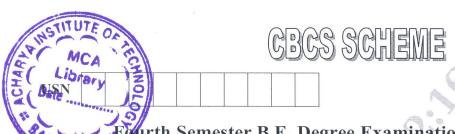
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immersed in static fluid.

Discuss on fluid pressure measuring devices.

21ME43

rth Semester B.E. Degree Examination, June/July 2023 Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

	Module-1	8	
a.	Explain the following terms:		
	(i) Total pressure (ii) Centre of pressure		
	(iii) Gauge pressure (iv) Buoyancy	(08	Marks)
b.	Derive expression for total pressure force and centre of pressure act on	a vertical	surface
	immersed in static fluid.	(08	Marks)

Explain the Eulerian and Langragian method of fluid flow analysis with suitable example. 2

(08 Marks) b. Derive the 3-dimensional flow continuity equation in cartesian coordinates. (08 Marks)

c. Calculate the velocity of fluid flow at a point (2, 3) if its 2-D flow stream function is given by $\psi = 2xy$. (04 Marks)

Module-2

Derive the Euler's equation of fluid motion and hence deduce Bernoulli's equation.

(10 Marks)

(04 Marks)

Derive an expression for discharge through venturimeter.

(10 Marks)

Derive expression for discharge through a triangular notch.

(10 Marks)

A horizontal venturimeter of 20 cm inlet diameter and 10 cm throat diameter is used to measure an oil flow. The discharge of oil through venturimeter is 60 lit/s. Calculate the reading of oil-mercury differential manometer. Take $C_d = 0.98$ and specific gravity = 0.8.

(10 Marks)

Module-3

- Derive Hagen Poiseulle equation for laminar flow through a circular pipe.
 - b. A crude oil flowing through a horizontal circular pipe of 10 cm diameter and 100 cm length. Assume laminar flow and calculate pressure drop if 100 kg oil collected in a tank in 30 seconds. Take viscosity = 0.97 N-S/m^2 and specific gravity = 0.9. (10 Marks)

Discuss the energy losses that occur in pipe flow. 6

(10 Marks)

Derive Darcy-Weisbach equation for determining loss of head due to friction.

(10 Marks)

Module-4

- Explain the following terms: 7
 - (i) Boundary layer thickness
- (ii) Streamline body
- (iii) Bluff body

(iv) Lift

(v) Drag

(10 Marks)

b. Deduce an expression for pressure drop (dp) in a pipe flow using Buckingham's π - theorem if fluid has velocity (V), viscosity (μ) and density (ρ). Consider pipe diameter (D) and length (L). (10 Marks)

OR

- 8 a. Explain the following terms:
 - (i) Reynold's number
- (ii) Froude's number
- (iii) Euler's number

- (iv) Weber's number
- (v) Mach number

(10 Marks)

- b. A flat plate 1.5 m \times 1.5 m moves at 50 km/hr in stationary air of density 1.15 kg/m³. The coefficients of drag and lift are 0.15 and 0.75 respectively. Compute:
 - (i) Lift force
 - (ii) Drag force
 - (iii) Resultant force
 - (iv) Power required to keep the plate in motion.

(10 Marks)

Module-5

- 9 a. Show that velocity of elastic wave propagation in an adiabatic medium is given by $C = \sqrt{\gamma RT} \ . \tag{10 Marks}$
 - b. A projectile travels in air of pressure 100 kPa at 10°C with a speed of 1500 km/hr. Compute the Mach number and Mach angle. Take $\gamma = 1.4$ and R = 287 J/kg-K. (10 Marks)

OR

10 a. Explain the necessity, applications and limitations of CFD.

(10 Marks)

b. A projectile travels with a speed of 1500 km/hr at 20°C temperature and 0.1 MPa air pressure. Calculate the Mach number and Mach angle. Take $\gamma = 1.4$ and R = 287 J/kg-K.

(10 Marks)
