Code No: 154BA

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, March - 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 uniform and non-uniform flow. Write a short note on velocity distribution in open channel flow?
b) Determine the economical cross-section for an open channel of trapezoidal section with side slopes of 1 vertical to 2 horizontal, to carry 10 m^3/s, the bed slope being 1/2000. Assume Manning coefficient as 0.022. [7+8]

2.a) When do you call the flows as critical, sub critical and super critical flows? Explain.
b) The depth of flow of water at a certain section of a rectangular channel of 2 m wide is 0.3 m. The discharge through the channel is 1.5 m^3/s. Find whether a hydraulic jump will occur and if so find its height and loss of energy per kg of water. [8+7]

3.a) Explain the term Rapidly Varying Flow (RVF) with a neat sketch in open channels.
b) A rectangular channel carries a discharge of 3 m^3/s per meter width. If the loss of energy in hydraulic jump is found to be 2.85 m, determine the conjugate depths before and after the jump. [7+8]

4.a) Derive the differential equation for steady gradually varied flow open Channels and list all assumptions?
b) Derive an expression for the depth of hydraulic jump in terms of upstream Froude number. [8+7]

5.a) What do you mean by a distorted model? Why models of rivers and harbours are made as distorted models?
b) A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find: i) The force on the Plate ii) The work done and iii) The efficiency of jet. [7+8]

6.a) Describe the Rayleigh's method for dimensional analysis with example.
b) A jet of water having a velocity of 30 m/s impinges on a series of vanes with a velocity of 15 m/s. The jet makes an angle of 35^0 to the direction of motion of vanes when entering and leaves at an angle of 120^0. Sketch velocity triangles at entrance and exit and determine the vane angles so that the water enters and leaves without shock. [8+7]

7.a) Define the term governing of turbines? Describe with a neat sketch the working mechanism of Pelton wheel.

b) A reaction turbine works at 550 r.p.m under a head of 120 m. the diameter of turbine at inlet is 110 cm and flow area is 0.38 m^2 The angles made by absolute and relative velocities at inlet are 18 ^{0} and 55 ^{0} respectively with the tangential velocity, determine: i) The volume rate of flow ii) The power developed iii) Efficiency, assume whirl at outlet to be zero. [7+8]

8.a) What are hydro-electric power plants? Also give the advantages and disadvantages.

b) The following data relate to a proposed hydro-electric station. Available head = 26 m, catchment area = 410 sq.km, rainfall = 130 cm/year, percentage of total rainfall utilized = 66%, penstock efficiency = 95%, turbine efficiency = 83%, generator efficiency = 88% and load factor = 46%. Calculate the power developed. [8+7]

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