Hall Ticket No | | | | | | | | | | | Question Paper Code: ACE005

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular) - May, 2018

Regulation: IARE – R16

FLUID MECHANICS

Time: 3 Hours **(CE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain the following terms related to fluids. **[7M]**
   i. Newtonian and Non Newtonian fluids
   ii. Surface tension
   iii. Specific gravity
   iv. Viscosity

   (b) A cubical blade of 20cm edge and weight 20kg(F) is allowed to slide down a plane inclined at 20 degree to the horizontal on which there is thin film of oil of viscosity 0.22 x 10^{-3} kg(F) $-s/m^2$.What terminal velocity will be attained by the block if the film thickness is estimated to be 0.025mm? **[7M]**

2. (a) The left leg of a U-tube mercury manometer is connected to a pipeline conveying water, the level of mercury in the leg being 0.6m below the centre of pipeline, and the right leg in open to atmosphere. The level of mercury in the right leg is 0.45m above that in the left leg and the space above mercury in the right leg contain benzene (specific gravity 0.88) to a height of 0.3m. Find the pressure in the pipe. **[7M]**

   (b) A vertical gate closes a horizontal tunnel 5m high and 3m wide running full with water. The pressure at the bottom of the gate is 196.2 KN/m^2. Determine the total pressure on the gate and position of the centre of pressure. **[7M]**

UNIT – II

3. (a) Differentiate between the following fluid flows **[7M]**
   i. Steady flow and Unsteady flow.
   ii. Uniform flow and Non uniform flow

   (b) The diameter of a pipe at the sections 1 and 2 are 10cm and 15cm respectively. Find the discharge through the pipe if the velocity of water flowing through the pipe at section 1 in 5m/s. Also, determine the velocity at section 2. **[7M]**

4. (a) The following cases represent the two velocity components; determine the 3rd component of velocity such that they satisfy the continuity equation. **[7M]**
   i. $U = x^2 + y^2 + z^2; V = xy^2 - yz^2 + xy$
   ii. $V = 2y^2, W = 2xyz$

   (b) A stream function is given as 5x-6y. Calculate the velocity components and also magnitude and direction of the resultant velocity at any point. **[7M]**

UNIT – III

5. (a) A pitot-static tube placed in the centre of a 300 mm pipeline has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.80 of the central velocity. Find the discharge through the pipe if the pressure difference between the two orifices is 60 mm of water. Take the co efficient of Pitot tube as c_v=0.98. **[7M]**

   (b) Obtain Bernoulli's equation from Euler's equation. State the assumptions made in the derivation of Bernoulli's equation. **[7M]**

6. (a) A horizontal venturimeter with inlet and throat diameter 30cm and 15cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow, take C_d=0.98. **[7M]**

   (b) An orifice meter with orifice diameter 15cm is inserted in pipe of 30m diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50cm of mercury. Find the rate of flow of oil of specific gravity 0.9 when the co-efficient of discharge of the meter=0.64. **[7M]**

UNIT – IV

7. (a) Derive an expression for displacement thickness due to formation of boundary layer. **[7M]**

   (b) Air is flowing over a smooth plate with a velocity of 10m/sec. The length of the plate is 1.2m and width 0.8m. If laminar boundary layer exists up to a value of $R_e = 2\,X\,10^5$, find the maximum distance from the leading edge up to which laminar boundary layer exists. Find the maximum thickness of laminar boundary layer if the velocity profile is given by, $u/U = 2(y/\delta) - (y/\delta)^2$. Take kinematic viscosity for air=0.15 stokes. **[7M]**

8. (a) What do you understand by separation of boundary layer? How it affects the flow pattern. **[7M]**

   (b) For the velocity profile for laminar boundary layer flow given as $u/U = 2(y/\delta) - (y/\delta)^2$. Find an expression for boundary layer thickness (δ), shear stress. **[7M]**

UNIT – V

9. (a) Derive an expression for loss of head due to friction in pipes. **[7M]**

   (b) Determine the wall shearing stress in a pipe of diameter 100 mm, which carries water. The velocities at the pipe centre and at 30mm from the centre of the pipe is 2m/s and 1.5m/s respectively. **[7M]**

10. (a) Explain the significance of major and minor losses in pipes. What are the general formulae to determine minor losses? **[7M]**

    (b) A crude oil of kinematic viscosity 0.4 stokes is flowing through a pipe diameter 300 mm at the rate of 300 litres per second. Find the head loss due to friction for a length of 50m of the pipe. **[7M]**

– ○ ○ ◯ ○ ○ –