Code No: 153AX **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, December - 2019

FLUID MECHANICS

(Civil Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) How the pressure can be measured by a manometer? [2]
b) What is flow net? [2]
c) What are practical applications of Bernoulli's equation? [2]
d) What is an equivalent pipe? [2]
e) What do you mean by Laminar sub layer? [2]
f) Define the term fluid. Distinguish between liquid and gas. [3]
g) Describe assumptions and limitations of Bernoulli's theorem. [3]
h) Explain the working principle of an orifice meter. [3]
i) Define the term Vena-Contract. [3]
j) Illustrate the examples of formation of boundary layer in day to day life. [3]

PART – B

(50 Marks)

2.a) Derive expression for total pressure and Centre of pressure for a vertically immersed surface?
b) A 18 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.50 cm. Both cylinders are 28 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 Nm is required to rotate the inner cylinder at 120 rpm determine the viscosity of the fluid. [5+5]

OR

3.a) What is Viscosity? Differentiate clearly between dynamic viscosity and kinetic viscosity.
b) A wooden block 4 m × 1.2 m × 0.5 m is floating in water. Its specific gravity is 0.76. Find the volume of concrete of specific gravity 2.5, that may be placed on the block which will immerse the i) block completely in water ii) block and concrete in water. [5+5]

4.a) Write the expression for the resultant force acting between two sections of the pipe in terms of discharge using impulse-momentum principle.
b) The stream function for a dimensional flow is given by $\Psi = 2xy$. Calculate the resultant velocity at P(3,4). Also the velocity potential function φ. [5+5]

OR

5.a) Derive the Bernoulli's equation from Euler's equation of motion? Write Application of Bernoulli's theorem for steady flow of an incompressible fluid.
b) The water is flowing through a pipe having diameter 20 cm and10cm at sections 1 and 2 respectively. The rate of flow through pipe is 3.5 lits / sec. This section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm^2, find the intensity of pressure at section 2. [5+5]

6.a) What are the advantages of a triangular notch over a rectangular notch?

b) A 400 × 200 mm venturimeter is provided in a vertical pipe line carrying oil of relative density 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30 cm. The differential U tube mercury manometer shows a gauge deflection of 250 mm. calculate the discharge of oil, if the coefficient of meter is 0.98. [5+5]

OR

7.a) Derive an expression for the time required to empty a tank with a rectangular notch.

b) The diameter of pipe bend is 0.4m at inlet and 0.2m at outlet and the flow is turned through 120^0 in a vertical plane. The axis at inlet is horizontal and the centre of the outlet section is 1m below the centre of inlet section. The total volume of fluid contained in the bend is $0.09m^3$. Neglecting friction, calculate the magnitude and direction of force exerted on the bend by the water flowing through it at $0.4m^3$ /s when the inlet pressure is 140 kN/m^2. [5+5]

8.a) Derive an expression for the power transmission through the pipes. Find also the condition for maximum transmission of power?

b) The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameters 300 mm, 200 mm and 400 mm respectively, is 12m. Determine the rate of flow of water if co – efficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering: (i) minor losses also (ii) neglecting minor losses. [5+5]

OR

9.a) What are the factors influencing the frictional loss in pipe flow?

b) A pipe line of length 2000 m is used for power transmission. If 110.3625 kW power is to be transmitted through the pipe in which water having a pressure of 490.5 N/cm^2 at inlet is flowing. Find the diameter of the pipe and efficiency of transmission if the pressure drop over the length of pipe is 98.1 N/cm^2. Take f = 0.0065. [5+5]

10.a) Distinguish between local co-efficient of drag and average co-efficient of drag.

b) In a circular pipe of diameter 100 mm a fluid of viscosity 7 poise and specific gravity 1:3 is flowing. If the maximum shear stress at the wall of the pipe is 196.2 N/m^2. Find i) The pressure gradient ii) The average velocity. [5+5]

OR

11.a) Explain the characteristics of laminar and turbulent boundary layer.

b) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and u = U at $y = \delta$, where δ = boundary layer thickness. Also calculate the value of δ^*/θ. [5+5]

---ooOoo---