Code No: 155SB **RA**

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

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

Answer any five questions
All questions carry equal marks

1.a) In a rectangular channel 3.5 m wide laid at a slope of 0.0036, uniform flow occurs at a depth of 2 m. Find how high can the hump be raised without causing afflux? If the upstream depth of flow is to be raised to 2.5 m, what should be the height of the hump? Take Manning's n equal to 0.015.
b) Describe critical flow in rectangular channels and derive the equation for critical flow. [9+6]

2.a) Describe the different types of flows in channels and explain their significance.
b) Elaborate on the methods used to determine the velocity of flow in channels. [9+6]

3.a) Briefly discuss the various categories into which the channel bottom slopes are classified.
b) A rectangular flume 2 m wide carries discharge at the rate of 2 m^3/s. The bed slope of the flume is 0.0004. At a certain section the depth of flow is 1 m. Calculate the distance of the section downstream where the depth of flow is 0.9 m. Solve by single-step method. Assume rugosity coefficient as 0.014. Is the slope of the channel mild or steep? How is this type of surface profile classified? [7+8]

4. Describe the various methods developed for integrating the varied flow equation. [15]

5. A jet of water 50 mm in diameter having a velocity of 20 m/s, impinges tangentially on a series of vanes, which when stationary deflect the jet through an angle of 120^0. Calculate the magnitude of the resultant force on the vanes when they are (a) stationary, (b) moving with a velocity of 10 m/s in the same direction as the jet. Also determine the work done per second and the efficiency in case (b). [15]

6. A Pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at a rate of 750 litres per second under a head of 35 m. If the bucket deflects the jet through an angle of 160^0, find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98 N. Neglect friction in the bucket. Also, determine the overall efficiency of the turbine if its mechanical efficiency is 80%. [15]

7.a) A pump operates at a maximum efficiency of 82% and delivers 2.25 m^3/s under a head of 18 m while running at 3600 rpm speed. Compute the specific speed of the pump. Also determine the discharge, head and power input to pump at a shaft speed of 2400 rpm. Cite the assumptions made, if any.
b) Define heads, losses, power and efficiencies associated with centrifugal pumps. [9+6]

8. What are the components of a hydropower plant and elaborate on the classification of hydropower plant based on the availability of water flow? [15]

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