DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular/Supplementary Winter Examination – 2024

Course: B. Tech. Branch : Mechanical Engineering/Mechanical Engineering(Sandwich)/Mechanical and Automation

Subject Code & Name: Fluid Mechanics (BTMC302) **Semester :III**

Max Marks: 60 **Date:07/02/2024** **Duration: 3 Hr.**

Instructions to the Students:

1. *Each question carries 12 marks.*
2. *Question No. 1 will be compulsory and include objective-type questions.*
3. *Candidates are required to attempt any four questions from Question No. 2 to Question No. 6.*
4. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
5. *Use of non-programmable scientific calculators is allowed.*
6. *Assume suitable data wherever necessary and mention it clearly.*

					(Level/CO)	Marks
Q. 1	**Objective type questions. (Compulsory Question)**					**12**
1	The resultant of hydrostatic force acts through a point known as				Understanding/1	1
	a. Centre of buoyancy	b. Centre of gravity	c. Centre of Pressure	d. None of the above		
2	For a floating body, if metacenter is above the centre of gravity, the equilibrium is called				Understanding/1	1
	a. Stable	b. Neutral	c. Unstable	d. None of the above		
3	Surface tension is caused by				Understanding/1	1
	a. Viscosity	b. Gravitational forces	c. Cohesion between fluid molecules	d. Temperature gradients		
4	Velocity components in 'x' and 'y' direction in terms of velocity potential (ϕ) are				Understanding/2	1
	a. $u=-\frac{\partial\phi}{\partial x}, v=\frac{\partial\phi}{\partial y}$	b. $u=-\frac{\partial\phi}{\partial y}, v=-\frac{\partial\phi}{\partial x}$	c. $u=\frac{\partial\phi}{\partial y}, v=\frac{\partial\phi}{\partial x}$	d. $u=-\frac{\partial\phi}{\partial x}, v=-\frac{\partial\phi}{\partial y}$		
5	In the Lagrangian method, fluid motion is studied by,				Understanding/2	1
	a. Observing fixed points in space	b. Tracking individual fluid particles	c. Measuring fluid velocity at specific locations	d. Analyzing streamlines		
6	Moody's diagram is used to determine				Understanding/3	1
	a. Velocity of fluid in a pipe	b. Friction factor for flow in a pipe	c. Reynolds number of the flow	d. Pressure drop across a valve		
7	The velocity distribution across a section of two fixed parallel				Understanding/3	1

	plates(Separated by distance 'B')having viscous flow is given by,					
	a. $u=\frac{1}{2\mu}\left(-\frac{\partial p}{\partial x}\right)\times\left(B^2-y^2\right)$	b. $u=\frac{1}{2\mu}\left(\frac{\partial p}{\partial x}\right)\times\left(y-By\right)$	c. $u=-\frac{1}{2\mu}\left(\frac{\partial p}{\partial x}\right)\times\left(By-y^2\right)$	d. $u=-\frac{1}{2\mu}\left(\frac{\partial p}{\partial x}\right)\times\left(B-y^2\right)$		
8	For laminar flow between two fixed parallel plates, the relation between the maximum velocity (V_{max}) and average velocity (V_{avg})is				Understanding/3	1
	a. $v_{\max}=\frac{1}{2}v_{avg}$	b. $v_{\max}=\frac{3}{2}v_{avg}$	c. $v_{\max}=2v_{avg}$	d. $v_{\max}=2.5v_{avg}$		
9	Boundary layer separation takes place if,				Understanding/3	1
	a. Pressure gradient is positive	b. Pressure gradient is negative	c. Pressure gradient is zero	d. None of the above		
10	Drag is defined as the force exerted by flowing fluid on a solid body				Understanding/3	1
	a. perpendicular to the direction of flow	b. in the direction of flow	c. at an angle 45^0 with the direction of flow	d. None of the above		
11	If in physical phenomenon is defined by a six variables and three fundamental dimensions, how many (π) terms exist as per Buckingham-π theorem.				Understanding/3	1
	a. 4	b. 6	c. 3	d. 2		
12	The ratio of viscous force to the inertia force is known as,				Understanding/3	1
	a. Euler Number	b. Froude Number	c. Mach Number	d. Reynold Number		
Q. 2	**Solve the following.**					**12**
A)	Define the following terms Viscosity, hydrostatic law, centre of buoyancy, total pressure				Understanding/1	**6**
B)	Calculate the capillary rise and depression 'h', if a glass tube 0.3 mm in diameter is immersed in water and mercury container at 20°C respectively. At a temperature 20°C, the surface tension of water and mercury in contact with water is 0.07 N/m and 0.37 N/m respectively. Take angle of contact θ = 0° for water and 125° for mercury.				Apply/5	**6**

Q.3	**Solve the following.**		**12**
A)	Explain in detail any two of the following Steady and Unsteady flow, compressible and incompressible flow, stream function and flow net.	Understanding/2	**6**
B)	Write a short note on a pitot tube and derive the equation for a velocity measurement by using a pitot tube.	Apply/4	**6**
Q. 4	**Solve Any Two of the following.**		**12**
A)	Explain in detail the major and minor losses in the case of flow through pipes.	Understanding/3	**6**
B)	For Laminar flow of an oil having dynamic viscosity μ = 1.766 Pa.s in a 0.3 m diameter pipe, the velocity distribution is parabolic with a maximum point velocity of 3 m/s at the centre of the pipe. Calculate the shearing stresses at the pipe wall.	Apply/5	**6**
C)	Obtain the condition for maximum efficiency in transmission of power through a pipeline?	Apply/4	**6**
Q.5	**Solve Any Two of the following.**		**12**
A)	Explain the following terms Lift, Drag, Boundary layer thickness, Magnus effect	Understanding/3	**6**
B)	Discuss the various methods of controlling the boundary layer.	Understanding/3	**6**
C)	Explain the cases of drag force on a flat plate held parallel and perpendicular to the flow.	Understanding/3	**6**
Q. 6	**Solve Any Two of the following.**		**12**
A)	List the different dimensionless numbers and define any one dimensionless number and derive it.	Understanding/3	**6**
B)	Write the steps in the Buckingham-π theorem method of dimension analysis.	Understanding/3	**6**
C)	A horizontal venturimeter with inlet and throat diameters 25 cm and 15 cm respectively is used to measure the flow of the oil having specific gravity 0.9. The reading of differential manometer connected to the inlet	Apply/5	**6**

	and the throat is 25 cm of mercury. Determine the rate of flow of oil .Take Cd=0.97.		
	***** End *****		