

**II B.Tech II Semester Supplementary Examinations, April/May 2005**  
**MECHANICS OF FLUIDS**  
**( Common to Mechanical Engineering and Metallurgy & Material Technology)**

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

**Answer any FIVE Questions**  
**All Questions carry equal marks**

\*\*\*\*\*

1. (a) State Newtons law of viscosity. Distinguish between Newtonian and Non-Newtonian fluids.  
(b) A circular disc of diameter  $d$  is slowly rotated in a liquid of large viscosity  $\mu$  at a small distance  $h$  from a fixed surface. Draw the sketch and derive an expression for the torque  $T$  necessary to maintain an angular velocity  $\omega$ .
2. (a) Define equipotential line and a line of constant stream function, Show that these lines intersect orthogonally.  
(b) Given that  $u = x^2 - y^2$  and  $v = -2xy$ . Check whether stream function exists. If so determine the stream function and potential function for the flow.
3. (a) Derive Euler's equation of motion for a fluid flow.  
(b) A jet of water issues from 20 mm dia fire hose at the end of which a 5.0 mm diameter nozzle is fixed. If pressure at inlet of the nozzle is  $200 \text{ kN/m}^2$ , determine force exerted by nozzle on the flow.
4. (a) Sketch the growth of boundary layer on a flat plate and explain the different regions of it.  
(b) Find the displacement thickness and wall shear stress for the velocity distribution in a boundary layer  $(u/U) = (y/\delta)$  where  $U$  is the Velocity and  $\delta$  is the boundary layer thickness.
5. Find the mass flow rate of air through Venturimeter having inlet diameter 300 mm and throat diameter 150 mm, The pressure and temperature of air at inlet section of venturimeter are  $137 \text{ kN/m}^2$  and  $15^\circ\text{C}$  respectively and pressure at throat is  $127 \text{ kN/m}^2$ . Take  $R = 290 \text{ J/K}^\circ\text{K}$  and adiabatic expansion  $\gamma = 1.4$ .
6. (a) Prove that in a steady uniform laminar flow, the pressure gradient in the direction of flow is equal to the shear stress gradient in the normal direction.  
(b) In an experiment, the details of laminar flow of fluid are as follows. Determine the discharge in the pipe.  
Specific gravity = 1.67  
Viscosity = 1.56 poise  
Diameter of pipe = 15 cm  
Length of the pipe = 2000 m  
Loss of head = 0.45 m

7. (a) What is siphon? On what principle it works?  
(b) A horizontal pipe of diameter 50 cm is suddenly contracted to a diameter of 25 cm. The pressure intensities in the large and smaller pipe are given as  $13.734 \text{ N/cm}^2$  and  $11.772 \text{ N/cm}^2$  respectively. If the rate of flow of water is 300 lit/sec, find the value of coefficient of contraction.
8. (a) Explain orifice meter in detail with diagram. Also derive an expression for finding out the actual discharge from a given orifice meter.  
(b) How will you find the discharge through or triangular notch

\*\*\*\*\*