KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 2nd Year 1st Term Examination (Online), 2020

ME 2113

(Fluid Mechanics I)

Time: 1.5 Hours | Total Marks: 120

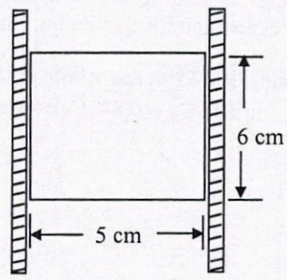
N.B.: i) Answer any TWO questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION-A

1(a) Explain no-slip boundary condition, vapor pressure and Bingham plastic. 10

1(b) Show that pressure at a point in a static fluid is independent of direction. 10

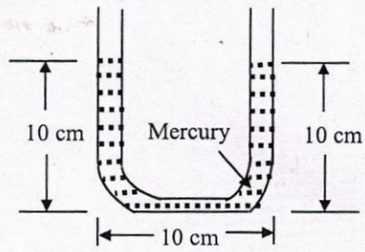
1(c) A piston of weight 21 N slides in a lubricated pipe as shown in the figure. The clearance between the piston and the pipe is 0.001 cm. If the piston decelerates at 2.1 m/s^2 when speed is 2 m/s, what is the viscosity of the oil? 10



2(a) For single column manometers, show that only one height needs to be measured for pressure measurement. 10

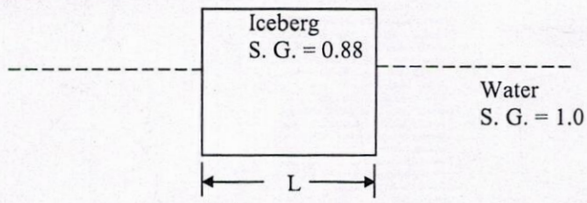
2(b) Show that hydrostatic forces on horizontal, vertical and inclined surface depend only on pressure at centroid and area of the surface when it is fully submerged in a stationary fluid? 12

2(c) The U-tube in the figure has 1 cm ID and contains mercury. If 20 cm^3 of water is poured into the right hand leg, what will the free surface height in each leg be after the sloshing has died down? 08



3(a) Explain the stability condition of partially submerged body into a stationary fluid? 10

3(b) An iceberg can be idealized as a cube of side length L, as shown in the figure. If sea water is denoted by S.G. = 1.0, then glacier ice (which form icebergs) has S.G. = 0.88. Is this cubic iceberg stable for the position shown? 10



3(c) Milk with density of 1020 kg/m^3 is transported in a level road in a 7 m long, 3 m diameter cylindrical tanker. The tanker is completely filled with milk (no air in space) and it accelerates at 2.5 m/s^2. If minimum pressure in the tanker is 100 kPa, determine the maximum pressure. 10

SECTION-B

4(a)	Derive the relation between system approach and control volume approach.	16
4(b)	Derive the Bernoulli's equation from the first principle.	14
5(a)	Show that the velocity field satisfies the continuity equation. $u = -\frac{x}{x^2+y^2}$ and $v = -\frac{y}{x^2+y^2}$	05
5(b)	Derive an expression for flow rate through a trapezoidal notch.	15
5(c)	Derive the expression for time required to empty a tank, if an orifice exists at the bottom of the tank.	10
6(a)	Describe the working procedure of measuring the flow rate by Orifice meter with neat sketch and deduce the necessary expression for calculating the flow rate.	20
6(b)	A vertical cylindrical tank of diameter 0.65 m has a hole at the bottom of 0.1 m diameter. If the initial depth of water is 3.3 m and C_d = 0.84. Calculate the time required to fall the water level to 0.6 m.	10