Code No: 133AV **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, September/October - 2023
FLUID MECHANICS – I
(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)	State the Pascal's law.	[2]
b)	List out the advantages and disadvantages of Manometers.	[3]
c)	Define Vorticity.	[2]
d)	Differentiate the Laminar flow and Turbulent flows of the fluid.	[3]
e)	Mention the differences between the orifices and notches in calculation of discharge of fluid flow.	[2]
f)	Mention the advantages of Broad crested weirs.	[3]
g)	What is meant by Water hammer?	[2]
h)	List out the characteristics of Laminar flow.	[3]
i)	Define Drag and Lift.	[2]
j)	Mention the characteristics of laminar boundary layer.	[3]

PART – B **(50 Marks)**

2.a) The right leg of a U-tube manometer containing mercury is open to atmosphere and the left leg is connected to a pipe through which a fluid of specific gravity 0.8 is flowing. Find out the vacuum pressure in the pipe, if the level of mercury in the left leg is 0.2m below the centre of the pipe and the difference of mercury levels in the two legs is 0.3 m.

b) A glass tube of internal diameter 4 mm is immersed in a liquid of specific gravity 12.2 and surface tension 0.55 N/m. The angle of contact with the glass is 120^0. Calculate capillary rise or depression in the tube. [5+5]

OR

3. A triangular plate of base width 1.5 m and height 2 m immersed in water with the apex downwards. The base of the plate is 1 m below and parallel to the free water surface. Calculate the total pressure on the plate and the depth of the Centre of pressure. [10]

4.a) Prove that buoyant force is equal to fluid displacement by a body.

b) A solid cylinder of 2m diameter of height 2m is floating in water with its axis vertical. If the specific gravity of the cylinder is 0.65, find its metacentric height and state whether the equilibrium is stable or unstable. [5+5]

OR

5.a) Explain the characteristics of stream function and velocity potential function.

b) A pipe, through which water is flowing, is having diameters 40 cm and 20 cm at the cross-sections 1 and 2 respectively. The velocity of water at section 1 is 5 m/s. Find the velocity head at the sections 1 and 2 and also rate of discharge. [5+5]

6. The diameters of pipe bend at the inlet and outlet are 30 cm and 15 cm and turned through 120^0 right in the vertical plane. The axis at the inlet is horizontal. The outlet is 1.5 cm below the inlet. The volume of water in the bend is 900 liters. Find the force acting on the bend when the water flow is 250 liters/second. And inlet pressure is 1.5 bar. [10]

OR

7. Describe the working of Orifice meter and also derive the expression to calculate the theoretical discharge of fluid flow. Explain the assumptions made. [10]

8.a) Derive the weisbach equation to find out the head loss due to friction of the fluid flow through the pipe.

b) Describe the Reynolds experiment for the description of the fluid flow. [5+5]

OR

9. The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300m, 170m, and 210m and of diameters 300mm, 200mm and 400mm respectively is 12m. Determine the rate of flow of water if co-efficient of friction is 0.005, 0.0052 and 0.0048 respectively. Considering: (a) minor losses (b) neglecting minor losses. [10]

10. Derive the Vonkarmen momentum integral equation representing the momentum balance across the thickness of the boundary layer. [10]

OR

11.a) Oil with a free stream velocity of 1.5m/sec flow over a thin plate 1.4 m wide and 2.2 m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity of oil as 0.80 and kinematic viscosity as 0.1 stoke.

b) The velocity distribution in the boundary layer is given by $(u/U)= (y/\delta)^{1/7}$. Determine the displacement thickness and momentum thickness. [5+5]

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