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

Question Paper Code: 53903

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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

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

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. What is meant by priming?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Explain the types of fluid motion. (10)

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

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 $g_{moon} = 1.62\ m/s^2$?

(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) Derive the equation of continuity in cartesian co-ordinates. (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 working principle and characteristics performance of centrifugal pumps. (16)

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)

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