Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, 2022-23

SUBJECT: FLUID MECHANICS [CIE – 2151]

REVISED CREDIT SYSTEM

(/ /2022)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data, if any, may be suitably assumed.

Q No		Marks	CO	BT
1A.	Define the followings: a) Saturation Vapor Pressure b) Coefficient of Compressibility c) Cavitation d) Adhesion e) Wetting Liquids f) Surface Tension	03	CO1	2
1B.	The space between to square parallel plates is filled with oil. Each side of the plate is 720mm. The thickness of the oil film is 15mm. The upper plate which moves with a velocity of 3m/s requires a force of 120N to maintain this speed. Determine, i) The dynamic viscosity of the oil ii) The kinematic viscosity of the oil if the specific gravity of the oil is 0.95.	03	CO2	3
1C.	An opening of 1.25m depth and 3m width is provided on the vertical side of a tank. The water surface of the tank is 5m above the top of the opening. If the opening is closed by a plate which is held in position by 4 bolts in 4 corners, determine force in each of the bolt.	04	CO1	4
2A.	A 6m long pipe is inclined at an angle of 20° with the horizontal. The smaller section of the pipe which is at lower level is of 100mm diameter and larger section of the is of 300mm diameter. If the pipe is uniformly tapering and the velocity of water at the smaller section is 1.8m/s, determine the difference of pressure between the two sections.	04	CO3	3
2B.	In a 3-dimensional incompressible flow, the velocity components in two directions are, $\mathbf{u=x^2+y^2z^3;\ v=-(xy+yz+zx)}$. Find the missing third component if continuity equation is satisfied. Also find the velocity components at a point (1.0, 0.0, 3.0).	03	CO3	3
2C.	Water flows through a 200mm diameter pipe at the rate of $0.015m^3/s$. An orifice meter of 100mm diameter was used to measure the discharge. What is the pressure head between the upstream section and vena-contracta? Take Cc=0.6 and Cv=1.	03	CO3	4

P.T.O.

3A.	A laminar flow is taking place in a pipe of diameter of 0.4m. The maximum velocity is 2 m/s. Find the mean velocity and the radius at which this occurs. Also, calculate the velocity at 0.006m from the wall of the pipe. Sketch the velocity distribution and shear stress distribution across a section of the pipe with diameter D.	04	CO4	3
3B.	What are the factors that govern the magnitude of pressure rise in a pipe due to water hammer? A hydraulic pipeline 3.8 km long and 40 cm in dimeter is used to convey water with a velocity of 2.0 m/s. Determine the pressure growth, if the valve provided at the outflow end is closed in (i) 20 sec (ii) 3.0 sec. Consider pipe to be rigid and take bulk modulus of water K = 20×10^8 N/ m^2	03	CO4	3
3C.	A 10 cm diameter pipe has a discharge of 500 lpm. At a section, the pipe has a sudden expansion to a size of 15 cm diameter. If the pressure just upstream of the expansion is 22 kN/m^2, calculate the pressure just after the expansion. Assume the pipe to be horizontal at the expansion region.	03	CO4	3
4A.	It is necessary to maintain a tail-water depth of 2m downstream of a sluice gate. If the sluice discharges 15 m^3/s of water, what is the depth of water before the jump? The channel section is rectangular with a width of 6m and has a horizontal floor. What is the power lost in the jump? Represent this hydraulic jump with a neat sketch.	04	CO4	4
4B.	A channel of trapezoidal section has a base width of 2.4m and depth of flow of 1.2m. The side slopes of the section are 45° with horizontal. If the discharge is 8m^3/s, calculate the Froude number and specific energy. What is the state of flow?	03	CO4	4
4C.	What is meant by most economical channel? A rectangular channel is discharging water at the rate of 15cumecs with a velocity of 2.5 m/s. Design the most economical channel, if Chezy's C = 70.	03	CO4	4
5A.	Give a detailed account of the classification of orifices.	03	CO5	2
5B.	A rectangular channel 1.5m wide has a discharge of 0.2m^3/s. The discharge in this channel measured by a right angled V-notch. Find the position of the apex of the notch from the channel bed if the maximum depth of water is not to exceed 1m. Take C_d=0.62.	03	CO5	3
5C.	An external cylindrical mouthpiece of 120mm diameter is discharging water under a constant head of 6m. If Cc for the vena-contracta of the mouthpiece is 0.62 and Cd is 0.86 for the mouthpiece, find i) Discharge through mouthpiece ii) Absolute pressure head of water at vena-contracta. Take atmospheric pressure head = 10.3m of water.	04	CO5	3