

CBCS SCHEME

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BAU403

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2026 Fluid Mechanics and Fluid Machines

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks, L: Bloom's level, C: Course outcomes.



Module – 1				M	L	C
Q.1	a.	Define the following terms and write suitable equations. i) Relative density ii) Viscosity iii) Surface tension iv) Specific weight v) Vacuum pressure		10	L2	CO1
	b.	A shaft of 0.1 m diameter rotates at 60 rpm in a 0.2 m long bearing. Assuming that the two surfaces are separated by a distance of 0.5 mm, find the power absorbed in the bearing. Further assume linear velocity distribution in the lube oil having dynamic viscosity of 4 cP.		10	L2	CO1
OR						
Q.2	a.	With a schematic explain the principle of working of a U – tube differential manometer. Further, show how pressure difference is measured in terms of head and specific weight, say, $p_A - p_B = w_2 h_2 + w_3 (h_3 - h_2) - w_1 h_1$		10	L2	CO1
	b.	Show that the centre of pressure for a vertical plane surface is $\bar{C}_p = \frac{I_{G-G}}{A\bar{h}} + \bar{h}$ Where I_{G-G} = MOI about an axis passing through centroid G and parallel to 0-0 (ref) $\bar{h}$ = Distance between surface to C.G. (G)		10	L3	CO1
Module – 2						
Q.3	a.	Explain the method of determining metacentric height experimentally.		10	L3	CO2
	b.	With suitable sketches explain the condition of equilibrium of a body.		10	L2	CO2
OR						
Q.4	a.	The velocity components of a two dimensional flow field of an incompressible fluid is $U = \frac{y^3}{3} + 2x - x^2y \text{ and } V = xy^2 - 2y - \frac{x^3}{3}$ Show that these functions represent a possible case of an irrotational flow obtain an expression for stream function ψ .		10	L3	CO2

	b.	Define : i) Laminar and turbulent flow ii) Steady flow and unsteady flow iii) Uniform and non uniform flow iv) Rotational and irrotational flow	10	L2	CO2
Module – 3					
Q.5	a.	Starting from Euler's equation of motion deduce Bernoulli's equation. State the assumptions made. Identify the pressure head potential head and kinetic head in the above equation.	10	L2	CO3
	b.	If pump has a tapering pipe running full of water. The pipe is placed vertically with the diameter at the base and top being 1.2m and 0.6m respectively. The pressure at the upper end is 240 mm of Hg while the pressure at the lower end is 15 kPa. Assume head loss to be 20% of difference in velocity head. Calculate discharge. The flow is vertically upwards, the difference of elevation is 3.9 m.	10	L4	CO2
OR					
Q.6	a.	Sketch and explain the working of a typical horizontal venturimeter. Write its merits and demerits.	10	L2	CO2
	b.	Sketch and explain the working of a Pitot tube. Starting from Bernoulli's equation show that the velocity of the fluid particle, $V = \sqrt{2gH}$, where H is the head in 'm' of water.	10	L4	CO3
Module – 4					
Q.7	a.	Mention minor losses in pipes. Using fundamentals derive an equation for minor loss due to sudden enlargement. $h_e = k \left(1 - \frac{A_1}{A_2} \right) \frac{V_1^2}{2g}$ Where A represents area, and V represents velocity.	10	L2	CO3
	b.	If 0.25 m pipe carries an oil of specific gravity 0.8 at the rate of 120 lps and pressure at a point is 19.62 kN/m ² . If the point 'A' is 3.5 m above the datum line, calculate the total energy at point 'A' in 'm' of oil.	10	L3	CO3
OR					
Q.8	a.	Define Reynold's number. Derive velocity distribution equation for laminar flow in a round pipe. $u = -\frac{1}{4\mu} \left(\frac{dp}{dx} \right) R^2 \left[1 - \left(\frac{r}{R} \right)^2 \right]$	10	L2	CO3
	b.	Oil is to be transported from a tanker to the shore at the rate of 0.005 m ³ /s using a 30 cm diameter pipe, 20 km length. If $\mu = 0.1 \text{ Nm/s}^2$, $\rho = 900 \text{ kg/m}^3$ calculate the power required to maintain the flow. Take, $\Delta p = \frac{8\mu u L}{R^2}$	10	L3	CO2

Module – 5

Q.9	a.	Define the following dimensionless numbers : i) Froude number ii) Mach number iii) Euler number iv) Weber number v) Reynolds number	10	L2	CO4
	b.	Find the expression for power developed by a pump (P) when it depends on the head (H), discharge (Q) and specific weight (W) of the fluid, using Reyleigh method.	10	L4	CO4
OR					
Q.10	a.	With reference to a centrifugal pump, define: i) Manometric head ii) Manometric efficiency iii) Total head iv) Net positive section head.	10	L2	CO4
	b.	Derive an expression for minimum starting speed for a centrifugal pump.	10	L4	CO4
