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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; March - 2021

Fluid Mechanics

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Understand and Explain various properties of fluids, Fluid - statics, kinematics & Dynamics and the basic concepts of Fluid mechanics.

CO2: Apply, Interpret and describe about laminar flow, compressible flow, Energy Losses in Flow through pipes and dimensional analysis about various primary & secondary units.

CO3: Derive Equations for fluids properties, Fluid - statics, kinematics & Dynamics and their applications.

CO4: Analyze/Compare, solve engineering problems involving fluid flow pertaining to fluids properties, Fluid - statics, kinematics & Dynamics and their applications.

CO5: Analyze and solve engineering problems pertaining fluid flow losses, dimensional analysis techniques and practical applications of fluid mechanics in compressible flow.

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	BLs	COs	POs
	I : PART - A	**10**			
I a.	Explain Newton's law of viscosity.	2	L2	CO1	PO1
b.	Explain the terms 'Meta centre' and 'Meta centric height'.	2	L2	CO2	PO1
c.	Explain the term Streak line.	2	L2	CO3	PO1
d.	Explain Mach cone.	2	L2	CO4	PO1
e.	Explain the term "dimensionally homogeneous equation".	2	L2	CO5	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Explain the phenomenon of capillarity. Derive the expression for capillary rise of a liquid.	9	L2	CO1	PO1
b.	Explain and show the relation between atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure with the help of a sketch.	9	L2	CO2	PO1
c.	U-tube containing mercury has its right hand limb open to atmosphere and left limb connected to a pipe conveying water under pressure, the difference in levels of mercury in the two limbs being 200 mm. If the Mercury level in the left limb is 300 mm below the centre line of the pipe. Find the gauge and absolute pressure in the pipe line.	9	L3	CO2	PO2
	UNIT - II	**18**			
2 a.	Show that for a completely submerged Inclined surface the centre of pressure lies always below the centre of gravity of the surface.	9	L2	CO1	PO1
b.	Show that the meta centric height of a floating body is given by; $GM = \frac{I}{\forall} - BG.$ Where,	9	L2	CO1	PO1

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I = Moment of Inertia of the plant of the floating body at the water surface

$\forall$ = Volume of the body submerged in water

BG = Distance between the centre of gravity (G) and the centre of buoyancy (B)

c.	A wooden block (Specific gravity 0.8) of dimensions 1m × 0.5 m × 0.4 m floats in water with its shortest axis vertical. Determine the meta centric height and state the condition of its equilibrium.	9	L3	CO2	PO2
	UNIT - III	**18**			
3 a.	Distinguish between; i) Steady and Unsteady flow ii) Uniform flow and Non-uniform flow iii) Rotational flow and Irrotational flow iv) Stream lines and Streak lines v) Circulation and Viscosity	9	L2	CO3	PO1
b.	Derive Euler's equation of motion along a stream line.	9	L2	CO1	PO1
c.	The Inlet and throat diameters of a vertically mounted venturimeter are 30 cm and 15 cm, respectively. The throat section is below the Inlet section at a distance of 10 cm. The density of the liquid is 850 kg/m^3. The intensity of pressure at Inlet and throat are 150 kN/m^2 and 90 kN/m^2, respectively. If 4% of the differential head is lost between inlet and throat, find the volumetric flow rate.	9	L3	CO4	PO2
	UNIT - IV	**18**			
4 a.	Show that for a steady, fully developed laminar flow through circular pipes, the velocity distribution across the section is parabolic and the average velocity is half of the maximum velocity.	9	L2	CO5	PO1
b.	Show that the velocity of sound wave in compressible fluid is given by, $C = \sqrt{E/S}$.	9	L2	CO4	PO1
c.	A rocket is travelling in air of pressure 35 kN/m^2 and temperature –40°, find the mach number and the velocity of the rocket. Take R = 287 J/kg-K and K = 1.4.	9	L3	CO4	PO2
	UNIT - V	**18**			
5 a.	Derive Darcy's formula to calculate the frictional head loss in a pipe.	9	L2	CO5	PO1
b.	Explain the following non-dimensional numbers: i) Reynolds number ii) Froude's number iii) Euler's number iv) Mach number	9	L2	CO5	PO1
c.	The resistance 'F' of a ship is a function of its length 'L', velocity 'V' acceleration due to gravity 'g' and fluid properties like density 'S' and viscosity 'μ'. Establish a dimensionless relationship of these parameters with the help of Buckingham π theorem.	9	L3	CO5	PO2

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