Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, 2023-24

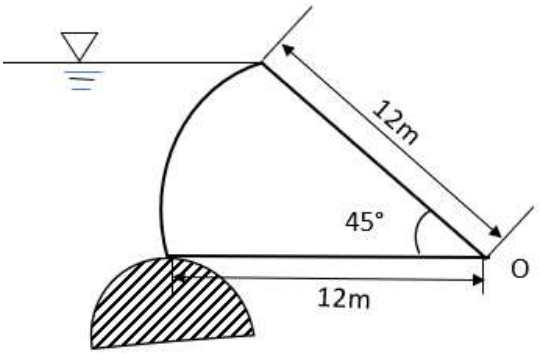
SUBJECT: **FLUID MECHANICS [CIE – 2121]**

REVISED CREDIT SYSTEM

(04 /01 /2024)

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.	Explain what do you mean by capillarity. Cite at least 4 examples where surface tension effects play a prominent role.	**03**	**CO1**	**3**
1B.	An object when immersed in water weighs 1000N, when immersed in oil of specific gravity 0.85 weighs 1150N. Determine the volume, specific gravity and weight of the body in air.	**02**	**CO1**	**3**
1C.	The tainter gate section shown in figure has a cylindrical surface with a radius of 12m. It is supported by a structural frame hinged at O. The gate is 10m long (in the direction perpendicular to the page). Determine the magnitude of the total hydrostatic force of water on the gate. 	**05**	**CO2**	**4**
2A.	A Cippoletti weir with a crest width of 400mm discharges water, the head over the crest being 250mm. If the channel of approach is 600mm wide and 450mm deep, find the discharge. Take C_d =0.62.	**03**	**CO3**	**3**
2B.	A tapering pipe of 100 m long laid such that its axis is at a slope of 2 vertical to 100 horizontal. At section A the diameter of the pipe is 200 mm while at section B it is 400mm. The section B is above the section A. The pipe carries a discharge of 500 lps of water. If the pressure gauge at A reads 125 kN/m^2 find the pressure at B in kPa. Neglect loss of energy between A and B.	**04**	**CO3**	**3**

<table>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2C.</td><td>Two velocity components are given. Find out the third velocity component such that they satisfy the continuity equation in 3 dimensions.
Given; $u = 2x^2, v = 2xyz$</td><td>03</td><td>CO3</td><td>3</td></tr>
<tr><td>3A.</td><td>Particulars of three pipes connected in parallel are given below,

<table><tr><td>Pipe</td><td>Length</td><td>Diameter</td></tr><tr><td>1</td><td>1200 m</td><td>200 mm</td></tr><tr><td>2</td><td>1400 m</td><td>250 mm</td></tr><tr><td>3</td><td>1500 m</td><td>300 mm</td></tr></table>Find the discharge in each pipe when the total discharge in the system is 0.5 m^3/sec. Assume same friction factor for all pipes.</td><td>04</td><td>CO4</td><td>3</td></tr>
<tr><td>3B.</td><td>Fluid of viscosity 0.65 N-s/m^2 and specific gravity 1.4 is flowing through a circular pipe of diameter 150 mm. The maximum shear stress at the pipe wall is given as 190 N/m^2. Find (a) the pressure gradient (b) the average velocity (c) the Reynolds number of flow.</td><td>03</td><td>CO4</td><td>3</td></tr>
<tr><td>3C.</td><td>Obtain the expression for head loss in sudden expansion in the pipe.</td><td>03</td><td>CO4</td><td>3</td></tr>
<tr><td>4A.</td><td>A 20m high water tower supplies water to a residential area by means of a 200mm diameter, 4000m long commercial steel pipe. In order to increase the discharge at the delivery point, engineers are considering the replacement of 200mm diameter pipe by a new pipe of 250 mm diameter pipe. Find the percentage increase in discharge for new pipe from the existing pipe. Take f = 0.036 for the existing pipe and f = 0.03 for the new pipe. Neglect minor losses.</td><td>03</td><td>CO4</td><td>4</td></tr>
<tr><td>4B.</td><td>Explain the phenomenon of water hammer. How is celerity associated with water hammer in pipes?</td><td>02</td><td>CO4</td><td>2</td></tr>
<tr><td>4C.</td><td>Show that in a rectangular channel
(i) Critical depth is two-third of specific energy and
(ii) Froude number at critical depth is unity.</td><td>05</td><td>CO5</td><td>3</td></tr>
<tr><td>5A.</td><td>A hydraulic jump occurs in a 2m wide rectangular channel. The depth of flow before and after the jump are 0.5m and 2m respectively. Find the discharge in the channel and the power lost due to the jump. What is the value of critical depth of flow? Determine the specific force.</td><td>04</td><td>CO5</td><td>3</td></tr>
<tr><td>5B.</td><td>A rectangular channel 7.5m wide carries 12m^3/s of water at a velocity of 1.5m/s. Find the specific energy and state of flow. Also find the depth and velocity at which the specific energy will be minimum and value of that minimum specific energy.</td><td>03</td><td>CO5</td><td>3</td></tr>
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5C.	Obtain the conditions required for a trapezoidal channel section such that it offers the least resistance to flow and hence it is able to carry maximum discharge for a given slope, area and roughness.	**03**	**CO5**	**3**