Hall Ticket No | | | | | | | | | | | Question Paper Code: AAE003

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech III Semester End Examinations (Supplementary) - July, 2018

Regulation: IARE – R16

FLUID MECHANICS AND HYDRAULICS

Time: 3 Hours **(AE)** **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) Define and explain Newtons law of viscosity. **[7M]**

   (b) Two horizontal plates are placed 1.25 cm apart, the space between them being filled with oil of viscosity 14 poises. Calculate the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s. **[7M]**

2. (a) State and prove Pascal's law in fluid mechanics. **[7M]**

   (b) A rectangular plane surface 3 m wide and 4 m deep lies in water in such a way that its plane makes an angle of 30^0 with the free surface of water. Determine the total pressure force and position of center of pressure, when the upper edge is 2 m below the free surface **[7M]**

UNIT – II

3. (a) A rectangular plate 3 meters long and 1 m wide is immersed vertically in water in such a way that its 3 meters side is parallel to the water surface and is 1m below it. Find **[7M]**
   i. Total pressure on the plate
   ii. Position of center of pressure.

   (b) Define Stream line, Path line and Streak line with neat sketches. **[7M]**

4. (a) A vertical cylinder 300mm in diameter is fitted at the top with a tight but frictionless piston and filled with water at 70^0 C. The outer portion of the piston is exposed to atmospheric pressure of 101.3 kPa. Calculate the minimum force applied on the piston that will cause water to boil at 70^0 C. Take Vapor pressure of water at 70^0 C as 32k Pa. **[7M]**

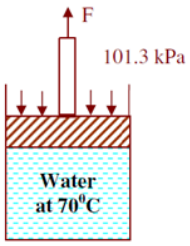

Figure 1

(b) Water is flowing through a pipe of diameter 5cm under a pressure of 29.43N/cm^2 (gauge) andwith mean velocity of 2 m/s. Find the total energy per unit weight of the water at a cross-section,which is 5m above the datum line. **[7M]**

UNIT – III

5. (a) Differentiate between forced vortex and free vortex flow. **[7M]**

   (b) A open circular tank of 20 cm diameter and 100 cm long contains water up to a height of 60 cm. The tank is rotated about its vertical axis at 300 rpm., find the depth of parabola formed at the free surface of water. **[7M]**

6. (a) State and derive Buckingham's π - theorem. **[7M]**

   (b) Define Reynold's number and Froude's numbers. Derive expressions for these numbers. **[7M]**

UNIT – IV

7. (a) What is meant by boundary layer? Why does it increase with distance from the upstream edge? **[7M]**

   (b) Explain Reynolds's experiment with neat sketch. **[7M]**

8. (a) Define: laminar boundary layer, turbulent boundary layer, laminar sub layer and boundary layer thickness. **[7M]**

   (b) An oil of viscosity 10 poise flows between two parallel plates which are kept at distance of 50 mm apart. Find the rate of flow of oil between the plates if the drop of pressure in a length of 1.2 m be 0.3 N/cm^2. The width of the plates is 200 mm. **[7M]**

UNIT – V

9. (a) Classify the fluid machine types with suitable examples. **[7M]**

   (b) Derive and explain Impulse momentum Equation (or) Momentum Equation **[7M]**

10. (a) Write the equation for Euler turbo machine? **[7M]**

    (b) Explain boundary layer characteristics. Derive the expression for boundary layer thickness. **[7M]**

– ○ ○ ◯ ○ ○ –