CBCS SCHEME

BME403 USN

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2024

Max. Marks: 100

Time: 3 hrs.

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

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

		Module – 1	M	L	C
Q.1	a.	Define the following properties of fluids and mention their S.I. units: (i) Weight density (ii) Surface tension (iii) Kinematic viscosity (iv) Compressibility	08	L2	CO1
	b.	The space between two square parallel plates is filled with an oil of relative density 0.95. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. It requires a force of 100 N to more the upper plate at a velocity of 2.5 m/s relative to the lower fixed plate. Determine: (i) The dynamic viscosity of oil in Pa-s (ii) Kinematic viscosity of oil	08	L3	C01
	c.	The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limb is 20 cm.	04	L3	CO1
0.0		OR	0 =	¥ .	~~1
Q.2	b.	State and prove Pascal's law. Derive an expression for the total pressure and the depth of centre of pressure for a vertical surface submerged in water.	05	L2 L3	CO1
	c.	Find the total pressure and position of centre of pressure on a triangular plate of base 2 m and height of 3m which is immersed in water in such a way that the plan of the plate makes an angle of 60° with the free surface of the water. The base of the plate is parallel to water surface and at a depth of 2.5 m from water surface.	07	L3	CO1
		Module – 2	-		
		Module			
Q.3	a.	Explain different types of fluid flow.	06	L2	CO2
Q.3	a. b.		06	L2 L3	CO2
Q.3	-	Explain different types of fluid flow. Derive continuity equation in Cartesian coordinate for a fluid flow in 3			
Q.3	b.	Explain different types of fluid flow. Derive continuity equation in Cartesian coordinate for a fluid flow in 3 dimensions. The stream function for a two dimensional flow is given by $\psi=2xy$, calculate the velocity at the point $P(2, 3)$. Find the velocity potential function φ .	08	L3	CO2
Q.3 Q.4	b.	Explain different types of fluid flow. Derive continuity equation in Cartesian coordinate for a fluid flow in 3 dimensions. The stream function for a two dimensional flow is given by $\psi = 2xy$, calculate the velocity at the point P(2, 3). Find the velocity potential function ϕ . OR Show that for viscous flow through a circular pipe, the maximum velocity is twice the average velocity.	08	L3	CO2
	b.	Explain different types of fluid flow. Derive continuity equation in Cartesian coordinate for a fluid flow in 3 dimensions. The stream function for a two dimensional flow is given by $\psi=2xy$, calculate the velocity at the point P(2, 3). Find the velocity potential function ϕ . OR	08	L3	CO2

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		Module – 3	08	L3	CO3		
Q.5	a.	Obtain the Euler's equation of motion along a stream line. Obtain	00		005		
	_	Bernoulli's equation. Mention the assumption made.	06	L3	CO3		
	b.	Derive an expression for discharge through a rectangular notch. An oil of specific gravity 0.8 is flowing through a venturimeter having inlet	06	L3	CO3		
	c.	diameter 20 cm and throat diameter 10 cm. The oil-mercury differential					
		manometer shows a reading of 25 cm. Calculate the discharge of oil					
		through the horizontal venturimeter. Take $C_d = 0.98$.					
		through the norizontal venturimeter. Take of 1990.					
0.6		Derive Darcy-Weisbach equation for loss of head due to friction in pipe.	08	L3	CO3		
Q.6	a.	Derive an expression for the loss of head due to the sudden enlargement in	06	L3	CO3		
	b.						
	0	What are the energy losses that occur in pipe? Give the expressions for	06	L2	CO3		
	c.	different minor energy losses.					
		Module – 4					
0.7	0	Define the drag force and lift force. Also derive their expressions.	10	L3	CO4		
Q.7	b.	Briefly explain what is meant by boundary layer and hence define the	06	L2	CO4		
	D.	following: (i) Boundary layer thickness (ii) Displacement thickness					
	c.	Explain what is stream-lined body and bluff body.	04	L2	CO4		
	C.	OR			to		
Q.8	a.	What is dimensional homogeneity? Explain with examples.	04	L2	CO4		
Q.o	b.	What is similitude? Explain the following:	08	L2	CO4		
	ο.	(i) Geometric similarity					
		(ii) Dynamic similarity					
		(iii) Kinematic similarity					
	c.	Show by Buckingham's π theorem that the frictional torque 'T' of a disc of	08	L3	CO4		
		diameter 'D' rotating at speed N in a fluid of viscosity '\mu' and density '\rho'					
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		in a flow is given by $T = D^5 N^2 \rho \phi \left \frac{\mu}{D^2 N \rho} \right $					
0.0		Module – 5	10	L3	CO5		
Q.9	a.	Show that velocity of propagation of elastic wave in an adiabatic medium is	10	LS	COS		
		given by $C = \sqrt{KRT}$ starting from fundamentals.	10	т 2	COS		
	b.	An air plane is flying at an altitude of 15 km where the temperature is	10	L3	CO5		
		-50°C. The speed of the plane corresponds to Mach number of 1.6. Assume					
	K = 1.4 and $R = 287$ J/kgK for air, find the plane speed and Mach angle.						
		OR	10	TA	005		
Q.10	a.		10	L2	CO5		
		(i) Subsonic flow (ii) Sonic flow (iii) Supersonic flow					
		(iv) Mach number (v) Mach angle	10	TA	COS		
	b.	1	10	L2	CO5		
		applications.					