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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Supplementary) - 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) Derive the equation for centre of pressure of an inclined plane surface submerges in a liquid. **[7M]**

   (b) An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in oil for a sleeve length of 100 mm. Assume the thickness of oil film is 1.0 mm. **[7M]**

2. (a) Explain about micro manometers with a neat sketch and derive the expression for pressure difference between two points using micro manometers. **[7M]**

   (b) Determine the total pressure and center of pressure of an isosceles triangular plate of base 4 m and altitude 4 m when immersed vertically in an oil of specific gravity 0.9. The base of the plate coincides with the free surface of oil. **[7M]**

UNIT – II

3. (a) Derive continuity equation in three-dimensional flow. **[7M]**

   (b) Derive the equation of stream function and velocity potential for a uniform stream of velocity(V) in a two-dimensional field, the velocity(V) being inclined to the X-axis at a positive angle α. **[7M]**

4. (a) Define total acceleration, convective acceleration and local acceleration. **[7M]**

   (b) Does the velocity potential exist for two dimensional incompressible flow prescribed by u = x-4y; v = -(y+4x). If so, determine velocity potential function and stream function. **[7M]**

UNIT – III

5. (a) State the momentum equation. How will you apply momentum equation for determining the force exerted by a flowing fluid on a pipe bend? **[7M]**

   (b) The head of water over an orifice of diameter 100mm is 10m. The water coming out from orifice is collected in a circular tank of diameter 1.5m. The rise of water level in this tank is 1.0 m in 25 seconds. Also the coordinates of a point on the jet, measured from vena-contracta are 4.3 m horizontal and 0.5 m vertical. Find the coefficients C_d, C_c and C_v. **[7M]**

6. (a) Derive Euler's equation of motion. How will you obtain Bernoulli's expression from it? **[7M]**

   (b) Find the discharge through a trapezoidal notch which is 1 m wide at the top and 0.4 m at the bottom and is 30 cm in height. The head of water on the notch is 20 cm. Assume C_d for rectangular portion as 0.62 while for triangular portion as 0.6. **[7M]**

UNIT – IV

7. (a) What are the different methods of preventing the separations of the boundary layers? Explain any two methods in detail to control separation with a neat sketch. **[7M]**

   (b) An open rectangular box 20m x 3m x 1.5m is drawn longitudinally through water at a velocity of 10 m/s. Determine the drag force. Take $\gamma = 1\,X\,10^{-6} m^2/s$ and $\rho = 1000 kg/m^3$. **[7M]**

8. (a) Define: boundary layer, boundary layer thickness, drag, lift and momentum thickness. **[7M]**

   (b) Discuss magnus effect in boundary layer theory and explain in detail two applications of magnus effect. **[7M]**

UNIT – V

9. (a) Derive Darcy-weisbach equation for determination of head loss in pipes. **[7M]**

   (b) A main pipe line divides into two parallel pipes which again forms one pipe. The length and diameter for the first parallel pipe are 2000m and 1m respectively, while the length and diameter for second parallel pipe are 2000m and 0.8m respectively. Find the rate of flow in each parallel line, if total flow in the main is $5m^3$/s. The coefficient of friction for each pipe is same and equal to 0.004. **[7M]**

10. (a) Explain about Reynold's experiment to determine type of flow. Classify the different types of flows based on it. **[7M]**

    (b) An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200mm at the rate of 60 liters/s. Find the head lost due to friction for a 500 m length of pipe. Find the power required to maintain this flow. **[7M]**

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