

Total No of Questions: [8]

SEAT NO. :

[Total No. of Pages :2]

**S. E. (Mechanical / Automobile) 2012 course**

**Fluid Mechanics (Code: 202045)**

**May 2014**

**Time: 2 Hours**

**Max. Marks : 50**

**Instructions to the candidates:**

1. Answer four questions out of 8.
2. Solve Q 1 or 2, Q 3 or 4, Q 5 or 6, Q 7 or 8.
3. All the four questions should be solved in one answer book and attach extra supplements if required.
4. Draw Diagrams wherever necessary.
5. Use of scientific calculator is allowed.
6. Assume suitable data where ever necessary

- Q1) a) What is viscosity? State and explain Newtons Law of viscosity. [6]  
 b) Discuss various type of flows with examples [6]

**OR**

- Q2) a) A circular plate of diameter 1.2 m placed vertically in water in such a way that the centre of the plate is 2.5 m below the free surface of water. i) determine total pressure on the plate ii) position of center of pressure. [6]  
 b) Explain i) surface tension ii) Vapour pressure iii) compressibility [6]
- Q3) a) Derive an expression for velocity profile for laminar flow through pipe [6]  
 b) A liquid of viscosity of 24.5 poise is flowing between two horizontal plates 100 mm apart with a maximum velocity of 1.5 m/s. Calculate i) The discharge per meter width ii) shear stress at the plates iii) The difference in pressure between two plates. [6]

**OR**

- Q4) A 200 mm x 100 mm venturimeter is provided in a vertical pipe carrying water flowing [6]  
 a) in a upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 220 mm. Find the rate of flow.  
 b) Derive an expression for continuity equation for 3-D flow [6]
- Q5) a) Derive an expression for Darcy-Weisbach equation [6]  
 b) Using Buckingham's  $\pi$ - theorem, show that the velocity through a circular orifice is given by [7]

$$V = \sqrt{2gH} \phi \left[ \frac{D}{H}, \frac{\mu}{\rho V H} \right]$$

All terms carry usual meaning

**OR**

- Q6) a) Explain i) Mach Number ii) Froude Number iii) Euler Number [6]  
 b) A 2500 m long pipeline is used for transmission of power. 120kW power is to be transmitted through the pipe in which water having a pressure of 4000kN/m<sup>2</sup> at inlet is flowing. If the pressure drop over the length of pipe is 800 kN/m<sup>2</sup> and  $f=0.006$ . Find [7]  
 i) Diameter of the pipe  
 ii) Efficiency of transmission.



- Q7) a) If velocity distribution in laminar boundary layer over a flat plate is assumed to be given by equation  $u = a + by + cy^2$ , determine its form using the necessary boundary conditions. [6]
- b) Assuming the cross-sectional area of a car to be  $2.7 \text{ m}^2$  with a drag coefficient of 0.6, estimate the energy requirement at a speed of 60 km/h. Assume the weight of car to be 30 kN and coefficient of friction 0.012. Assume density to be  $1.208 \text{ kg/m}^3$  [7]

OR

- Q8) a) Draw profile of symmetrical and unsymmetrical aerofoil and define following terms for an aerofoil i) Chord line ii) Angle of attack iii) stall iv) Camber [6]
- b) Write a short note on "Separation of Boundary Layer its Control" [7]