INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL

B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – Nov./ Dec. 2020

III SEMESTER - FLUID FLOW OPERATIONS (ICHM 231)

(BRANCH: CHEMICAL)

Time: 3 Hours **Date: 19 November 2020** **Max. Marks: 50**

- ✓ **Answer ALL the questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1.A The pressure difference in a pipeline through which water is flowing measured by U tube mercury manometer. The manometer indicates 20cm of mercury. What would be the corresponding reading, if the manometer is replaced by CCl_4 of specific gravity 1.5? Derive the equation used here **05**

1.B Derive equations for velocity profile and shear stress distribution in a steady, laminar flow through a circular pipe and prove that the average velocity is equal to ½ the maximum velocity **05**

2.A Derive Bernoulli's equation. State all the assumptions. **05**

2.B The discharge of water in a pipeline of 10 cms dia is measured by inserting an orifice plate of 5 cms dia. Two pressure gauges fitted upstream and downstream of the plate have shown the readings of 180 kN/m^2 and $90kN/m^2$. Taking the coefficient of 0.625, find the discharge. Derive the equation used here. **05**

3.A Derive Prandtl's $1/7^{th}$ power law of fluids for turbulent flow through a circular pipe. Sate all the assumptions. **05**

3.B Electrical transmission towers are stationed at 1 km intervals and a conducting cable 2 cm in dia is placed between them. If the wind velocity is 50 km/hr blowing transversely across the wires, calculate the total force to which each tower carrying 25 such cables. Assume the drag coefficient to be 1.2 and the density of air to be 1.2 kg/m^3. **05**

4.A Derive the equations for bed expansion and minimum fluidization velocity in fluidized beds. **05**

4.B Explain the industrial application of packed and fluidized beds and name some industrial packing materials. **05**

5.A Explain the physical significance of Mach Number. Hydrogen gas flows at a velocity of 50 m/s under a pressure of 1.3 bars absolute. If the temperature of the gas is 25^oC, at what Mach number does the flow takes place. Indicate the range. Assume n=1 for hydrogen gas. **05**

5.B A refrigerant of specific gravity 1.4 flows upwards through a pipe which tapers from 1.5 cm diameter at lower end to 0.8 cm diameter over a distance of 1.2 m. the pipe is inclined at 30^0 to the horizontal. If the pressure at the lower end is $196KN/m^2$ (gauge) and the upper end is atmospheric, calculate the rate of flow in liters per second. Neglect losses due to friction. **05**

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