OR   iii.   The thrust developed by the propeller P depend upon the angular **6** velocity □, speed of advance V, diameter D, dynamic viscosity μ, mass density p, elasticity of the fluid medium which can be denoted by speed of the sound in the medium C. Derive the expression having suitable parameter to present the thrust P in terms of dimensionless parameters.

Q.6   Attempt any two:

i.   Prove that average velocity is half of the maximum velocity when **5** fluid of density p and viscosity μ is flowing through a circular pipe of radius R.

ii.   Explain Darcy Weisbach equation for major losses determination? **5**

iii.   Explain the significance of Reynold number and method of **5** determination?

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Enrollment No....................................

Faculty of Engineering
End Sem (Even) Examination May-2019
AU3CO08 / FT3CO08 Fluid Mechanics
Programme: B.Tech.   Branch/Specialisation: AU/FT

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.   Define Viscosity? **1**
(a) Resistance to flow of an object
(b) Resistance to flow of air
(c) Resistance to flow of fluid
(d) Resistance to flow of heat

ii.   The pressure at any given point of a non-moving fluid is called the **1**
(a) Gauge Pressure   (b) Atmospheric Pressure
(c) Differential Pressure   (d) Hydrostatic Pressure

iii.   The continuity equation is the result of application of the following **1** law to the flow field
(a) First law of thermodynamics
(b) Conservation of energy
(c) Newtons second law of motion
(d) Conservation of mass

iv.   The flow of ideal fluid is defined as: - **1**
(a) Sink flow   (b) Source flow
(d) Potential flow   (d) None of these

v.   Bernoulli's equation cannot be applied when the flow is **1**
(a) Rotational   (b) Turbulent
(c) Unsteady   (d) All of these

vi.   The discharge can be measured through: - **1**
(a) Venturi meter   (b) Orifice meter
(c) Pitot tube   (d) Both (a) and (b)

P.T.O.

vii. The unit of physical quantity which does not depend on the unit of **1** any other physical quantity is called as
(a) Independent dimension   (b) Fundamental dimension
(c) Core dimension   (d) None of these

viii. Which of the following statements are true for dimensional **1** analysis?
I. The functional relationship between dependent and non-dependent variables can be expressed into dimensionless terms by dimensional analysis
II. In model testing, it reduces the number of variables into three numbers
III. It is used to change the theoretical equation into dimensionless form
IV. It helps to convert the units of quantities from one system to another system
(a) I, II and III   (b) II, III and IV
(c) I, III and IV   (d) I, II, III and IV

ix. When a problem states "The velocity of the water flow in a pipe is **1** 20 m/s", which of the following velocities is it talking about?
(a) RMS velocity   (b) Average velocity
(c) Absolute velocity   (d) Relative velocity

x. The Reynold's number for transition flow is: **1**
(a) Less than 2000   (b) More than 2000
(c) 2000- 4000   (d) More than 4000

Q.2   Attempt any two:

i. Explain surface tension. Prove that the relationship between **5** surface tension and pressure inside the a droplet of a liquid is excess of outside pressure is given by 4p/d where d is diameter of droplet.

ii. Explain the following: - **5**
(a) Newtonian & non-Newtonian fluid
(b) Meta center & metacentric height
(c) Center of pressure

iii. A solid cylinder of 4 m has a height of 4 m. Find the meta-centric **5** height of the cylinder if the specific gravity of the material of cylinder is 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.

Q.3 i. Explain: - **3**
(a) Flow net   (b) Velocity potential function
(c) Stream function

ii. If for a two dimensional potential flow, the velocity potential **7** function is given by $\phi = x(2y - 1)$. Determine the velocity at the point P (4, 5) and the value of stream function the point P.

OR iii. (a) Develop the three dimensions equation of continuity? **7**
(b) A 25 cm diameter carries oil of sp gr. 0.9 at a velocity of 3 m/s. At another section the diameter is 20 cm. Find the discharge at 20 cm diameter section.

Q.4 i. Define vena contracta and coefficient of contraction. **2**

ii. State Bernoulli's theorem and derive it. Mention the assumption **8** made? How it is modified while applying in practice? List out its engineering applications?

OR iii. (a) Compare triangular & rectangular notchs? **8**
(b) Water flows through at triangular right-angled weir first and then over a rectangular weir of 1 m width. The discharge co-efficient of the triangular and rectangular weirs are 0.6 and 0.7 respectively. If the depth of the water over the triangular weir is 260 mm, find the depth of the water over the rectangular weir.

Q.5 i. Explain Following dimensionless number and their significance.: - **4**
(a) Froude's number   (b) Euler's number
(c) Weber's number   (d) Mach's number

ii. State Buckingham's pi theorem. Why this theorem is considered **6** superior over the Rayleigh's method for dimensional analysis?

Marking Scheme
AU3CO08 / FT3CO08 Fluid Mechanics

Q.1   i.   Define Viscosity?   **1**
(c) Resistance to flow of fluid

ii.   The pressure at any given point of a non-moving fluid is called the   **1**
(d) Hydrostatic Pressure

iii.   The continuity equation is the result of application of the following   **1**
law to the flow field
(d) Conservation of mass

iv.   The flow of ideal fluid is defined as: -   **1**
(b) Source flow

v.   Bernoulli's equation cannot be applied when the flow is   **1**
(d) All of these

vi.   The discharge can be measured through: -   **1**
(d) Both (a) and (b)

vii.   The unit of physical quantity which does not depend on the unit of   **1**
any other physical quantity is called as
(b) Fundamental dimension

viii.   Which of the following statements are true for dimensional   **1**
analysis?
(d) I, II, III and IV

ix.   When a problem states "The velocity of the water flow in a pipe is   **1**
20 m/s", which of the following velocities is it talking about?
(b) Average velocity

x.   The Reynold's number for transition flow is: **1**
(c) 2000- 4000

Q.2   Attempt any two:

i.   Surface tension definition   1 mark   **5**
Relationship b/w surface tension and pressure   4 marks

ii.   Explain the following: -   **5**
(a) Newtonian & non-Newtonian fluid   2 marks
(b) Meta center & metacentric height   2 marks
(c) Center of pressure   1 mark

iii.   Find the meta-centric height of the cylinder   4 marks   **5**
State whether the equilibrium is stable or unstable   1 mark

Q.3   i.   Explain: -   **3**
(a) Flow net   1 mark
(b) Velocity potential function   1 mark

(c) Stream function   1 mark

ii.   Determine the velocity at the point P (4, 5) and the value of stream   **7**
function the point P.
Stepwise marking

OR   iii.   (a) Develop the three dimensions equation of continuity   **7**
   3.5 marks
(b) Find the discharge at 20 cm diameter section.   3.5 marks

Q.4   i.   Definition vena contracta   1 mark   **2**
Coefficient of contraction   1 mark

ii.   Bernoulli's theorem   2 marks   **8**
Derivation   3 marks
Assumption   1 mark
Modification   1 mark
Engineering applications   1 mark

OR   iii.   (a) Compare triangular & rectangular notchs   2 marks   **8**
(b) Triangular weir   3 marks
   Rectangular weir   3 marks

Q.5   i.   Explain Following dimensionless number and their significance.: -   **4**
(a) Froude's number   1 mark
(b) Euler's number   1 mark
(c) Weber's number   1 mark
(d) Mach's number   1 mark

ii.   Buckingham's pi theorem   4 marks   **6**
Comparison   2 marks

OR   iii.   Derive the expression having suitable parameter to present the thrust   **6**
P in terms of dimensionless parameters.
Stepwise marking

Q.6   Attempt any two:

i.   Prove that average velocity is half of the maximum velocity when   **5**
fluid of density p and viscosity μ is flowing through a circular pipe
of radius R.

ii.   Darcy Weisbach equation for major losses determination   **5**

iii.   Significance of Reynold number and method of determination   **5**

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