CBCS SCHEME

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BAU403

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.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 properties of fluids with their SI units : i) Specific gravity ii) Specific volume iii) Kinematic viscosity iv) Absolute viscosity.	8	L1	CO1
	b.	Derive an expression for a capillary rise of a liquid.	6	L2	CO1
	c.	Find the kinematic viscosity of an oil having density 981 Kg/m^3. The shear stress at a point in air is 0.2452 N/m^2 and velocity gradient at that point is 0.2 per second.	6	L3	CO1
		OR			
Q.2	a.	Define the following and relate them i) Absolute pressure ii) Gauge pressure iii) Vacuum pressure iv) Atmospheric pressure	8	L1	CO1
	b.	Derive an expression for centre of pressure of the vertical plane surface submerged in a liquid.	6	L2	CO1
	c.	A U-tube manometers is used to measure the pressure of oil of specific gravity 0.85 flowing in a pipe line. Its left end is connected to the pipe and the right limb is open to the atmosphere. The center of pipe is 100 mm below the level of mercury in the right limb. If the difference of mercury level in the two limb is 160 mm, determine the absolute pressure of oil in the pipe. Take atmospheric pressure = 100 KPa.	6	L3	CO1
		Module – 2			
Q.3	a.	Define the following : i) Buoyancy ii) Meta-centre iii) Centre of gravity iv) Centre of Buoyancy.	8	L1	CO2
	b.	Derive an experimental method of finding meta-centric height of a floating body.	6	L2	CO2
	c.	A solid cylinder 2 m in diameter and 2 m high in floating in water with its axis vertical. If the specific gravity of the material of cylinder is 0.65. Find its meta-centric height. State also whether the equilibrium is stable or unstable.	6	L3	CO2

		OR			
Q.4	**a.**	Define the following : i) Steady flow ii) Laminar flow iii) Turbulent flow iv) Unsteady flow v) Non-uniform flow vi) Uniform flow.	**6**	**L1**	**CO2**
	b.	Derive continuity equation for 3-d flow in Cartesian coordinator.	**8**	**L2**	**CO2**
	c.	The stream function for a 2-d flow is $\phi = 8xy$. Calculate the velocity at (4, 5) and find the velocity potential function.	**6**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Differentiate between venturimeter and orificemeter.	**6**	**L1,2**	**CO3**
	b.	Derive Bernoulli's equation for fluid flow list the assumptions made.	**8**	**L2**	**CO3**
	c.	A horizontal venturimeter with inlet diameter 200m and throat diameter 10 cms is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60 lit/s. Find the reading of the oil mercury differential monometer. Take $C_d = 0.98$.	**6**	**L3**	**CO3**
		OR			
Q.6	**a.**	Derive an expression for actual discharge through venturimeter.	**10**	**L2**	**CO3**
	b.	Oil of specific gravity 0.9 flows through a pipe 50 mm dia. A pitot tube is introduced in the flow such that its measurement tip is at the centre of pipe and oriented such that it is facing the flow. The leads of the tube are connected to mercury manometer which shear a deflection of 100 mm. Calculate the flow rate of oil, if the coefficient of the Pitot static tube is 0.98. Assume parabolic velocity profile in the pipe.	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Derive Darcy – Weisbach equation for a fluid flow through a pipe.	**10**	**L2**	**CO4**
	b.	Determine rate of flow of water through a pipe of diameter 20 cms and length 50 m. when one end of pipe is connected to a tank and other end of pipe is open to atmosphere. The pipe is horizontal and height of water in tank is 4 m above the centre of pipe. Considered all minor losses and take coefficient of friction f = 0.009.	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Derive Hagen Poiseuille's equation for laminar flow through circular pipe.	**10**	**L2**	**CO4**
	b.	Fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through circular pipe of diameter 100 mm, maximum shear stress at pipe wall is 196.2 N/m^2. Find the pressure gradient and Reynold's number.	**10**	**L3**	**CO4**

Module – 5					
Q.9	**a.**	Define the following with expressions : i) Reynold's number ii) Fraude's number iii) Weber number iv) Mach number v) Euler's number.	**10**	**L1**	**CO5**
	b.	Using Buckingham's π - theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\,\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$ where H is the head causing the flow 'D' is diameter of orifice, μ is coefficient of viscosity, 'ρ' mass density and 'g' is the acceleration due to gravity.	**10**	**L2**	**CO5**
OR					
Q.10	**a.**	With a neat schematic diagram, explain the working of centrifugal pump.	**10**	**L1,2**	**CO5**
	b.	The mass flow rate through a turbo machine is 1 Kg/L. The fluid enters the vane at a radius of 150 mm with a velocity 300 m/s and leaves at a radius 75 mm with a velocity of 50m/s. Find the torque and state whether the machine is power generating or absorbing. If the flow direction is reversed, what will be the torque and what is the type of machine?	**10**	**L3**	**CO5**

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