Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2019

CE3CO08 Fluid Mechanics

Programme: B.Tech. Branch/Specialisation: CE

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Which of the following contribute to the reason behind the origin of surface tension? **1**

(a) Only cohesive forces
(b) Only adhesive forces
(c) Neither cohesive forces nor adhesive forces
(d) Both cohesive forces and adhesive forces

ii. The specific gravity of a liquid has **1**

(a) The same unit as that of mass density
(b) The same unit as that of weight density
(c) The same unit as that of specific volume
(d) No unit

iii. A block of material of specific gravity 0.45 floats in water, the meta-centric height of the block if its size is 3m x 2m x 0.8 m. is **1**

(a) 0.506 m (b) 0.376 m (c) 1.012 m (d) 0.127 m

iv. When body is completely or partially immersed in a fluid, how much its weight be distributed for it to be in stable equilibrium. **1**

(a) Around the lower part
(b) Around the upper part
(c) Is independent of weight distribution
(d) None of these

v. What will be the shape of the path line for one-dimensional flow be like? **1**

(a) Straight line (b) Parabolic
(c) Hyperbolic (d) Elliptical

P.T.O.

vi. When the flow particles flow in zigzag manner and rotate about their own axis it is what type of flow? **1**
(a) Turbulent flow (b) Irrotational flow
(c) Rotational flow (d) None of these

vii. The Navier- Stokes equation can be used in which of the following applications? **1**
(a) Automobiles (b) Ocean Currents
(c) Airplanes (d) Thermometer

viii. The discharge through totally drowned orifice of width 3.3 m if the difference of water levels on both side of the orifice be 50 cm. The height of water from to and bottom of the orifice are 2.25 m and 2.67 m respectively. **1**
(a) 2.8 m^3/s (b) 2.7 m^3/s (c) 2.6 m^3/s (d) 2.5 m^3/s

ix. The aim of pipe network analysis is **1**
(a) To determine the mass of fluid.
(b) To determine the volume of fluid.
(c) To determine the flow rates and pressure drops.
(d) To determine the cross sections of the pipe.

x. The frictional resistance for fluids in motion is **1**
(a) Inversely proportional to the square of the surface area of contact.
(b) Inversely proportional to the surface area of contact.
(c) Proportional to the square of the surface area of contact.
(d) Proportional to the surface area of contact.

Q.2 i. Define the term dynamic and kinematic viscosity. **2**
ii. State the Newton's law of viscosity. **3**
iii. State and prove Pascal's law. **5**
OR iv. Discuss in detail the stepwise procedure of determining Buckingham-Pi theorem. **5**

Q.3 i. Write down about Archimedes Principle. **2**
ii. A kite 0.8 x 0.8 m weighing 4N assumes an angle of 12^o to horizontal. The string attached to the kite makes an angle of 45^o to the horizontal. The pull on the string is 25 N when the wind is blowing at a speed of 40 kmph. Find the coefficient of lift & drag. Take $P_a = 1.2$ kg/m^3. **8**

OR iii. With the help of a neat sketch explain the circulation theory of lift and derive the expression for Magnus force. **8**

Q.4 i. Differentiate between Sub-Critical, Critical & Super-Critical flow. **3**
ii. What do you understand by Vorticity? Define and explain velocity potential and stream function. **7**
OR iii. If the velocity field is given by u = (16y-8x), v = (8y-7x). Find the circulation around the closed defined by x = 3, y = 2, x = 7, y = 7. **7**

Q.5 i. Discuss in brief about the various pressure measuring devices. **4**
ii. State and prove the Bernoulli's equation from Euler's equation. **6**
OR iii. Derive the expressions for energy and momentum correction factors. **6**

Q.6 i. What do you understand by equivalent pipes? **3**
ii. Derive an expression for head loss due to sudden expansion and sudden contraction of a pipe. **7**
OR iii. What do you mean by water hammer? Obtain an expression for rise in pressure in a thin plastic pipe in which the flow of water is suddenly stopped by closing the valve. **7**

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Marking Scheme
CE3CO08 Fluid Mechanics

Q.1	i.	Which of the following contribute to the reason behind the origin of surface tension? (d) Both cohesive forces and adhesive forces	**1**
	ii.	The specific gravity of a liquid has (d) No unit	**1**
	iii.	A block of material of specific gravity 0.45 floats in water, the meta-centric height of the block if its size is 3m x 2m x 0.8 m. is (b) 0.376 m	**1**
	iv.	When body is completely or partially immersed in a fluid, how much its weight be distributed for it to be in stable equilibrium. (a) Around the lower part	**1**
	v.	What will be the shape of the path line for one-dimensional flow be like? (a) Straight line	**1**
	vi.	When the flow particles flow in zigzag manner and rotate about their own axis it is what type of flow? (d) None of these	**1**
	vii.	The Navier- Stokes equation can be used in which of the following applications? (b) Ocean Currents	**1**
	viii.	The discharge through totally drowned orifice of width 3.3 m if the difference of water levels on both side of the orifice be 50 cm. The height of water from to and bottom of the orifice are 2.25 m and 2.67 m respectively. (a) 2.8 m^3/s	**1**
	ix.	The aim of pipe network analysis is (c) To determine the flow rates and pressure drops.	**1**
	x.	The frictional resistance for fluids in motion is (d) Proportional to the surface area of contact.	**1**

Q.2	i.	Dynamic viscosity	1 mark	**2**
		Kinematic viscosity	1 mark	
	ii.	Newton's law of viscosity.		**3**
		Statement	2 marks	
		Formula	1 mark	
	iii.	Pascal's law.		**5**
		Statement	2 marks	
		Derivation	3 marks	
OR	iv.	Stepwise procedure of determining Buckingham-Pi theorem.		**5**
		1 mark for each step	(1 mark * 5)	

Q.3	i.	Statement of Archimedes Principle.		**2**
	ii.	Formula	2 marks	**8**
		Coefficient of lift	3 marks	
		Coefficient of drag	3 marks	
OR	iii.	Circulation theory of lift		**8**
		Explanation with diagram	3 marks	
		Derivation for Magnus force	5 marks	

Q.4	i.	Differentiate between Sub-Critical, Critical & Super-Critical flow.		**3**
		1 mark for each	(1 mark * 3)	
	ii.	Vorticity	2 marks	**7**
		Velocity potential	2.5 marks	
		Stream function	2.5 marks	
OR	iii.	Find the circulation around the closed defined		**7**
		3.5 marks for each set of solution	(3.5 marks * 2)	

Q.5	i.	Pressure measuring devices		**4**
		1 mark for each device	(1 mark * 4)	
	ii.	Bernoulli's equation from Euler's equation.		**6**
		Statement	2 marks	
		Derivation	4 marks	
OR	iii.	Derivation for energy correction factors	3 marks	**6**
		Derivation for momentum correction factors	3 marks	

Q.6	i.	Definition of equivalent pipes	1 mark	**3**
		Pipes in series	1 mark	
		Pipes in parallel	1 mark	
	ii.	Derivation for head loss due to sudden expansion	3.5 marks	**7**
		Derivation for head loss due to sudden contraction	3.5 marks	
OR	iii.	Definition of water hammer	2 marks	**7**
		Expression for rise in pressure	5 marks	

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