocity ratio $V_r = \left[\left(D_r^{\frac{7}{6}}\right) \div \left(n_r L_r^{\frac{1}{2}}\right)\right]$. [7+8]

6.a) Discuss the analysis of force exerted by fluid jet on a moving flat plate, when the plate is normal to the jet.
b) A jet having a velocity V strikes a single curved vane moving in the same direction as the jet with velocity u, so that the velocity of the jet relative to the vane is $(V - u)$. The vane causes the jet to be reversed in direction. Show that the maximum efficiency is obtained when $V = 3u$ and that this maximum efficiency is slightly less than 0.6. [7+8]

7.a) What do you understand by governing of hydraulic turbines? Explain with sketches the working of an oil pressure governor.

b) Briefly explain the various considerations in the selection of a proper type of turbine for a hydroelectric station, indicating also the conditions where a particular type of turbine is suitable. [7+8]

8.a) How do you estimate the hydropower potential of a region? Explain.

b) A centrifugal pump is required to deliver 280 liters of water per second against a head of 16 m. If the vanes of the impeller are radial at outlet and the velocity of flow is constant and equal to 2 m/s, find the proportions of the pump. Assume η_{mano} = 80% and the ratio of breadth to diameter at outlet as 0.1. [7+8]

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