

# **III SEMESTER B.TECH. (CIVIL ENGINEERING)**

## END SEMESTER EXAMINATIONS, 2022-23

## SUBJECT: FLUID MECHANICS [CIE - 2151]

#### **REVISED CREDIT SYSTEM**

	Instructions to Candidates:
*	Answer <b>ALL</b> the questions.
*	Missing data, if any, may be suitably assumed.

Time: 3 Hours

# MAX. MARKS: 50

Q No		Marks	CO
1A.	What is Capillarity? Derive the expression for the Difference in pressure $(\Delta p)$ between the inside & outside of Liquid Jets, Liquid Bubbles.	03	CO1
1B.	The velocity distribution over a plate is given by $\mathbf{u} = \frac{3}{2}\mathbf{y} - \frac{1}{2}\mathbf{y}^2$ , where $\mathbf{u} = \frac{1}{2}\mathbf{v}$ velocity in m/s and y = distance from the plate boundary in m. If the viscosity of the fluid is 8 poise find the shear stress at the plate boundary and at y=0.15m from the plate.	03	CO1
1C.	Explain the <b>'Inverted U-Tube manometer'</b> with a neat sketch. A circular plate of diameter 1.5m is placed vertically in water at a certain distance below such that the total pressure acting on the plate is 52kN. Determine the distance to the center of the plate from the water surface. Also determine the position of the center of pressure.	04	CO2
2A.	State the assumptions made in the derivation of Bernouli's theorem.	03	CO3
2B.	<ul> <li>A pipe 450mm diameter branches into two pipes of diameters 300mm and 200mm respectively. If the average velocity in the 450mm diameter pipe is 3m/s, determine,</li> <li>i) Discharge in 450mm diameter pipe.</li> <li>ii) Average velocity in 200mm diameter pipe if the average velocity in the 300mm diameter pipe is 2.5m/s.</li> </ul>	03	CO3
2C.	A horizontal Venturimeter of size 300mm×150mm is used to measure the flow of water. The reading of the differential manometer is 150mm Mercury (Hg). Determine the actual discharge and the velocity of flow at inlet and throat. Take Cd=0.97.	04	CO3
3A.	Water flows through a 10 cm diameter, 30m long pipe at a rate of 1400lpm. What percent of head would be gained by replacing the central one third	05	

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.40	length of the pipe by another pipe of 20 cm diameter? Assume that the changes in section are abrupt and friction factor = $0.032$ for all pipes. Neglect entrance and exit loss but consider all other losses.		CO4
3B.	Water flows through a 20 cm diameter, 6mm thick, 800m long steel pipe at the rate of 3000 lpm. Determine the instantaneous pressure of water when a valve at the end of pipe is closed abruptly. Calculate the circumferential and longitudinal stress developed in the pipe wall. Assume bulk modulus of water is $2 \times 10^9$ N/m <sup>2</sup> and modulus of elasticity of steel is 206000 N/mm <sup>2</sup>	03	CO4
3C.	The friction factor in a laminar flow through a pipe of diameter 20cm is 0.064. What is the Reynolds number? What is the pressure gradient, if the shear stress at the boundary is $10 \text{ N/m}^2$ and how much pressure head is lost in 100m length of the pipe?	02	CO4
4A.	<ul> <li>A rectangular channel of width 2m has a Manning's roughness coefficient 0.019. Determine:</li> <li>(a) The normal slope at a normal depth of 0.5m when the discharge is 1.2 cumecs.</li> <li>(b) The critical slope and the corresponding depth when the discharge is 1.2 cumecs.</li> <li>(c) The critical slope and discharge for a depth of 0.5m.</li> </ul>	04	CO4
4B.	Determine the best dimensions of the most efficient rectangular section for an open channel to carry a discharge of 8 cumecs on a slope of 0.009. The rugosity coefficient for the channel is 0.015. What is the state of flow?	03	CO4
4C.	The depth and velocity of flow of water at the foot of a spillway in a wide rectangular channel with a horizontal floor are 0.75m and 16 m/sec respectively. Examine whether a hydraulic jump can occur. If yes, compute the Froude number and depth of flow after the jump. Also determine the efficiency of jump.	03	CO4
5A.	Discuss in detail the classification of mouthpieces.	03	CO5
5B.	A tank has two identical orifices in one of its vertical sides. The upper orifice is 1.5m below the water surface and the lower one is 3m below the water surface. Find the point at which the two jets intersect if the coefficient of velocity is 0.92 for both the orifices.	04	CO5
5C.	Water flows over a rectangular weir of 1.1m wide with a depth of 16cm and afterwards it passes through a right angled triangular notch. Find out head over the triangular notch. Take $Cd = 0.62$ for the rectangular notch and 0.59 for the triangular notch.	03	CO5