Reg. No. : | | | | | | | | | | |

Question Paper Code: 51933

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Third Semester

Chemical Engineering

15UCH303 - FLUID MECHANICS FOR CHEMICAL ENGINEERING

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. An ideal fluid is defined as the fluid which

   (a) is compressible (b) is incompressible
   (c) is incompressible and non-viscous (d) has negligible surface tension

2. A fluid in which resistance to deformation is independent of the shear stress is called

   (a) Bingham plastic fluid (b) Pseudo plastic fluid
   (c) Dilatant fluid (d) Newtonian fluid

3. Pascal's law states that pressure at a point is equal in all direction

   (a) in a liquid at rest (b) in a fluid at rest
   (c) in a laminar flow (d) in a turbulent flow

4. Gauge pressure at a point is equal to

   (a) absolute pressure plus atmospheric pressure
   (b) absolute pressure minus atmospheric pressure
   (c) vacuum pressure plus absolute pressure
   (d) none of the above

5. Reynold's number is defined as the

(a) ratio of inertia force to a gravity force
(b) ratio of viscous force to a gravity force
(c) ratio of inertia force to a elastic force
(d) ratio of inertia force to a viscous force

6. Geometric similarity between model and prototype means

(a) the similarity discharge
(b) the similarity of linear dimensions
(c) the similarity of motion
(d) the similarity of forces

7. Flow occurring in a pipeline when a valve is being opened is

(a) steady (b) unsteady (c) laminar (d) vortex

8. If the fluid particles move in a zig zag way the flow is called

(a) unsteady (b) non-uniform (c) turbulent (d) incompressible

9. For measuring flow by a venturimeter, it should be installed in

(a) vertical line
(b) horizontal line
(c) inclined line with upward flow
(d) in any direction and in any location

10. Which of the following forces does not act in case of fluids?

(a) Centrifugal force
(b) Tensile force
(c) Vibratory force
(d) Elastic force

PART - B (5 x 2 = 10 Marks)

11. State Newton's law of viscosity.

12. Define Pressure energy.

13. What are the types of similarities?

14. Define coefficient of velocity.

15. What is meant by priming?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Find the kinematic viscosity of an oil having density 981 kg/m^3. The shear stress at a point in oil is 0.2452 N/m^2 and velocity gradient at that point is 0.2 *per second* in detail. (6)

(ii) Explain the types of fluid motion. (10)

Or

(b) (i) Explain briefly about the Newtonian and non-Newtonian fluid. (8)

(ii) If the velocity profile of a fluid over a plate is a parabolic with the vertex 20 *cm* plate, where the velocity is 120 *cm/se*. Calculate the velocity gradients and shear stresses at a distance of 0, 10 and 20 *cm* from the plate, if the viscosity of the fluid is 8.5 *Poise*. (8)

17. (a) (i) Derive the equation of continuity in cartesian co-ordinates. (10)

(ii) A pipe through which water is flowing is having diameter, 20 *cm* and 10 *cm* at the cross-section 1 and 2 respectively. The velocity of water at section 1 is given 4.0 *m/s*. Find the velocity head at sectors 1 and 2 also the rate of discharge. (6)

Or

(b) Illustrate and derive the different types of differential manometers. (16)

18. (a) Using Buckingham's π theorem, show that velocity through a circular orifice is given by $V=\sqrt{2gh}\ \Phi\ [\frac{D}{H},\frac{\mu}{\rho VH}]$, where H is the head causing flow, D is the diameter of the orifice , μ is the coefficient of viscosity , ρ is the mass density and g is the acceleration due to gravity. (16)

Or

(b) Explain the different types on the laws of dynamic similarities. (16)

19. (a) (i) Derive the loss of energy to friction in pipes. (6)

(ii) An oil of specific gravity 0.9 and viscosity 0.06 *Poise* is flowing through a pipe of diameter 200 *mm* at the rate of 60 *l/s*. Find the head lost due to friction for a 500 *m* length of pipe. Find the power required to maintain this flow. (10)

Or

(b) (i) With a neat sketch explain Reynold's experimental setup. (8)

(ii) Water of density 1000 kg/m^3 and viscosity 0.0008 Ns/m^2 is pumped at 1000 cm^3/s through a 25 *mm* inner diameter of pipe. Calculate the value of the Reynolds number. (8)

20. (a) (i) How does orifice meter differ from venturimeter. (8)

(ii) An orifice meter with orifice diameter 15 *cm* is inserted in a pipe of 30 *cm* diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 *cm* of mercury. The specific gravity of oil 0.9 when the co-efficient of discharge of the meter = 0.64. Find the rate of flow rate of oil. (8)

Or

(b) Explain the working principle and characteristics performance of centrifugal pumps. (16)
