Hall Ticket No | | | | | | | | | | | Question Paper Code: AAEC03

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024
Regulation: UG20

FLUID DYNAMICS

Time: 3 Hours **(AERONAUTICAL ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Outline the concept of viscosity and obtain its equation. Mention the variation of viscosity with temperature. [BL: Understand| CO: 1|Marks: 7]

   (b) The dynamic viscosity of oil used for lubrication between a shaft and sleeve is 6 poise. The shaft diameter is 0.4m and rotates at 190 RPM. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness foil film is 1.5mm. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) List various types of forces acting on a moving fluid. Demonstrate about geometric similarity kinematic similarity and dynamic similarity with suitable example and diagrams. [BL: Understand| CO: 2|Marks: 7]

   (b) Water is flowing through a pipe of diameter 30 cm at a velocity of 4 m/s. Calculate the velocity of oil flowing in another pipe of diameter 10 cm, if the condition of dynamic similarity is satisfied between two pipes. The viscosity of water and oil is given as 0.01 poise and 0.025 poise. The specific gravity of oil =0.8. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) State law of conservation of mass. Determine continuity equation for three dimensional, compressible and steady flow. [BL: Understand| CO: 3|Marks: 7]

   (b) Water is flowing through a pipe of 5cm diameter, under a pressure of 29.43N/cm^2 and with mean velocity of 2 m/sec. find the total head or total energy per unit weight of water at a cross-section, which is 5m above datum line. [BL: Apply| CO: 3|Marks: 7]

4. (a) Describe the working principle and evaluate an expression for rate of flow through venturi meter. [BL: Understand| CO: 4|Marks: 7]

   (b) A pitot tube is placed in the centre of a 300mm pipe line has one end 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 60mm of water. Co-efficient of pitot tube $C_V = 0.98$. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Outline the momentum thickness of boundary layer for a flow over a flat plate and find its equation. [BL: Understand| CO: 5|Marks: 7]

   (b) Calculate the displacement thickness and momentum thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$. [BL: Apply| CO: 5|Marks: 7].

6. (a) Write the Von Karman integral momentum equation and interpretthe average co efficient of drag and boundary conditions for the velocity profiles for it. [BL: Understand| CO: 5|Marks: 7]

   (b) A thin plate is moving in still atmosphere air at a velocity of 5 m/s. The length of the plate is 0.6 m and width is 0.5 m. Calculate the thickness of boundary layer at the end of the plate and drag force on one side of the plate take density of air is 1.24 kg/m^3 and kinematic viscosity 0.15 stokes. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Classify turbines according to the type of energy available at the inlet of the turbine, direction of flow through the vanes, head at the inlet of the turbine and specific speed of the turbine. [BL: Understand| CO: 6|Marks: 7]

   (b) A Pelton wheel has a mean bucket speed of 10m/s with a jet of water flowing at the rate of 700lts/sec under a head of 30 m. the buckets deflect the jet through an angle of 1600 calculate the power given by the water to the runner and hydraulic efficiency of the turbine? Assume co-efficient of velocity=0.98. [BL: Apply| CO: 6|Marks: 7]

8. (a) Explain various types of the casing of a centrifugal pump mostly adopted in engineering applications. [BL: Understand| CO: 6|Marks: 7]

   (b) A single acting reciprocating pump running at 50 RPM delivers 0.01 m^3/s of water. Thediameter of pistonis 200mm and stroke length in 400mm. Determine

   i) The theoretical discharge of pump

   ii) Co-efficient of discharge

   iii) Slip and the percentage slip of pump. [BL: Apply| CO: 6|Marks: 7]

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