

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
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Course: CE21003
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Total Marks: NA

Properties of Fluid

- Q1) A thin plate is placed between two flat surfaces h cm apart such that the viscosity of liquids on the top and bottom of the plate are μ_1 and μ_2 , respectively. Determine the position of the thin plate such that the viscous resistance to uniform motion of the thin plate is (a) minimum (b) equal on both sides.

[Assume h to be very small].

- Q2) Classify the fluids A to D based upon the following results of a test on their rheological behavior:

Fluid	Parameter	Values in Units			
A	Shear rate $= \frac{\partial u}{\partial y} = 0$	0.5	1.0	1.5	2.0
	Shear stress $= \tau = 0$	1.0	2.0	3.0	4.0
B	Shear rate $= \frac{\partial u}{\partial y} = 0$	0.50	1.0	1.5	2.0
	Shear stress $= \tau = 0$	2	3	4	5
C	Shear rate $= \frac{\partial u}{\partial y} = 0$	0.50	1.0	1.5	2.0
	Shear stress $= \tau = 0$	0.59	1.0	1.36	1.7
D	Shear rate $= \frac{\partial u}{\partial y} = 0$	0.50	1.0	1.5	2.0
	Shear stress $= \tau = 0$	0.35	1.0	1.84	2.83
E	Shear rate $= \frac{\partial u}{\partial y} = 0$	0.50	1.0	1.5	2.0
	Shear stress $= \tau = 0$	0	0	0	0

- Q3) A plate 0.025 mm distant from a fixed plate, moves at 60 cm/s and requires a force of 2 N per unit area i.e., 2 N/m^2 to maintain this speed. Determine the fluid viscosity between the plates.
- Q4) Derive an expression for relation between pressure and surface tension for: -
- a) water droplet.
 - b) soap bubble.
- Q5) Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8 m x 0.8 m and an inclined plane with angle of inclination 30° . The weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm.