B.Tech. – VIEP – Mechanical Engineering / B.Tech. Civil Engineering (BTMEVI/BTCLEVI)
Term-End Examination
December, 2014

00225

BIME-004 : FLUID MECHANICS

Time : 3 hours   *Maximum Marks : 70*

*Note : Attempt any **five** questions. All questions carry equal marks. Use of non-programmable scientific calculator is allowed.*

1. (a) Define surface tension. Establish the relationship among surface (σ), pressure within the droplet of liquid in excess of outside pressure (p) and diameter of droplet (d).   7

    (b) Define mass density, weight density, viscosity and specific gravity of fluid, with units.   7

2. (a) Derive an expression of continuity equation for three-dimensional flow.   7

    (b) A stream function in a two-dimensional flow is $\psi = 2xy$. Determine the corresponding velocity potential ϕ.   7

3. (a) What are the differences between single point manometer and differential manometers ? Discuss with neat sketch. 7

   (b) A circular plate 4 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 2 m respectively. Determine the total pressure on one face of the plate and position of the centre of pressure. 7

4. (a) What is a pitot tube ? How is it used to measure velocity of flow at any point in a pipe or channel ? 7

   (b) What do you mean by equivalent pipe ? Give an expression for equivalent pipe. 7

5. (a) Explain Buckingham's π theorem. 6

   (b) What do you mean by dimensionless numbers ? Derive an expression for Reynolds' number and Froude's number with examples. 8

6. (a) Derive an expression for the loss of head due to friction in pipes. 7

   (b) Explain the Prandtl's mixing length theory for turbulent shear stresses and find the expression for velocity profile. 7

7. (a) What do you understand by   7

       (i) Total drag on a body ?

       (ii) Resultant force on a body ?

       (iii) Coefficient of drag and lift ?

   (b) Define and distinguish with neat sketches between source flow and sink flow.   7

8. Write short notes on the following : $4 \times 3\frac{1}{2} = 14$

   (a) Dynamic and Kinematic viscosity

   (b) Syphon and its uses

   (c) Boundary layer separation

   (d) Simple surge tank