A

Question Paper Code: 93904

B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Third Semester

Chemical Engineering

19UCH304- FLUID FLOW OPERATIONS

(Regulation 2019)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1.   Poise is the unit of   CO1- R

(a) mass density   (b) kinematic viscosity   (c) viscosity   (d) velocity gradient

2.   Manometers are devices used to measure   CO1- R

(a) pressure   (b) density   (c) volume   (d) colour

3.   Continuity equation takes the form   CO1- R

(a) $A_1V_1=A_2V_2$ (b) $A_1V_1H_1=A_2V_2H_2$ (c) $A_1V_1J_1= A_2V_2H_2$ (d) $A_1=A_2$

4.   Bernoulli's equation is dependent on the   CO1- R

(a)first law of thermodynamics.   (b) third law of thermodynamics

(c) law of conservation of momentum   (d) none of these

5.   Ratio of inertial forces to surface tension forces is called the   CO1- R
_____ number.

(a) Weber   (b) Euler

(c) Froude   (d) Mach

6.   Identification of pipelines carrying different liquids and gases is done   CO2- R
by the_____ of the pipe.

(a) colour   (b) diameter   (c) length   (d) thickness

7. At superficial velocities above the minimum fluidization velocity,   CO2- R
   fluidization may in general be

   (a) non bubbling   (b) bubbling

   (c) either bubbling or non-bubbling   (d) both bubbling and non-bubbling

8. Region just above the bed surface in which coarse particles fall back down   CO1- R

   (a) Splash   (b) Freeboard   (c) Disengagement   (d) Dilute phase

9. Priming is needed in a _____ pump   CO1- R

   (a) centrifugal   (b) gear   (c) reciprocating   (d) diaphragm

10. Molten soap mass is transported by means of a   CO1- R
    _____ pump

    (a) centrifugal   (b) reciprocating   (c) diaphragm   (d) gear

PART – B (5 x 2= 10 Marks)

11. Calculate the specific weight, and specific gravity of one litre of liquid which   CO3- Ana
    weights 7 N.

12. If the discharge velocity of water in a pipe flow is 0.8 m/s and diameter of the   CO3- Ana
    pipe is 5 cm, then find out how much time required to fill 50 litre tank.

13. List out different types of similarity.   CO2- U

14. Define Bubbling velocity .   CO2- U

15. Define Specific speed of a pump   CO2- R

PART – C (5 x 16= 80 Marks)

16. (a) The space between tow square flat parallel plates is filled with oil.   CO3- App   (16)
    Each side of the plate is 60 cm. The thickness of the oil film is 12.5
    mm. The upper plate, which moves at 2.5 m/s requires a force of
    98.1 N to maintain the speed. Determine:

          (i) Dynamic viscosity of the oil in poise

          (ii) Kinematic viscosity of the oil in stokes if the specific
            gravity of the oil is 0.95

    <div align="center">Or</div>

    (b) Determine Mass density, Specific volume, and Specific weight of   CO2- Ana   (16)
    liquid whose specific gravity is 0.85.

<div align="center">2</div>

17. (a) Water flows through a pipe AB 1.2m diameter at 3m/s and then CO3- App (16)
passes through a pipe BC 1.5m diameter. At C, the pipe branches. Branch CD is 0.8m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE

Or

(b) Derive the equation of continuity in cartesian coordinates assuming CO2 -U (16)
the fluid is under steady state and incompressible.

18. (a) The resisting force (R) of a supersonic flight can be considered as CO5- E (16)
dependent upon length of aircraft (l), velocity (V), air viscosity 'μ', air density 'ρ', and bulk modulus of air ' k'. Express the functional relationship between these variables and the resisting force.

Or

(b) A ship is 300 m long moves in sea water, whose density is 1030 CO5- E (16)
kg/m^3. A 1:100 model of this to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30 m/s and the resistance of the model is 60 N. Determine the velocity of ship in sea water and also the resistance of the ship in sea water. The density of air is given as 1.24 kg/m^3. Take the kinematic viscosity of sea water and air as 0.012 stokes and 0.018 stokes respectively.

19. (a) Give an elaborate note on the types of fluidization CO6- U (16)

Or

(b) Discuss in detail the application of Fluidization Technology in the CO2- Ana (16)
perspective of Chemical Engineering.

93904

20. (a) A centrifugal pump impeller having external and internal diameter CO4- App (16)
480 mm and 240 mm respectively is running at 1000 rpm. The rate
of flow through the pump is 0.0576 m^3/s and velocity of flow is
constant and is equal to 2.4 m/s. the diameter of suction and delivery
pipes are 180 mm and 120 mm respectively and suction and delivery
heads are 6.2 m (abs) and 30.2 m of water respectively. If the power
required to the pump is 23.3 KW and the outlet vane angle is 45°.
Determine:

 (i) Inlet vane angle

(ii) Overall efficiency of pump

(iii) Manometric efficiency of pump

Or

(b) Explain in detail about the principle and working of double acting CO2- U (16)
reciprocating pump with neat diagram andexpress the equation for
discharge, work done and power required for reciprocating pump

93904