



College of Engineering, Pune  
Wellesley Road, Shivajinagar, Pune 411005  
End Semester Examination  
CE-207 Fluid Mechanics-I

Civil

Program: S. Y. B.Tech  
Specialization: Civil Engineering  
Year: 2012-13

Day & Date: Monday 01/12/2012  
Duration: 3 hours  
Max. Marks: 100

**Instructions**

1. Read all the questions carefully before you start writing the answers.
2. Numbers to the right indicate full marks
3. All Questions are compulsory.

- Q.1**
- a) Give five examples of fluid flow phenomenon encountered in every day life. Also state which of the fluid property/properties are important in those phenomenon? **(05)**
  - b) If  $u=ax$  and  $v= ay$  and  $w= -2az$  are the velocity components for a fluid flow in a particular case, check whether they satisfy the continuity equation. If they do, is the flow rotational or irrotational? Also obtain equation of stream line passing through the point (2, 2, 4) **(10)**
  - c) Three cylindrical tubes of 0.50 m length are placed co-axially and the central tube is rotated at 5 rpm applying a torque of 6.0 N-m. Determine the viscosity of oil which fills the space between the tubes. Take  $R_1, R_2, R_3$  as 0.150, 0.152, and 0.154 m. **(05)**
- Q.2**
- a) A tank shown in Figure-01 contains oil of relative density 0.80. If it is given an acceleration of  $5.0 \text{ m/s}^2$  along a  $30^\circ$  inclined plane in the upward direction, determine the slope of free surface and pressure at b. **(10)**

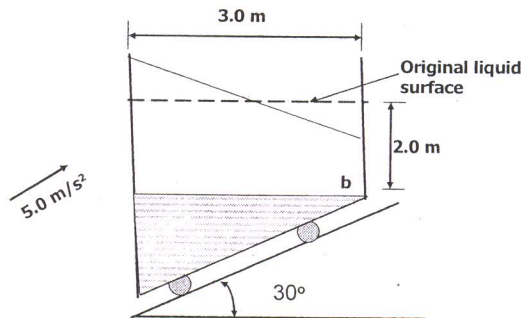
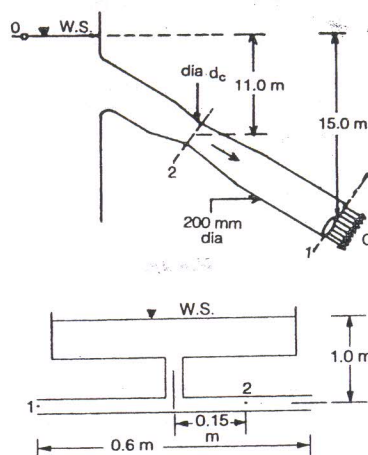


Figure-01

- b) A reservoir is connected to 0.60 m diameter parallel circular plates kept 2mm distance apart as shown in Figure-02. Determine the discharge and gauge pressure at section 2. **(10)**

Figure-02



- Q. 4 a) Determine the ratio of throat diameter to exit diameter of a convergent-divergent mouthpiece for the condition of maximum discharge if  $H=3.0$  m,  $H_a= 10.3$  m and minimum allowable pressure at the throat is equivalent to 2.0 m water absolute. Assume no energy loss in the convergent section and 20 percent of head loss in sudden expansion for divergent section. If throat diameter is 50 mm, determine the discharge. **(10)**
- b) A vane with a turning angle  $\theta$  can move on a cart in the same direction as the jet of area  $A$  and velocity  $U$  which strikes on it tangentially. Assume the cart to be stationary and as the jet strikes it, the cart moves at a velocity  $u$ . Find an expression for  $u(t)$  if the cart weighs  $W$  N. Neglect friction. **(10)**

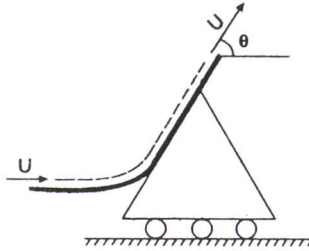


Figure-03

- Q. 5 a) Laminar flow takes place between parallel plates 12 mm apart. The plates are inclined at  $37^\circ$  with the horizontal. For oil of viscosity  $1.25$  kg/m-s and mass density of  $1260$  kg/m<sup>3</sup>, the pressure at two points 1.25 m vertically apart are  $80$  kN/m<sup>2</sup> and  $250$  kN/m<sup>2</sup> when the upper plate moves at  $2.00$  m/s velocity relative to the lower plate but in opposite direction to flow. Determine **(10)**
- i) velocity distribution
  - ii) maximum velocity and
  - iii) shear stress on the top plate.
- b) Air flows at  $30.0$  m/s on a wide plate kept parallel to the air stream assuming the laminar boundary layer to follow the velocity distribution  $u/U= y/\delta$ , determine the rate of flow across section bc, if section cd is located  $0.25$  m downstream of the leading edge of the plate, where boundary layer thickness is  $0.15$  mm as shown in Figure-04 **(10)**

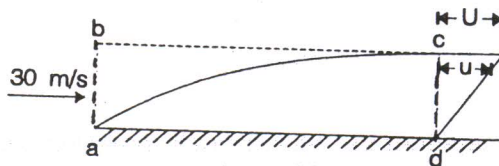


Figure-04

**(OR)**

- b) A smooth pipe carries 7 liters of water per second at  $20^\circ$  c ( $\nu= 1 \times 10^{-6}$  m<sup>2</sup>/sec) with a head loss of 7.5 cm per 10 m of length. Determine the pipe diameter. **(10)**