Code No: 154BA **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, April/May - 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 is meant by super critical flow?	[2]
b)	Define specific energy and state its importance in open channel flow.	[3]
c)	Define non uniform flow.	[2]
d)	Classify the channel bottom slopes.	[3]
e)	Define model. What is its importance in dimensional analysis?	[2]
f)	List the applications of impact of jets.	[3]
g)	Define hydraulic efficiency and mechanical efficiency of turbine.	[2]
h)	List out the functions of draft tube.	[3]
i)	Define specific speed of the pump.	[2]
j)	State the importance of load factor.	[3]

PART – B

(50 Marks)

2.a) Derive the expression of critical depth for Triangular Channel.
b) Explain in detail the types of flows in open channel. [5+5]

OR

3.a) Derive the condition for a most economical rectangular channel.
b) A concrete channel with slope 0.001 is to be designed to carry a flow, assuming the manning roughness constant as 0.015. (i) If the cross-section of the channel is square with sides 2 m determine the flow rate. (ii) If the cross-section of the channel is semi-circular with diameter 2 m, what will be the flow rate? [5+5]

4.a) Define Hydraulic Jump. Derive the expression for power dissipated in Hydraulic jump in Rectangular Channel.
b) Derive the basic equation for Gradually Varied flow in open channel. [5+5]

OR

5. A hydraulic jump occurs downstream of a sluice gate. If the flow depth ahead of the jump is 1.5 m and Froude number downstream of the jump is 0.29, (a) determine the flow depth after the jump, (b) the Froude number ahead of the jump. (c) If the gate is 15 m wide, determine the power dissipated in the jump. [10]

6. Explain the Buckingham Π theorem to form the dimensionless numbers. [10]

OR

7. A jet of water coming out of nozzle at a velocity of 40 m/s strikes to a series of vanes without the shock which are moving with a velocity of 20m/s. The direction of jet 15 ^{0} to the motion of vanes. The relative velocity of jet at outlet is 0.8 of relative velocity at inlet. The absolute velocity of jet at outlet is normal to the motion of vanes. Find (a) the inlet and exit vanes angles (b) work done per kg and efficiency of system. [5+5]

8. A Kaplan turbine is to develop 2400 KW when running at 240 rpm under a net head of 49m. In order to predict its performance a model of scale 1:5 is tested under a net head of 25m. At what speed should the model run and what power would it develop. Determine the discharge in the model and in full scale turbine if the overall efficiency of the model is 85%. [10]

OR

9.a) Derive the expressions for unit head, unit speed, unit power and Specific speed of the turbine

b) Explain the phenomenon of cavitation why it is prominent in reaction turbines? [5+5]

10.a) A single acting reciprocating pump has a 15 cm piston with a crank of radius 15 cm. The delivery pipe is 10 cm diameter. At a speed of 60 rpm, 310 liter/min of water is lifted to a total height of 15 m. Find the slip, coefficient of discharge and theoretical power in kW required to drive the pump.

b) What is priming of a centrifugal pump? Why is it necessary? [5+5]

OR

11. A centrifugal pump discharges 0.2 m^3/s of water at head of 25 m when running at a speed of 1400 rpm. The manometric efficiency is 80%. If the impeller has an outer diameter of 30 cm and width of 5 cm, determine the vane angle at the outlet. [10]

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