CBCS SCHEME

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BAE303/BAS303

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

Fluid Mechanics

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 mass density, specific gravity, viscosity and surface tension with their S.I. units.	08	L1	CO1
	b.	Define capillarity. Obtain an expression for capillary rise of a liquid.	06	L1	CO1
	c.	Illustrate the surface tension on liquid droplet and liquid jet.	06	L3	CO1
		OR			
Q.2	a.	Derive an expression for force exerted and center of pressure for completely submerged inclined plane surface.	07	L2	CO1
	b.	Derive an expression for force exerted and center of pressure for completely submerged curved plane surface.	07	L2	CO1
	c.	Find the volume of water displaced and position of centre of buoyancy for a wooden block of width 2.5 m and depth 1.5 m when it floats horizontally in water. The density of wooden block is 650 kg/m^3 and its length 6.0 m.	06	L3	CO1
		Module – 2			
Q.3	a.	Derive stream function and potential function for source flow and also plot the streamlines and potential lines.	10	L2	CO2
	b.	Derive stream function and potential function for uniform flow. Also plot the streamlines and potential lines.	10	L2	CO2
		OR			
Q.4	a.	Derive the continuity equation for a three dimensional steady incompressible flow.	10	L2	CO2
	b.	Derive Navier-Stokes equation using control volume approach.	10	L2	CO2
		Module – 3			
Q.5	a.	Derive the relation for Euler's equation and obtain Bernoulli's equation from the Euler's equation.	10	L2	CO3
	b.	How does the Bernoulli's equation helps in the production of aircraft's lift and also identify some of the practical application of venturimeter in the aircraft's fuel system.	10	L3	CO3
		OR			
Q.6	a.	Explain geometric, kinematic and dynamic similarities.	06	L1	CO3
	b.	Define and derive an expression for Reynold's number and Mach number.	06	L1	CO3
	c.	State Buckingham's π theorem, the efficiency η of a fan depends on density 'ρ', dynamic viscosity 'μ' of fluid, angular velocity 'ω', diameter 'D' of the rotor and the discharge 'Q'. Express 'η' in terms of dimensionless parameters.	08	L2	CO3
		Module – 4			
Q.7	a.	Explain the boundary layer concept over a flat plate and also mention the boundary layer separation zone for an UAV.	10	L3	CO2
	b.	Derive Von Karman's integral equation for boundary layer flows.	10	L2	CO2

OR					
Q.8	**a.**	Derive an expression for lift and drag and by fundamental airfoil theory, mention the drag and lift points for NACA 2412 airfoil.	**10**	**L2 L3**	**CO3**
	b.	Derive Kutta-Joukowski equation.	**10**	**L2**	**CO2**
Module – 5					
Q.9	**a.**	An aeroplane is flying at an height of 15 km where the temperature is –50°C. The speed of the plane is corresponding to M = 2.0. Assume K = 1.4, R = 287 J/kg°K. Find the speed of airplane.	**06**	**L3**	**CO3**
	b.	Derive velocity of sound wave in a fluid and express in terms of bulk modulus.	**14**	**L2**	**CO3**
OR					
Q.10	**a.**	Derive compressible Bernoulli's equation.	**10**	**L2**	**CO3**
	b.	A gas is flowing through horizontal pipe at a temperature of 4°C. The diameter of the pipe is 8 cm and at a section 1-1 in the pipe, the pressure is 30.3 N/cm^2 (gauge). The diameter of pipe changes from 8 cm to 4 cm at section 2-2 where pressure is 20.3 N/cm^2. Find velocities of gas at these sections assume isothermal process. Take R = 287.14 Nm/kgK, atmospheric pressure = 10 N/cm^2.	**10**	**L2**	**CO2**

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