**A** **Reg. No. :** | | | | | | | | | | |

**Question Paper Code: 53903**

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

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 fluid in which the shearing stress within it is proportional to the velocity gradient across he sheared section, is called a _____ fluid. CO1- R

   (a) Newtonian (b) Bingham (c) perfect (d) none of these

2. Surface tension is CO1- R

   (a) Line force (b) Surface force (c) Volume force (d) Both (b) and (c)

3. Very small pressure difference (<5mm water column) can be most conveniently measured by a/an _____ manometer CO2- R

   (a) U-tube mercury (b) U-tube water

   (c) inclined tube mercury (d) inclined tube water

4. Manometric liquid have specific gravity _____ than that of the process fluid whose pressure is to be measured. CO2- R

   (a) Less than (b) Equal to (c) Greater than (d) Both (a) and (b)

5. Which of the following is not a dimensionless parameter? CO3- R

   (a) pressure co-efficient (b) Froude number

   (c) kinematic viscosity (d) weber number

6. Which of the following is not a dimension-less parameter? CO3- R

   (a) Euler number (b) Specific gravity

   (c) Fanning friction factor (d) None of the these

7. The terminal velocity of a particle moving through a fluid varies us dpn. What is the value of 'n' for Newton law regime? CO4- R

(a) 2 (b) 1 (c) 1.5 (d) 0.5

8. Pressure drag does not depend upon the CO4- R

(a) Roughness of surface of the body (b) Pressure of main flow only

(c) Length of the body in flow direction (d) All (a), (b) and (c)

9. If the discharge of the centrifugal pump is throttled , then its suction lift CO5- R

(a) decreases (b) increases

(c) remains unchanged (d) data insufficient to predict

10. Multistage compressors are used in industry , because they CO5- R

(a) reduce the cost of compressor

(b) reduce the size requirement

(c) resemble closely to isothermal compression

(d) are easy to control

PART – B (5 x 2= 10 Marks)

11. Define Bingham fluid. CO1- R

12. State Bernoulli equation. CO2- R

13. Define Dimensional Homogenity CO3- R

14. Define boundary layer thickness. CO4- R

15. What are the advantages of centrifugal pump? CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) Explain in detail about the classification of fluid and (ii) types of fluid motion CO1-App (16)

Or

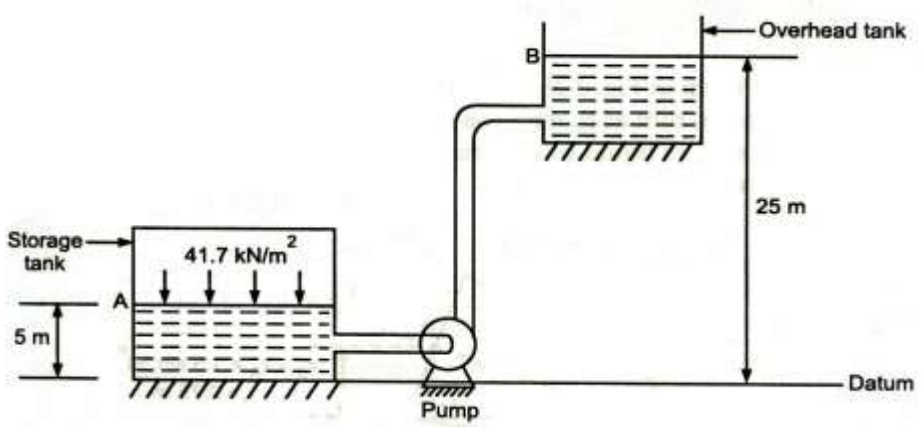
(b) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60cm. The thickness of the oil film is 12.5mm. The upper plate, which moves at 2.5 meter per sec, requires a force of 98.1N to maintain the speed. Determine the Dynamic viscosity of the oil in poise, Kinematic viscosity of the oil in stokes and the specific gravity of the oil is 0.95. CO1-App (16)

17. (a) (i) How do we measure pressure difference using U –tube manometer? CO2-App (16)

(ii) what are the advantages and disadvantages of manometer?

Or

(b) A 15 kW pump is used to discharge oil of specific gravity 0.85 to the overhead tank as shown in Figure. If the head loss in the entire system is 1.75 m of oil, find the discharge of the oil from pump, if efficiency of pump is 80% (neglect velocity heads). CO2- Ana (16)




18. (a) The discharge $Q$ through an orifice is a function of the diameter $d$, the pressure difference $p$, the density ρ, and the viscosity μ, show that $Q = \frac{d^2 p^{1/2}}{\rho^{1/2}} \Phi\left(\frac{d\,\rho^{1/2} p^{1/2}}{\mu}\right)$, where Φ is some unknown function. CO3-Ana (16)

Or

(b) Explain Buckingham's π theorem with its application for dimensionless analysis. CO3-Ana (16)

19. (a) Explain briefly about the loss of head due to friction at laminar flow condition in circular pipe. CO4-App (16)

Or

(b) Water is pumped from a reservoir to a height of 1000 m from the reservoir level, through a pipe of 15 cm I.D. at an average velocity of 4 m/s. If the pipeline along with the fittings is equivalent to 2000 m long and the overall efficiency is 70%, what is the energy required for pumping? Friction factor $f = 0.046\ Re^{-0.2}$. CO4-App (16)

20. (a) Derive the flow equation for the venturimeter where the pressure difference is expressed in terms of pressure head. CO5- U (16)

Or

(b) A centrifugal pump pumps brine from the bottom of the supply tank and delivers it into the bottom of another tank. The level of the brine in the receiving tank is 50 m above that in the supply tank. The tanks are connected by a 180 mm pipe of length 200 m. The flow rate of brine is $0.05 m^3/s$. The pipeline between the tanks has two gate valves and 8 other pipe fittings. What is the energy cost for running this pump for a 24-h day? CO5-App (16)

Data:

Density of brine = 1180 $kg/m^3$

Viscosity of brine = 1.2 mPa s

One gate valve is equivalent to 7 pipe diameters and each of the fittings is equivalent to 60 pipe diameters.

Energy costs Rs.0.80 per kWh and the overall efficiency of the pump – motor set is 60%.