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]**

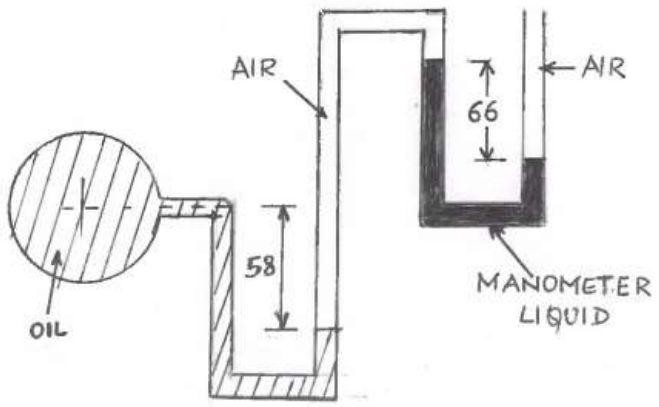
REVISED CREDIT SYSTEM

(/ /2023)

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.	Discuss the Newton's law of viscosity and obtain the expression. Give examples of its application.	**03**	**CO1**	**3**
1B.	An object having a volume of 0.18 m^3 requires a force of 265 N to keep it immersed in water and 157 N to keep it immersed in another liquid. What is the specific gravity of the liquid and weight of the body in air?	**02**	**CO1**	**3**
1C.	Why is mercury preferred in manometers as manometric liquid? A manometer as shown in figure, is installed to measure pressure in a pipe carrying oil (G=0.82). If the manometer liquid is carbon tetrachloride (G =1.60), determine the pipe pressure in meters of water column height and in kPa.  Dimensions are in cm	**05**	**CO2**	**3**
2A.	The head of water over and orifice of diameter 200mm is 20m. The water coming out from the orifice is collected in a circular tank of diameter 3m. The rise of water level in this tank is 1.5m in 20 seconds. Also the co-ordinates of a point on the jet, measured from the vena-contracta are 5.3m horizontal and 0.65m vertical. Find the co-efficients, C_d, C_v and C_c	**03**	**CO3**	**3**

2B.	Water flows up in a vertically tapering pipe of 0.6 m diameter at lower end and 0.3 m diameter at upper end which is at height of 3 m from lower end. If the pressure gauges connected in the upper and lower ends read 20 kN/m^2 and 60 kN/m^2 respectively, determine the velocity of flow at the lower end and in the upper end. Also calculate the rate of flow in lpm. (Neglect loss of energy)	**04**	**CO3**	**3**
2C.	Eulerian method is commonly adopted in Fluid Mechanics-Justify Given; $u = x^2y\,, v = 2yz - xy^2\,, w = x^2 - z^2$. Check whether three dimensional continuity equation is satisfied with these velocity components.	**03**	**CO3**	**3**
3A.	A syphon spillway is 80m long with diameter of 10cm. It is used to discharge water to a downstream reservoir 12m below the upstream reservoir. The length of pipe up to the summit is 25 m. How many pipes are needed if the total quantity of water required to be conveyed is 90 lps? What is the maximum permissible height of the summit above the water level in the upstream reservoir so that the water pressure at summit may not fall below 75kPa (vacuum)? Take f = 0.03 and neglect minor losses.	**04**	**CO4**	**3**
3B.	Viscous flow is taking place in a pipe of diameter 200mm. The maximum velocity is 3 m/sec. Find the mean velocity and the radius at which it occurs. Also calculate the velocity at 40 mm from the wall of the pipe.	**03**	**CO4**	**3**
3C.	Obtain the equation used to get the size of the equivalent pipe (Dupit's equation), required to replace number of pipes connected in series.	**03**	**CO4**	**3**
4A.	A city water company wants to transport 2880 m^3 of water per day to a plant from a reservoir 5km away. At a particular stretch, a horizontal pipe 10 cm in diameter is joined by sudden enlargement to a 15 cm diameter pipe. Report to the company, the loss of head due to abrupt expansion and the pressure difference in the two pipes.	**03**	**CO4**	**4**
4B.	Discuss the causes of water hammer. What provision is made in the hydropower plants to minimize the effects of water hammer?	**02**	**CO4**	**2**
4C.	Discuss the characteristics of critical flow in any open channel section. Obtain a relation between alternate depths (y_1 and y_2) and critical depth (y_c) for a rectangular channel section.	**05**	**CO5**	**3**
5A.	A hydraulic jump is formed in a 3m wide rectangular channel. The height of the jump is 1.5m and Froude number before the jump is 2.2. Find the (i) depths before and after the jump (ii) loss of energy	**04**	**CO5**	**3**
5B.	A 2.5m wide rectangular channel is conveying 22m^3/s of water at a depth of 1.5m. What is the other depth of flow at which this discharge can be carried with same specific energy?	**03**	**CO5**	**3**
5C.	A sufficiently deep excavation into stiff clay has side slope of 1V:1.5H and bottom slope of 1 in 1000. Design the channel to convey 11m^3/s discharge without being eroded. Take Manning's n = 0.025	**03**	**CO5**	**4**