III Semester Chemical Engineering B Tech End Semester Examinations - December 2022

Momentum Transfer CHE~~2135~~ 2153

Q1. What is meant by hydrostatic equilibrium? Derive the expression for it and then deduce the Barometric equation. (4)

Q2. Define Newton's law of viscosity. Find the kinematic viscosity of oil of density 981kg/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. (3)

Q3. Define the term Manometry. Derive the working equation for a U tube differential manometer. (3)

Q4. Derive Bernoulli's equation. State all assumptions. (4)

Q5. Water is pumped from a large reservoir to the bottom of an open tank 10m above the reservoir surface through 12cm I.D. pipe at a rate of 12 liters per second. The total energy loss due to friction in the piping system is 125 J/Kg. Calculate the HP required for the pump which has the overall efficiency of 60%. (4)

Q6. Define: i) Entrance length ii) Equivalent diameter. (2)

Q7. A Venturimeter is used to measure the flow rate of water flowing through a pipe of 30 cm diameter. A differential mercury manometer connected between the pressure tappings to entrance and the throat indicates the reading of 5.5 cms. Calculate the discharge through the Venturimeter in m^3/sec. Assume the discharge co efficient 0.98 and the throat diameter is 12cm. Derive the equation used here. (4)

Q8. Explain the construction, principle and working of a Rotameter. (3)

Q9. What do you understand by Torricelli's theorem? How do you use this to deduce the equation for discharge through V notch? (3)

Q10. Deduce Prandtl's log velocity distribution equation for turbulent flow through a circular pipe. State all the assumptions. (4)

Q11. What diameter pipe will deliver oil at a Reynolds number of 2000 and at 170 litres per minute? The kinematic viscosity of oil is 2.3x10-2 m2/hr. (3)

Q12. Define Mach number and explain its physical significance. Ammonia flows at a velocity of 22.275m/s under a pressure of 2 atmospheres absolute. If the temperature is 17°C, at what Mach number does the flow takes place? Indicate the range. (3)

Q13. Explain the basic hydrodynamic behavior and industrial applications of fluidized beds. (4)

Q14. The pressure drop in a viscous incompressible fluid flowing through a pipe in a length 'L' may be represented functionally as $\Delta P = f(\mu, \rho, v, D, L, k)$ where μ= viscosity, ρ= density, v= velocity, L= length and k= roughness. Using Buckingham π method of dimensional analysis, find the correct representation for the pressure drop in terms of dimensionless groups. (4)

Q15. Compare and contrast between Centrifugal and Reciprocating pumps. (2)