Code No: 134BC **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, September/October - 2023
FLUID MECHANICS AND HYDRAULIC MACHINES
(Mechanical 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 Specific volume of a fluid and write its unit.	[2]
b)	Define gauge pressure, atmospheric pressure and vacuum pressure.	[3]
c)	Distinguish between uniform and non-uniform flow.	[2]
d)	What do you understand by Continuity Equation?	[3]
e)	What are the factors influencing the frictional loss in pipe flow?	[2]
f)	List out the conditions for separation of boundary layer.	[3]
g)	List the important characteristic curves of a turbine.	[2]
h)	Define and explain hydraulic efficiency and mechanical efficiency.	[3]
i)	What is slip and when does a negative slip occur?	[2]
j)	Define specific speed of a centrifugal pump and write its formula?	[3]

PART – B

(50 Marks)

2.a) Explain the piezometer with a neat sketch and write its advantages and disadvantages.
b) The space between two square flat parallel plates is filled with oil. Each side of the plate is 750 mm. The thickness of the oil film is 18 mm. The upper plate, which moves at 3.5 m/s requires a force of 130 N to maintain the speed. Determine (i) The dynamic viscosity of the oil (ii) The kinematic viscosity of oil if the specific gravity of oil is 0.92. [5+5]

OR

3.a) Derive an expression for the pressure inside a droplet and hollow bubble.
b) Two horizontal plates are placed 1.35 cm apart. The space between them is being filled with oil of viscosity 18 poises. Examine the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s. [5+5]

4.a) Derive the continuity equation for a three-dimensional incompressible flow.
b) A 45^0 reducing bend is connected to a pipe line, the diameters at the inlet and outlet of the bend being 620 mm and 310 mm respectively. Find the force exerted by bend on water if the intensity of pressure at the inlet to bend is 8.9 N/cm^2 and rate of flow of water is 600 litres/s. [5+5]

OR

5.a) State Bernoulli's theorem for steady flow of a incompressible fluid. Derive an expression for Bernoulli's equation from first principle and state the assumption made for such a derivation.

b) A 45 cm diameter pipe, conveying water, branches into two pipes of diameters 32 cm and 22 cm respectively. If the average velocity in the 45 cm diameter pipe is 3 m/s, find the discharge in this pipe. Also determine the velocity in 22 cm pipe if the average velocity in the 32 cm diameter pipe is 2 m/s. [5+5]

6.a) Explain the principle of Venturi meter and derive the equation to find the rate of flow of water through a pipe using the same.

b) Predict the head lost due to friction in a pipe of diameter 310 mm and length 55 m, through which water is flowing at a velocity of 3 m/s. Take kinematic viscosity of water is 0.01 stoke. [5+5]

OR

7.a) An orifice meter with orifice diameter 10cm is inserted in a pipe of 20cm diameter. The pressure gauges fitted upstream and downstream of $19.62 N/cm^2$ and $9.81 N/cm^2$.
Respectively co-efficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe

b) Analyze the following boundary layer parameters for the velocity distribution $u/U = (y/\delta)^{2/3}$
i) Displacement thickness, ii) Momentum thickness. [5+5]

8.a) Derive the expression for velocity triangles and work done for Pelton wheel.

b) A jet of water strikes with a velocity of 44 m/s a flat plate inclined at 30^0 with the axis of the jet. If the cross-sectional area of the jet is 30 cm^2, determine the force exerted by the jet on the plate. [5+5]

OR

9.a) Calculate the force and work-done when jet strikes moving vertical and inclined flat plate.

b) A Kaplan turbine develops 2500kW under a net head of 7.5m with an overall efficiency of 88%. It is to be fitted with blow type draft tube (draft tube efficiency 88%) having its inlet 1.8m diameter. Determine how much above or below the tail race level should the draft tube inlet be set so that vacuum pressure there does not exceed 450 mm of mercury. [5+5]

10.a) Write a note on work done by the centrifugal pump (impeller) on water.

b) A single acting reciprocating pump running at 55 r.p.m., delivers $0.11 m^3/s$ of water. The diameter of the piston is 220 mm and stroke length 420 mm. Determine the theoretical discharge of the pump, coefficient of discharge, slip and percentage slip of the pump. [5+5]

OR

11.a) Write a note on Net Positive Suction Head (NPSH).

b) What is reciprocating pump? Describe the principle and working of a reciprocating pump with a neat sketch. [5+5]

---ooOoo---