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# INTERNATIONAL CENTRE FOR APPLIED SCIENCES
## MAHE, MANIPAL
### B.Sc. (Applied Sciences) in Engg.
### End – Semester Theory Examinations – NOV 2021
### III SEMESTER - FLUID MECHANICS (IME 234)

**Time: 3 Hours** **Date: 26 NOV 2021** **Max. Marks: 50**

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

1A Explain various types of fluids and show them in a plot of shear stress vs. rate of shear strain.

1B Derive an expression for capillary fall.

1C In a 50 mm long journal bearing arrangement, the clearance between the two at concentric condition is 0.1 mm. The shaft is 2.0 mm in diameter and rotates at 300 rpm. The dynamic viscosity of the lubricant used is 0.01 Ns/m$^2$ and the velocity variation in the lubricant is linear. Considering the lubricant to be Newtonian, calculate the frictional torque the journal has to overcome and the corresponding power loss.

(2+3+5=10 Marks)

2A A closed tank contains water to a depth of 1 m, oil (0.8) over it to a depth of 2 m and air at the top to a depth of 1.2 m. If the vacuum gauge at the top of tank reads 10 cm of mercury (-ve pressure). Find the pressure at (i) the interface of oil and water and at (ii) the pressure at the bottom of the tank

2B Find the difference in mercury level 'h' for manometer arrangement shown in Fig 1.Sp. Gravity of liquid in pipe A = 2. Sp. gravity of liquid in pipe B = 1.5, Sp. gravity of Mercury = 13.6, Pressure at A is 20 N/cm$^2$, Pressure at B = 30 N/cm$^2$.

2C Derive an expression for total pressure and centre of pressure for inclined surface submerged in liquid.

(2+3+5=10 Marks)

3A Write continuity equation for 3-dimensional fluid flow. Deduce it for the case of steady incompressible fluid flow.

3B A pipeline carrying oil of specific gravity 0.87, changes in diameter from 250 mm diameter at a position A to 500 mm diameter at a position B which is 4 m higher than that at A. If the pressures at A and B are 1 kgf/cm$^2$ and 0.6 kgf/cm$^2$ respectively and the discharge is 200 kg/s, determine the loss of head and direction of flow.

3C State and prove Bernoulli's equation from fundamentals.

(2+3+5=10 Marks)

4A Derive an expression for actual discharge through venturimeter. How differential head can be obtained for inclined venturimenter when lighter fluid is flowing in the pipe.

4B The variable controlling the motion of a floating vessel in water are the drag force F, which depends on speed V, the length L, mass density p, dynamic viscosity μ and acceleration due to gravity g. Derive the expression or F using Buckingham's π- theorem.

(5+5=10 Marks)

5A Derive an expression for head loss due to viscous flow between two parallel fixed plates.

5B A water tank is connected with A horizontal pipeline at one end and other end discharges water freely into the atmosphere. For the first 25 m from the tank, the pipe is 150 m in diameter and its diameter suddenly enlarged to 300 mm and remains the same for another 15 m length. The height of water level in the tank is 10 m above the centre of pipe. Considering all the losses of head which occur, determine the rate of flow. Take co-efficient of friction f=0.01 for section-1 and 0.02 for section-2 of pipeline.

(5+5=10 Marks)

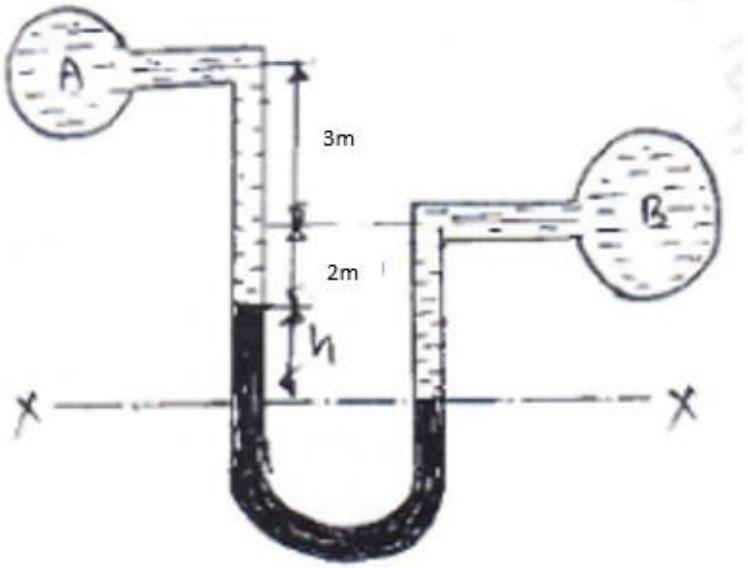


Fig.1

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