Code No: 43035/43036 **R07** **Set No - 3**

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) Describe Reynolds experiments to demonstrate the laminar and turbulent fluid flows. How is the type of flow related to Reynold number?
   (b) Determine the nature of flow when an oil of specific gravity 0.85 and kinematic viscosity 1.8×10^{-5} m^2/s flows in a 10 cm diameter pipe at 0.5 liter per second. [8+8]

2. (a) Explain the difference between ideal fluid and real fluid.
   (b) A wooden block of size 2m × 1m × 0.8 m is floating in water. If its specific gravity is 0.7 find its metacentric height. [6+10]

3. (a) What do you understand by the terms: Major energy loss and Minor energy losses in pipes?
   (b) What do you understand by total energy line, hydraulic gradient line, pipes in series, pipes in parallel and equivalent pipe? [4+8]

4. A pipe 200 m long slopes down at 1 in 100 and tapers from 800 mm diameter at the higher end to 400 mm diameter at the lower end, and carries 100 l/s of oil. (Specific gravity of oil is 0.85). If the pressure at the higher end reads 50 kN/m^2, determine
   (a) the velocities at the two ends, and
   (b) pressure at the lower end. Assume that the losses are negligible. [16]

5. (a) Explain why air flowing at low velocities can be considered incompressible?
   (b) A pitot-static tube is inserted into an airstream and the mercury manometer connected differentially to it shows a difference in levels of 600 mm. The free stream pressure and temperature are 101.3 kN/m^2 absolute and 288 K respectively. Calculate the air velocity considering air to be compressible. What percentage error in velocity calculations would be committed if the air flow is considered as incompressible? [4+12]

6. Water flowing in a certain 20mm pipe becomes turbulent at a velocity of 11.4cm/s. What is the maximum velocity for the flow of air to be laminar in a pipe 40mm diameter of similar construction? Take viscosity of water = 1.12 x 10^{-3} kg/m-s and air as 17.7 N-s/m^2, density of water = 1000 kg/m^3 and air =1.23 kg/m^3. [16]

7. (a) Define

i. Path line
ii. Stream line
iii. Streak line
iv. Stream tube.

(b) Show that $\Psi = x^2 - y^2$ represents a two dimensional irrotational flow. Find the potential function. [8+8]

8. (a) How will you find the drag on a flat plate due to laminar and turbulent boundary layers?

(b) For the velocity profile for turbulent boundary layer $\frac{u}{U} = \left(\frac{y}{\delta}\right)^{\frac{1}{7}}$, obtain an expression foe boundary layer thickness, shear stress, drag force on one side of the plate and co-efficient of drag in terms of Reynolds number. Given the shear stress (t0) for turbulent boundary layer as $\tau_0 = 0.0225\rho U^2 \left(\frac{\mu}{\rho U \delta}\right)^{\frac{1}{4}}$. [4+12]

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