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

Question Paper Code: 53093

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

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. The flow of an incompressible fluid with no shear is known as

   (a) potential flow (b) laminar flow
   (c) turbulent flow (d) coulter flow

2. An ideal fluid is defined as the fluid which

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

3. The fluid force considered in the Navier stokes equation are

   (a) gravity, pressure and viscous (b) gravity, pressure and turbulent
   (c) pressure, viscous and turbulent (d) gravity, viscous and turbulent

4. Bernoullis equation cannot be applied when the flow is

   (a) rotational (b) turbulent
   (c) unsteady (d) all the above

5. In laminar flow maximum velocity at the centre of pipe is how many times to the average velocity?

   (a) ML^{-3} (b) $M^{-3}L$ (c) $ML^{-1}T^{-1}$ (d) ML^{-2}

6. The dimensions of density is

(a) compressive (b) impact (c) shear (d) none of these

7. A large Reynold's Number is indication of

(a) smooth and stream line flow (b) laminar flow
(c) steady flow (d) highly turbulent flow

8. Reynold's Number is defined as the

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

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. Define Newton's law of viscosity.

12. Define fluid statics.

13. Define dimensional homogeneity.

14. Define drag and drag coefficient.

15. Explain cavitation in a pump.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Distinguish between Newtonian and non -Newtonian fluids. (6)

(ii) What is meant by continuum concept of the system? (6)

(iii) Define viscosity and Kinematic viscosity and give its unit. (4)

Or

(b) (i) Write a brief note on thermodynamic properties of a fluid. (10)

(ii) A body weighs 1000 lbf when exposed to a standard earth gravity g=32.174 ft/s^2.

(a) What is its mass in kg?

(b) What will the weight of this body be in N if it is exposed to the moon's standard acceleration gmoon = 1.62 m/s^2?

(c) How fast will the body accelerate if a net force of 400 lbf is applied to it on the moon or on the earth. (6)

17. (a) (i) Discuss about hydrostatic pressure distribution or general equation for variation of pressure due to gravity at various heights in a static fluid. (8)

(ii) Give the derivation of one dimensional flow continuity equation and three dimension in detail. (8)

Or

(b) Derive Bernoulli's equation starting from Euler's equation. Mention its assumptions and applications (16)

18. (a) (i) The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft l, velocity V, air viscosity μ, air density ρ, and bulk modulus of air k. Express the functional relationship between the variables and the resisting force. (10)

(ii) A pipe of diameter 1.5 m is required to transport an oil of specific gravity 0.90 and viscosity $3x10^{-2}$ poise at the rate of 3000litre/sec. Tests were conducted on a 15 cm diameter pipe using water at 20° C. Find the velocity and rate of flow in the model. (6)

Or

(b) (i) Write a brief note on the similitude and explain the types of similarity in detail. (8)

(ii) A river model is to be constructed to a vertical scale of 1:50 and a horizontal of 1:200. At the design flood discharge of $450m^3$/sec, the average width and depth of flow are 60m and 4.2m respectively. Determine the corresponding discharge in model and check the Reynolds' Number of the model flow. (8)

19. (a) Derive Kozeny – Carman equation and Burke –plummer equation for the friction in flow of fluids through the beds of solids. (16)

Or

(b) (i) Write short notes on Internal versus External Viscous Flows. (6)

(ii) Derive Darcy Weisbach formula for the head loss due to friction in a pipe line. (10)

20. (a) (i) Explain the characteristics curves of centrifugal pump. (6)

(ii) With a neat sketch explain the working of a reciprocating pump. (10)

Or

(b) (i) Discuss the relative merits and demerits of venturimeter with respect to orifice meter. (6)

(ii) Explain the working principles of venturimeter with a neat diagram. Derive the volumetric flow rate expression. (10)

———————