Code No: 134BA **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, September/October - 2023
FLUID MECHANICS - II
(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) List out various hydraulic jump. [2]
b) Compare uniform and non-uniform flow. [3]
c) Define geometric similarities. [2]
d) Define Reynold's number and Mach number. [3]
e) Explain impact of jet on moving flat plate. [2]
f) List out applications impulse turbine. [3]
g) Draw draft tube and write down its uses. [2]
h) Draw the cross section of a Pelton wheel along with its components. [3]
i) Compare system characteristic curve and pump characteristic curves. [2]
j) Draw the indicator diagram and explain. [3]

PART – B

(50 Marks)

2.a) Explain the significance of channels of most efficient section.
b) A channel carries a discharge of 5 cumec with a flow depth 1 m. The side slopes are 1 to 1 and bed slope 1 in 3520. Find the bed width and the velocity. The values of Chezy's C for this channel for different values of hydraulic radius R are as tabulated below. [4+6]

Hydraulic Radius R	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4
Chezy's C	34	35	37	38	39	40	41	41

OR

3. State and discuss the assumptions made in the derivation of the dynamic equation for gradually varied flow. Starting from first principles derive equations for the slope of the water surface in gradually varied flow with respect to
a) Channel bed,
b) Horizontal. [10]

4. A spillway model is to be made to a scale of 1/25 across a flume which is 0.5 m wide. The prototype is 15 m high and the maximum head expected is 2 m.
a) What height of model and what head on model should be used?
b) If flow over the model at 60 mm head is 0.02 m^3/s, what flow per metre length of prototype may be expected?
c) If the model shows a measured hydraulic jump of 30 mm, how high is jump in prototype? [10]

OR

5. Explain the following:
a) Distorted model
b) Non-distorted model
c) Scale effect. [3+3+4]

6. A jet of water having a velocity of 45 m/s impinges without shock a series of vanes moving at 15 m/s, the direction of motion of the vanes being inclined at 20° to that of the jet. The relative velocity at outlet is 0.9 of that at inlet, and the absolute velocity of the water at exit is to be normal to motion of the vanes. Find: (a) vane angles at entrance and exit; (b) work done on vanes per unit weight of water supplied by the jet; and (c) the hydraulic efficiency. [10]

OR

7.a) A jet of water moving at 20 m/s impinges on a symmetrical curved vane shaped to deflect the jet through 120^0 (that is the vane angles θ and φ are each equal to 30^0. If the vane is moving at 5 m/s, find the angle of the jet so that there is no shock at inlet. Also determine the absolute velocity of exit in magnitude and direction, and the work done.

b) A jet having a velocity V strikes a single curved vane moving in the same direction as the jet with velocity u, so that the velocity of the jet relative to the vane is (V-u). The vane causes the jet to be reversed in direction. Show that the maximum efficiency is obtained when, V = 3u and that this maximum efficiency is slightly less than 0.6. [5+5]

8. A Francis turbine supplied through a 6 m diameter penstock has the following particulars:

Output of installation Flow	63500 kW
Flow	117 m^3/s
Speed	150 r.p.m
Hydraulic efficiency	92%
Mean diameter of turbine at entry	4 m
Mean blade height at entry	1 m
Entry diameter of draft tube	4.2 m
Velocity in tail race	2.4 m/s

The static pressure head in the penstock measured just before entry to the runner is 57.4 m. The point of measurement is 3 m above the level of the tail race. The loss in the draft tube is equivalent to 30% of the velocity head at entry to it. The exit plane of the runner is 2 m above the tail race and the flow leaves the runner without swirl. Determine:
a) The overall efficiency,
b) The direction of flow relative to the runner at inlet,
c) The pressure head at entry to the draft tube. [10]

OR

9.a) What is meant by cavitation? What is Thoma's cavitation factor, and what is its significance for water turbines?

b) What are the characteristic curves of a hydraulic turbine? How are they useful to practical Engineer? How are small scale models useful in obtaining these curves for a proposed turbine of a hydroelectric installation? [5+5]

10. What is an indicator diagram of a reciprocating pump? Sketch the theoretical indicator diagram for a single-acting reciprocating pump not fitted with an air vessel. With the help of the diagram explain clearly the effect of acceleration and friction on both suction and delivery strokes. How is this modified if air vessels are provided on both suction and delivery pipes? [10]

OR

11.a) Define static and manometric head of a centrifugal pump. State the different types of head losses which may occur in a pump installation.

b) What are the different efficiencies of a centrifugal pump? [5+5]

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