Code No: 43035/43036 **R07** **Set No - 1**

II B.Tech I Semester Regular Examinations,Nov/Dec 2009
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) Identify the common features and differences between stream and velocity potential functions.
   (b) Examine whether the velocity field U = 2ax(3y^2-x2) and V = 2ay (3x^2-y^2) represent a possible two dimensional in compressible fluid flow. [8+8]

2. Derive an expression for the discharge over a sharp crested rectangular weir. A sharp edged weir is to be constructed across a stream in which the normal flow is 200 litres/sec. If the maximum flow likely to occur in the stream is 5 times the normal flow then determine the length of weir necessary to limit the rise in water level to 38.4cm above that for normal flow. C_d=0.61. [16]

3. (a) Explain in different losses that take place when the fluid flows through a pipe.
   (b) A pipe carrying the water at the rate of 3 m^3/min reduced suddenly from 20 cm to 10 cm. The pressure head just before contraction is 0.6 m greater than that of the pressure before the contraction. Determine the coefficient of contraction. [4+12]

4. (a) Explain the characteristics of laminar and turbulent boundary layers.
   (b) A plate 450 mm × 150 mm has been placed longitudinally in a stream of crude oil (specific gravity 0.925 and kinematic viscosity of 0.9 stoke) which flows with velocity of 6 m/s. Calculate:
      i. The friction drag on the plate,
      ii. Thickness of the boundary layer at the trailing edge and
      iii. Shear stress at the trailing edge. [6+10]

5. A 600mm diameter pipeline carries water under a head of 30m with a velocity of 3m/s. This water main is fitted with a horizontal bend which turns the axis of the pipeline through 75 (i.e. the internal angle at the bend is 105). Calculate the resultant force on the bend and its angle to the horizontal. [16]

6. (a) How is turbulent motion classified?
   (b) In a pipe of 300 mm diameter having turbulent flow, the center-line velocity is 6 m/s and that at 50 mm from the pipe wall is 5 m/s. Calculate the shear friction velocity. [6+10]

7. (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]

8. (a) The face of a dam is vertical to a depth of 7.5m below the water surface then slopes at 30^o to the vertical. If the depth of water is 17m what is the resultant force per meter acting on the whole face?

(b) With the help of rheological diagram, explain the various types of fluids.[8+8]

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