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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Automobile Engineering

Semester End Examination; Dec. - 2019

Fluid Mechanics

Time: 3 hrs *Max. Marks: 100*

Note: i) PART - A is compulsory. **Two** marks for each question.

ii) PART - B: Answer any **Two** sub questions (from a, b, c) for Maximum of **18 marks** from each unit.

Q. No.	Questions	Marks
	I : PART - A	**10**
I a.	Define Weight density and Mass density.	2
b.	Define; i) Buoyancy and ii) Metacentre.	2
c.	Define Euler's equation of motion of fluid.	2
d.	Differentiae Subsonic and Supersonic flow.	2
e.	State "Buckingham's Π theorem".	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	Classify any four types of fluids and represent in a shear stress and velocity gradient graph.	9
b.	Define differential Manometers. Derive a pressure difference equation of U-tube manometer with sketches.	9
c.	A vertical cylinder of diameter 180 mm rotates concentrically inside another cylinder of 181.2 mm. Both the cylinder is 300 mm high. The space between cylinders is filled with a liquid of unknown viscosity. Determine the liquid viscosity if a torque of 20 N-m is required to rotate the Inner cylinder at 120 rpm.	9
	UNIT - II	**18**
2 a.	Derive an expression for the depth of centre of pressure from free surface of liquid of an Inclined plane surface submerged in liquid.	9
b.	Derive the expression for meta-centric height of a floating body by analytical method.	9
c.	A wooden cylinder of specific gravity 0.6 and circular in cross section is required to float in oil of specific gravity 0.9, find L/D ratio for the cylinder to float with its longitudinal axis vertical in oil, where L is the height of cylinder and D is its diameter.	9
	UNIT - III	**18**
3 a.	Derive an expression for continuity equation in 3-D flow and deduce it to 2-D flow.	9
b.	Obtain an expression for Euler's equation of motion along stream line and deduce it to Bernoulli's equation.	9

Contd…2

c. The velocity potential for ϕ is given by, $\phi = \frac{-xy^3}{3} - x^2 + \frac{x^2 y}{3} + y^2$. Calculate the velocity components in *x* and *y* directions. Check the possibility of such flow. 9

UNIT - IV **18**

4 a. Starting from first principles, show that for Laminar flow between fixed parallel plates the mean velocity is 2/3rd of maximum velocity. 9

b. Show that velocity of sound wave in a compressible fluid medium is given by $C = \sqrt{\frac{K}{\rho}}$ where K and ρ are bulk modulus of elasticity and density of fluid respectively 9

c. Calculate the velocity and Mach number of a supersonic air craft flying at an altitude of 1200 m when a temperature is 300 K. Sound of air craft is heard 2 second after passage of air craft over the head of an observer. Take; γ = 1.41 , R = 287 J/kgK. 9

UNIT - V **18**

5 a. Derive Darcy-Weisbach equation. 9

b. Explain different types of similitude. 9

c. Assume the viscous force '*F*' exerted by a fluid on sphere of diameter *D* depends on viscosity μ of mass density ρ and velocity of motion '*V*' of the sphere. Obtain the expression for shear force '*F*', using Buckingham's Π-theorem method. 9

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