

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

III SEMESTER B.S. DEGREE EXAMINATION – APRIL / MAY 2017

SUBJECT: FLUID FLOW OPERATIONS (CHM 231)

(BRANCH: CHEMICAL)

Tuesday, 16 May 2017

Reg.No.

Time: 3 Hours Max. Marks: 100 \checkmark Answer ANY FIVE full Ouestions. ✓ Missing data, if any, may be suitably assumed 1A. Derive a relationship for velocity profile when flow takes place between a rectangular narrow slit. 1**B**. What power is required per kilometer of a 10 cm pipe line (horizontal) to maintain a flow of 8 lt./s of oil having a dynamic viscosity of 0.98 kg/m.s? [12+8]2A. Explain in detail the Rheological classification of fluids. **2B.** Explain any two of the "Semi Empirical Theories of Turbulence". [8+12] 3A. State and derive the Pascal's law (px = py = pz)**3B.** Urea pellets are made by spraying drops of molten urea into cold gas at the top of a tall tower and allowing the material to solidify as it falls. Pellets of 6 mm in diameter are to be made in a tower of 25 m height containing air at 20°C. The density of urea is 1330 kg/m^3 . Assuming free settling conditions, calculate the terminal settling velocity of the [12+8] pellets. **4A**. Write a note on U-tube manometers and derive the necessary relations. A liquid of viscosity 1.5 cP and density 900 kg/m³ flows through a packed bed of **4B**. spherical particles of diameter 10 mm at a rate of 2.5 m^3 /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 [10+10]the liquid through the bed. A venturimeter is installed in a 25mm internal diameter pipe line. The pressure drop 5A. across the upstream side and throat of the venturimeter is two meters of water. Calculate the volumetric flow rate of water in m^3/s through the pipe line. Given data: Diameter of throat of venturimeter =15mm Density of water =1000kg/m³

Coefficient of venture =0.98

5B. With a neat sketch, explain in detail about the working of a centrifugal pump.

6A. Explain and derive Prandtl's Power law of velocity distribution

6 B .	A Simple U tube manometer is filled with mercury (specific gravity 13.6) and the liquid above mercury is carbon tetrachloride (specific gravity 1.6). The manometer reads 200 mm. What is the pressure difference in N/m^2 ?	[15+5]
7A.	Derive velocity relationships for compressible fluid flow through pipes under Isothermal and Isentropic flow conditions.	
7B.	What is the significance if transition length?	[15+5]
8.	Derive Ergun's equation from the fundamentals for a flow of fluid through a packed bed. Discuss also its limitations.	[20]

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