Code No: 114AA **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, September/October - 2023
HYDRAULICS AND HYRAULIC 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)	Define hydraulic jump.	[2]
b)	Compare uniform and non-uniform flow.	[3]
c)	Define model and prototype.	[2]
d)	List any three uses of dimensional analysis.	[3]
e)	Define angular momentum principle.	[2]
f)	Draw inlet and outlet velocity triangles.	[3]
g)	Write the uses of draft tube.	[2]
h)	Draw Pelton wheel and list out components.	[3]
i)	Define load factor.	[2]
j)	Classify hydropower plants.	[3]

PART - B

(50 Marks)

2. Explain briefly the following:
a) Uniform and Non-Uniform flows
b) Laminar and turbulent flows
c) Steady and unsteady flows
d) Subcritical and Supercritical flows. [10]

OR

3.a) State the following formulae for the values of C:
i) Bazin's formula,
ii) Kutter's formula
iii) Manning's formula.

b) What do you mean by 'Most-economical section' of an open channel? How is it determined? [5+5]

4. Describe Buckingham's method or π-theorem to formulate a dimensionally homogeneous equation between the various physical quantities effecting a certain phenomenon. [10]

OR

5. The performance of a spillway of an irrigation project is to be studied by means of a model constructed to a scale of 1: 9, neglecting the viscous and surface tension effects, determine: (a) Rate of flow in model for a prototype discharge of 1200 m^3/s; (b) The dissipation of energy in the prototype hydraulic jump, if the jump in the model dissipates 0.25 kW. [10]

6. A jet of water having a velocity of 45 m/s impinges without shock on a series of vanes moving at 15 m/s. The direction of motion of the vanes is inclined at 20^0 to that of jet The relative velocity at outlet is 0.9 of that at inlet, and absolute velocity of water at exit is to be no to the motion of vanes. Find: (a) Vane angles at inlet and outlet, (b) Work done on vanes per N (newton) of water supplied by the jet, and (c) Hydraulic efficiency. [10]

OR

7. Show that the force exerted by a jet of water on moving inclined plate in the direction of jet is given by $F_x = \rho a (V-u)^2 \sin^2 \theta$ where, a = Area of jet, V = Velocity of the jet, and θ = Inclination of the plate with the jet. [10]

8.a) Derive an expression for hydraulic efficiency of a Pelton wheel.
b) What is governing and how it is accomplished for different types of water turbines? [5+5]

OR

9. A turbine is to operate under a head of 25m at 200 r.p.m. The discharge is 9 m^3/s. If the efficiency is 90 percent determine the performance of the turbine under a head of 20m. [10]

10.a) Define the terms Static head, Manometric head, and Total head.
b) How are small and large centrifugal pumps primed? [5+5]

OR

11. A centrifugal pump working in a dock pump 1565 litres per second against a mean lift of 6.1m when the impeller rotates at 200 r.p.m. The impeller diameter is 1.22m and the area at outer periphery is 6450 cm^2. If the vanes are set back at an angle of 26^0 at the outlet determine (a) Hydraulic efficiency, (b) Power required to drive the pump, and (c) Minimum speed to start pumping if the ratio of external to internal diameter is 2. [10]

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