INTERNATIONAL CENTRE FOR APPLIED SCIENCES (Manipal University) III SEMESTER B.S. DEGREE EXAMINATION – NOV. / DEC. 2016 SUBJECT: FLUID FLOW OPERATIONS (CHM 231) (BRANCH: CHEMICAL) Friday, 2 December 2016

Time: 3 Hours

- ✓ Answer ANY FIVE full Questions.
- ✓ Missing data, if any, may be suitably assumed
- **1A.** Explain in detail the different types of fluid flows.
- 1B. Fuel oil is to be transported through a pipe at a rate of 170 lt./min. The kinematic viscosity (v) of the fuel oil is 2.3 * 10⁻² m²/hr and the Reynolds number is 2000. Calculate the diameter of the pipe?
- 2A. Define Absolute, Gauge, atmospheric and Vacuum pressure and derive a relationship to explain the hydrostatic law.
- 2B. Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8m x 0.8m and an inclined plane with angle of inclination 30°. The weight of the square plate is 300N and it slides down, the inclined plane with a uniform velocity of 0.3m/s, the thickness of an oil film 1.5mm. [12+8]
- **3A.** Derive the equation from basics for the terminal velocity of a particle settling in Stokes region.
- **3B.** A differential manometer is connected at the two points A & B of two pipes. The pipe A contains a liquid od specific gravity of 1.5 while pipe B contains a liquid of specific gravity of 0.9. The pressures at A & B are 1 and 1.8 kgf/cm² respectively. Find the difference in mercury level in the differential manometer.

- **4A.** Explain in detail the different types of friction factors and how they are evaluated.
- **4B** Explain the phenomena of fluidization.

[10+10]

[10+10]







Max. Marks: 100

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- **5A.** Derive velocity relationships for compressible fluid flow through pipes under Isothermal and Isentropic flow conditions.
- 5B. Calculate the pressure drop per unit length when diethyl amine is flowing through horizontal smooth pipe of internal diameter 0.03 m. Volumetric flow rate is 1.1 litre/sec. Density of liquid is 935 kg/m³. Viscosity is 0.00195 kg/m.s. Length of the pipe is 1 m. The value of friction factor may be taken as 0.006. [15+5]
- **6A.** Write a note on differential manometers and derive the necessary relations.
- 6B. A liquid of viscosity 1.5 cP and density 900 kg/m³ flows through a packed bed of spherical particles of diameter 10 mm at a rate of 2.5 m³/sec. The dia. of the bed is 0.8 m and bed height is 3m porosity of bed is 0.4. Calculate the power required for pumping the liquid through the bed. [10+10]
- **7A.** Explain in detail with mathematical relations, the principle and working of an orifice and venturi-meters.
- **7B.** Write a note on flow measurements in open channels. [12+8]
- 8. Explain the different "Semi Empirical Theories of Turbulence". [20]

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