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Code No: 07A30105 **R07** **Set No. 2**

II B.Tech I Semester Examinations,MAY 2011
MECHANICS OF FLUIDS
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Differentiate between the Eulerian and lagrargian methods of representing fluid flow.
   (b) The flow field of a fluid is given by V = xyi+2yzj - (yz+z^2) k.
      i. Show that it represents a possible three dimensional steady incompressible continuous flow.
      ii. Is this flow rotational or irrotational? [8+8]

2. (a) A supersonic plane at a height H from the ground is flying. The observer on the ground hears the sonic boom t seconds after passing the plane over his head. Prove that, the Mach number of the flying plane is given by
   $\frac{1}{M} = \sqrt{1 - \left(\frac{Ct}{H}\right)^2}$
   where C is the sound speed.
   (b) Find the sonic velocity for the following fluids:
      i. Crude oil, ρ = 800 kg/m^3 and K = 1530 MN/m^2,
      ii. Mercury, p = 13600 kg/m^3 and K = 27000 MN/m^2. [10+6]

3. A horizontal circular tube of radius 'a' has a fixed coaxial cylindrical core of radius b. τ_a and τ_b are the shear stresses along the tube and core surfaces when a viscous liquid is flowing through the annulus. The flow is laminar and the rate of variation of pressure along the length of the passage is $\left(-\frac{\partial p}{\partial l}\right)$ Show that:
   $a\tau_a - b.\tau_b = \frac{1}{2}(a^2 - b^2)\left(\frac{\partial p}{\partial l}\right)$. [16]

4. A vertical venturimeter 40 cm× 20 cm is provided in a vertical pipe to measure flow of oil of relative density 0.8. The difference in elevation of throat section and the entrance section is 1 m, the direction of flow being vertically upwards. The oil mercury differential gauge shows deflection of mercury equal to 40 cm. Neglecting the losses, determine the quantity of oil flowing through the pipe. [16]

5. (a) Two vertical parallel glass plates distance t apart are partially submerged in a liquid of specific weight g and surface tension s. Show that the capillary rise is given by
   $h = \frac{2\sigma Cos\theta}{t\gamma}$
   (b) Derive the expression for the total pressure and centre of pressure for a submerged inclined plane surface. [8+8]

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6. (a) What is a boundary layer? Why does it increase with distance from the up stream edge?

   (b) For the velocity profile in laminar boundary layer given as $\frac{u}{U} = \frac{3}{2}(y/\delta) - \frac{1}{2}(y/\delta)^3$, find the thickness of the boundary layer and shear stress 1.8 m from the leading edge of a plate. The plate is 2.5 m long and 1.5 m wide and is placed in water which is moving with a velocity of 15cm per second. Find the drag on one side of the plate if the viscosity of water = 0.01 poise. [4+12]

7. (a) When pipes are connected in series what is the loss of head in the system?

   (b) A sudden expansion from a diameter of 250 mm to a diameter of 500 mm is provided in a pipe line. The power lost due to the sudden enlargement is found to be 5 kW. Find the rate of flow in the pipe and the difference of pressure between sections before and after the sudden enlargement. [6+10]

8. (a) State and prove the impluse momentum equation, giving the expression for force exerted by the fluid on a bend in a pipe.

   (b) Water is flowing at the rate of 40 lit/s through a tapering pipe the diameters at the bottom and upper ends are 300 mm and 200 mm respectively. If the intensities of pressure at the bottom and upper ends are 250 kN/m^2 and 100 kN/m^2 respectively. Find the difference in datum head. [8+8]

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Code No: 07A30105 **R07** **Set No. 4**

II B.Tech I Semester Examinations,MAY 2011
MECHANICS OF FLUIDS
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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   (b) A sudden expansion from a diameter of 250 mm to a diameter of 500 mm is provided in a pipe line. The power lost due to the sudden enlargement is found to be 5 kW. Find the rate of flow in the pipe and the difference of pressure between sections before and after the sudden enlargement. [6+10]

3. (a) Differentiate between the Eulerian and lagrargian methods of representing fluid flow.
   (b) The flow field of a fluid is given by V = xyi+2yzj - (yz+z^2) k.
      i. Show that it represents a possible three dimensional steady incompressible continuous flow.
      ii. Is this flow rotational or irrotational? [8+8]

4. (a) A supersonic plane at a height H from the ground is flying. The observer on the ground hears the sonic boom t seconds after passing the plane over his head. Prove that, the Mach number of the flying plane is given by
   $\frac{1}{M} = \sqrt{1 - \left(\frac{Ct}{H}\right)^2}$
   where C is the sound speed.
   (b) Find the sonic velocity for the following fluids:
      i. Crude oil, ρ = 800 kg/m^3 and K = 1530 MN/m^2,
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5. (a) Two vertical parallel glass plates distance t apart are partially submerged in a liquid of specific weight g and surface tension s. Show that the capillary rise is given by
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   (b) Derive the expression for the total pressure and centre of pressure for a submerged inclined plane surface. [8+8]

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Aeronautical Engineering

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Code No: 07A30105 **R07** **Set No. 3**

II B.Tech I Semester Examinations,MAY 2011
MECHANICS OF FLUIDS
Aeronautical Engineering

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