Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (Civil Engineering) END SEMESTER EXAMINATIONS

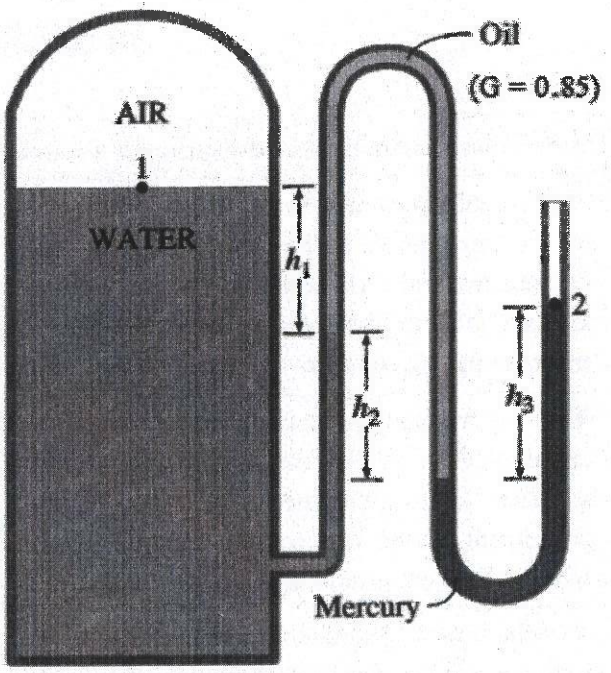
March 2021

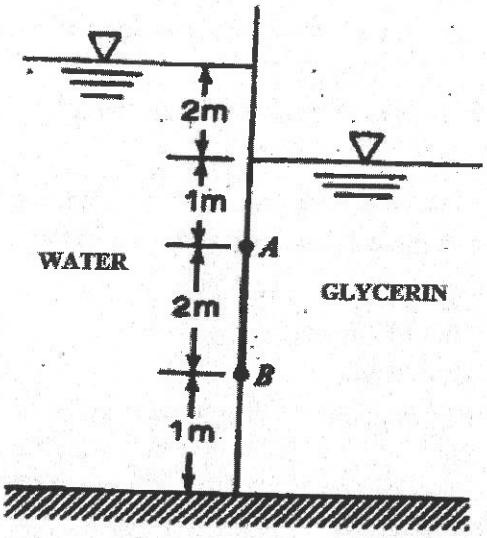
SUBJECT: CIE 2151: FLUID MECHANICS

Date of Exam:01/03/2021 Time of Exam:2.00-5.00PM Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed

1A.	Define Newton's law of viscosity. Does viscosity increase with temperature? Justify. Is poise a SI unit? If no, explain.	**3**
1B.	Express the pressure intensities of + 6 kg/cm^2 and – 3 kg/cm^2 in the following units of pressure measurement, both gauge and absolute systems. i. kPa ii. mm of mercury iii. m of water Represent their relationship diagrammatically	**4**
1C.	To measure the pressure of air in the closed water tank a compound manometer is fitted as shown in the fig. The local atmospheric pressure at the location of tank is 85.6 kPa. Determine the air pressure in the tank if, $h_1 = 0.1$ m, $h_2 = 0.2$ m, and $h_3 = 0.35$ m. 	**3**
2A.	A pipe line carrying oil of specific gravity 0.87 changes in diameter from 200 mm at a position A to 500 mm at a position B which is 4 m above A. If the pressures at A and B are 9.81 N/cm^2 and 5.89 N/cm^2 respectively and the discharge is 200 litres per second, determine the loss of head and the direction of flow	**3**

2B.	A 300 mm × 150 mm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the inlet and the throat section is 300 mm. The differential-tube mercury manometer shows a gauge deflection of 250 mm. Calculate: i. The discharge of the oil ii. The pressure difference between the entrance and the throat section. Take the coefficient of the meter as 0.98 and the specific gravity of mercury as 13.6	3
2C.	Find the net hydrostatic force per unit width on rectangular panel AB in the fig and determine its line of action with respect to the free surface of liquid. Specific weight of glycerin is 12.36 kN/m^3 	4
3A.	Derive from fundamentals the expression for Hagen Poiseuille's formula	3
3B.	A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely to atmosphere at the other end. The first 25 m of its length from the tank is 15 cm in diameter and its diameter is suddenly enlarged to 30 cm. The height of water level in the tank is 10 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.04 for both sections of the pipe	3
3C.	When a horizontal pipe line suddenly contracts from 50 cm to 25 cm, the pressure changes from 103 kN/m^2 to 67.689 kN/m^2. Calculate the rate of flow. Assume coefficient of contraction of jet to be 0.65. Following this if there is a sudden enlargement from 25 cm to 50 cm and if the pressure at 25 cm section is 67.689 kN/m^2, what will be the pressure at the 50 cm enlarged section?	4
4A.	A circular tank of diameter 5 m contains water upto a height of 6 m. The tank is provided with an orifice (C_d = 0.6) of diameter 0.5 m at the bottom. Find i. The time taken by the water to fall from 6 m to 3 m ii. To completely empty the tank iii. What will be the height of water in the tank after 1 minute	3

4B.	An external cylindrical mouthpiece of diameter 15 cm is discharging 0.2 m^3/sec of water. If C_d for the mouthpiece is 0.855 what will be the constant head under which this discharge is taking place? Also determine the absolute pressure at vena contracta if C_c for the vena contracta is 0.62 and atmospheric pressure head is 10.3 m of water	**3**
4C	Water is flowing in a rectangular channel of 1.2 m wide and 0.8 m deep. A rectangular notch (C_d = 0.60) of crest length 70 cm is used to measure the discharge through the channel. If the head over the crest is 25 cm what will be the error in the discharge measurements if i. The end contractions are neglected ii. The velocity of approach is neglected	**4**
5A.	What is hydraulic jump? List the assumptions made in the analysis of hydraulic jump. Define specific force, write the equation and draw the specific force diagram illustrating its characteristics.	**3**
5B.	The discharge of water through a rectangular channel of width 6m is 18 cumecs, when depth of flow of water is 2m. Calculate, i. Specific energy of flowing water ii. Critical depth and critical velocity iii. Value of minimum specific energy	**3**
5C.	Show that, the trapezoidal channel is most economical when i. the side length of the section is half the top width ii. the hydraulic radius is half the depth of flow iii. the shape of the channel is half hexagon	**4**

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