DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Winter 2018

Course: B. Tech in Mechanical Engineering **Sem: III**

Subject Name: Fluid Mechanics **Subject Code: BTMEC303**

Max Marks:60 **Date: 05-12-2018** **Duration: 3 Hr.**

Instructions to the Students:

1. *Solve **ANY FIVE** questions out of the following.*
2. *The level 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.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any <u>Two</u> of the following.**		
A)	State and derive Pascal's law.	**(Remember)**	**(6)**
B)	A cubical block weighing 4.5 N and having a 40 cm edge is allowed to slide down an inclined plane surface making an angle of 30^0 with the horizontal on which there is a uniform layer of oil 0.005 cm thick. If the expected steady state velocity of the block is 12.5 cm/s, determine viscosity of the oil. Also express the kinematic viscosity in stokes if the oil has mass density of 800 kg/m^3.	**(Apply)**	**(6)**
C)	List some occurrences which can be attributed to the physics of surface tension. Set-up a relationship between surface tension and pressure intensity (in excess of outside pressure) for a liquid droplet.	**(Analysis)**	**(6)**
Q.2	**Solve the following questions.**		
A)	A rectangular plate 3 m x 5m is immersed vertically in water such that the 3 m side is parallel to the water surface. Determine the hydrostatic force and centre of pressure if the top surface is i) flush with the water surface ii) 2 m below the water surface.	**(Apply)**	**(6)**
B)	A solid cylinder of diameter 4.0m has a height of 3m .Find the meta–centric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder = 0.6. Comment on the stability of cylinder	**(Understand)**	**(6)**
Q. 3	**Solve the following questions.**		
A)	Derive the differential form of continuity equation in Cartesian coordinate system.	**(Understand)**	**(6)**
B)	A stream function is given as $\psi = 2xy$. Determine i) whether the flow is possible ii) whether the flow is rotational or irrotational	**(Analysis)**	**(6)**

Q.4 Solve the following questions.

A) State Bernoulli's theorem. Derive Euler's equation of motion and from it derive Bernoulli's equation. **(Understand)** **(6)**

B) A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm mercury. Determine the rate of flow .Take C_d=0.98 **(Apply)** **(6)**

Q. 5 Solve the following questions.

A) Derive an expression for the velocity distribution for viscous flow through a circular pipe. **(Understand)** **(6)**

B) Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300 mm and length 400 m. The rate of flow of water through the pipe is 300 litres/s. Consider all losses and take the value of f = 0.008 **(Analysis)** **(6)**

Q. 6 Solve Any <u>Two</u> of the following questions.

A) In a compressor, the frictional torque T in the impeller depends on diameter D, rotational speed N, fluid density ρ and viscosity μ. Using Buckingham's π theorem, obtain an expression for torque. **(Apply)** **(6)**

B) The velocity distribution in the boundary layer is given by $\frac{u}{U} = \left(\frac{y}{\delta}\right)^{\frac{1}{7}}$. Calculate the displacement thickness and momentum thickness. **(Apply)** **(6)**

C) What do you understand by the terms drag, lift and coefficient of drag? **(Recall)** **(6)**

***** End *****

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Winter SemesterExamination – December - 2019

Branch: Mechanical Engineering **Sem.:-III**

Subject with Subject Code:-Fluid Mechanics - BTMEC303 **Marks:60**
Date:-14/12/2019 **Time:- 3 Hr.**

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Instructions to the Students

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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(Marks)

Q.1. (a) Define the following fluid properties: (06)

(i)Viscosity

(ii)Compressibility

(iii)Surface Tension

(b)A U-tube manometer is used to measure the pressure of water in a pipe line,which is excess of atmospheric pressure. The right limb of the manometer contains mercury and open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of the water in the main line. If the difference in the level of mercury in the limbs of U-tube is 10cm and the free surface of mercury is in the level with the center of the pipe. If the pressure of water in the pipe line reduced to 9810N/$m^{2.}$ Calculate the new difference in the level of mercury. Sketch the arrangement in both cases. (06)

Q.2.(a) Prove that the Center of Pressure of a completely sub-merged plane surface is always below the Center of Gravity of the sub-merged surface when the plane surface is vertical. (06)

(b)What are the conditions of equilibrium of floating body and sub-merged body? (06)

Q.3.(a)Define the following flow: (06)

(i)Steady Flow

(ii)Non-Uniform Flow

(iii)Laminar Flow

(iv)Turbulant Flow

(v)Compressible Flow

(vi)Irrotatinal Flow

(b)Derive an expression of three dimensional continuity equation in rectangular cooridinate system. (06)

OR

(b)If for a two-dimensional potential flow, the velocity potential is given by $\Phi = x(2y - 1)$ Determine the velocity at the point P(4,5) and value of stream function at the point P. (06)

Q.4.(a)Derive an expression for the Discharge throughTriangular Notch. (06)

(b)A 30cm×15cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 30cm. The

differential U-tube mercury manometer shows a difference of mercury level 25cm.

Calclate:

(i)The discharge of oil

(ii)The pressure difference between entrance section and throat section.

Take Cd=0.98 and specific gravity of mercury =13.6 (06)

Q.5.(a)Derive an expression for shear stress distribution and velocity distribution for Laminar flow though circular pipe. (06)

(b)A horizontal pipe line 40m long is connected to a water tank at one end and discharges freely into atmosphere at other end. For the first 25m of its length from the tank, the pipe is 150mm diameter and its diameter is suddenly enlarged to 300mm.The height of water level in the tank is 8m above the center of the pipe. Considering all losses of head which occur. Determine the rate of flow.Take f=0.01for both pipe. (06)

Q.6.(a)The efficiency η of fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω , diameter D of the rotor and the discharge Q. Express efficiency η of fan in terms of dimensionless parameters. (06)

(b) Define Displacement thickness. Derive an expression for displacement thickness. (06)

OR

(b)What do you understand by: Total drag on the body,Resulant force on a body, co-efficient of drag and co-efficient of lift. (06)

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Winter SemesterExamination – December - 2019

Branch: Mechanical Engineering **Sem.:-III**

Subject with Subject Code:-Fluid Mechanics - BTMEC303 **Marks:60**
Date:-14/12/2019 **Time:- 3 Hr.**

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Summer 2019

Course: B. Tech in Mechanical Engineering **Sem: III**

Subject Name: Fluid Mechanics **Subject Code:BTMEC303**

Max Marks: 60 **Date: 30/05/2019** **Duration: 3 Hr.**

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		(Level/CO)	Marks
Q. 1 A)	Explain with the neat sketch U-tube differential Manometer**.**		**6**
B)	A vertical gap 2.2cm wide of infinite extent contains a fluid of viscosity 2.0Ns/m^2 and specific gravity 0.9. A metallic plate 1.2m x 1.2m x 0.2cm is to be lifted up with a constant velocity of 0.15m/sec, through the gap. If the plate is in the middle of the gap, find the force required. The weight of the plate is 40N.		**6**
Q.2 A)	Explain with the neat sketch the condition for equilibrium for floating bodies.		**6**
B)	A rectangular plane surface is 2m wide and 3m deep. It lies in vertical plane to water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and a) coincides with water surface, b) 2.5m below the free water surface.		**6**
Q. 3 A)	Derive the general equation for continuity for a three dimensional flow in Cartesian Co-ordinates for a steady incompressible flow.		**6**
B)	Explain the various types of fluid flows.		**6**
Q.4 A)	Derive the expression for discharge over a triangular notch.		**6**
B)	Describe an Venturimeter.		**6**
Q. 5 A)	Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow.		**6**
B)	What is minor energy loss in the pipe? Explain various types of minor losses in pipe flow.		**6**
Q. 6 A)	State Buckingham's π–Theorem and explain procedure for determining the π–groups and their functional relationship.		**6**
B)	What are the different methods of preventing the separation of boundary layers. Explain with the neat sketches.		**6**

***** End *****