Code No: 155SB **RA**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a)	What do you mean by Specific energy?	[2]
b)	Write Chezy's, and Manning's formula.	[3]
c)	Why is a bed slope provided for an open channel?	[2]
d)	What are the various types of flow in open channels?	[3]
e)	Define the terms dimensional analysis and model analysis.	[2]
f)	List the various model laws applied in model analysis.	[3]
g)	What is penstock?	[2]
h)	Define the terms 'unit power', 'unit speed' and 'unit discharge'.	[3]
i)	Define specific speed of a centrifugal pump.	[2]
j)	Give any three advantages of hydroelectric power plants.	[3]

PART – B

(50 Marks)

2.a) Derive the condition for most efficient Trapezoidal channel section for uniform flow.
b) The specific energy for a 6 m wide rectangular channel is to be 5 kg-m/kg. If the rate of flow of water through the channel is 24 m^2/s. Determine the alternate depth of flow? [5+5]

OR

3.a) Discuss velocity distribution in an open channel flow in detail.
b) A triangular channel has an apex angle of 600 and carries a flow with a velocity of 2.0 m/s and depth of 1.25 m. (i) Is the flow sub-critical or supercritical? (ii) What is the specific energy at critical depth? [5+5]

4.a) Write classification and characteristics of Surface profiles in detail.
b) Explain how the hydraulic jump forms in detail? [5+5]

OR

5.a) What type of GVF Profiles will be obtained when the bed is horizontal? Explain.
b) Find an expression for loss of energy head for a hydraulic jump. [5+5]

6.a) What is meant by geometric, kinematic and dynamic similarities? Are these similarities truly attainable? If not why?

b) A jet of water impinges on a symmetrically curved vane at its center. The velocity of the jet is 65 m/s and the diameter 125 mm. the jet is deflected through an angle of 120^0 Calculate the force on the vane if the vane is fixed. Also determine the force if the vane moves with a velocity of 30 m/s in the direction of the jet. What will be the power and efficiency? [5+5]

OR

7.a) What are the different laws on which models are designed for dynamic similarity? Where are they used?

b) Show that in case of jet striking the flat plates mounted on wheel, the efficiency will be maximum when the tangential velocity of wheel is half of the jet. [5+5]

8.a) What do you understand by the characteristic curves of a turbine? Name the important types of characteristics curves?

b) A Kaplan turbine produces 60000 kW under a net head of 25 m with an overall efficiency of 90%. Taking the value of speed ratio is 1.6 and flow ratio is 0.5 and the hub diameter as 0.35 times the outer diameter. Find the diameter and speed of the turbine. [5+5]

OR

9.a) Define the specific speed of a turbine? Derive an expression for the specific speed and what is its significance?

b) An inward flow reaction turbine has an external diameter of 1 m and its breadth at inlet is 200 mm. If the velocity of flow at inlet is 1.5 m/s, find the mass of water passing through the turbine per second. Assume 15% of the area of flow is blocked by blade thickness. If the speed of the runner is 200 r.p.m. and guide blade makes an angle of 15^0 to the wheel tangent, draw the inlet velocity triangle and find: (i) The runner vane angle at inlet (ii) Velocity of wheel at inlet, (iii) The absolute velocity of water leaving the guide vanes and (iv) The relative velocity of water entering the runner blade. [5+5]

10.a) What are the main components of hydropower plants and explain each in detail.

b) The impeller of centrifugal pump is 1m in diameter and rotates at 1500 rpm. The blades are curved backward and make an angle of 30^0 to the tangent at the periphery. Calculate the power required if the velocity of flow at outlet is 20m/s. Determine the head to which water can be lifted when a diffuser casing reduces the outlet velocity to 60%. [5+5]

OR

11.a) Briefly explain the classification of power plants based on the storage characteristics.

b) Derive the expression for minimum starting speed of a centrifugal pump. [5+5]

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