Reg. No.										

MANIPAL UNIVERSITY

THIRD SEMESTER B.S. (ENGG.) DEGREE EXAMINATION – DECEMBER 2015

SUBJECT: FLUID FLOW OPERATIONS (CHM 231)

(BRANCH: CHEMICAL)
(NEW SCHEME)

Friday, December 18, 2015

Time: 10:00 – 13:00 Hrs. Max. Marks: 100

- **Answer any FIVE full questions.**
- **Missing data if any may be suitably assumed.**

1A. Define the flowing terms:

i) Steady flow
ii) Equivalent length
iii) Compressible and incompressible flow
iv) Mach number
v) Kinematic viscosity

1B. What is meant by hydrostatic equilibrium? Derive the equation for it and then deduce barometric equation.

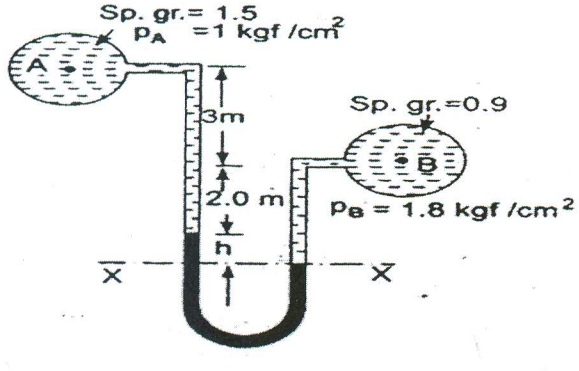
((2 marks × 5)+10 = 20 marks)

2A. Calculate the dynamic viscosity of an oil, which is used for lubrication between square plate of size 0.8m × 0.8m and an inclined plane with angle of inclination 30^0. The weight of square plate is 300N and it slides down the inclined plane with a uniform velocity of 0.3m/s. The thickness of oil film is 1.5mm.

2B. Derive the equations for shear stress and velocity distribution in a steady, laminar flow through a circular pipe.

(10+10 = 20 marks)

3A. A differential manometer is connected at the two points A and B of two pipes as shown in figure. The pipe A contains a liquid of sp.gr =1.5 while pipe B contains a liquid of sp.gr =0.9. The pressure at A and B are 1 kgf/cm^2 and 1.80 kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer.



3B. Derive Bernoulli's equation. State all the assumptions.

(10+10 = 20 marks)

4A. Derive the equations for volumetric flow rate trough V-notch and rectangular notch.

4B. A venturimeter with a throat diameter of 7.5cm is installed in a 15ch diameter of pipe. The pressure at the entrance to the meter is 70kPa (gauge) and it is desired that the pressure at any point should not fall below 2.5cm of water absolute. Determine maximum flow rate of water through a meter. Take Cd=0.97 and atmospheric pressure as 100kPa.

(10+10 = 20 marks)

5A. Derive an equation for laminar flow of Newtonian fluids (Hagen-Poiseuille equation).

5B. Define the terms: Drag and Drag co-efficient.

5C. Hydrogen gas flows at a rate of 50 m/sec under the pressure 1.3 bar absolute. If the temperature of the gas is 25^0C, at what Mach number does flow take place? Assume n=1 for hydrogen gas.

(10+5+5 = 20 marks)

6A. Explain the phenomena of fluidization.

6B. A venturimeter is installed in a 25mm internal diameter pipe line. The pressure drop 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/m^3
Coefficient of venture =0.98

(8+12 = 20 marks)

7. **Explain the following:**

7A. Newtonian and non-Newtonian fluids

7B. Fanning friction factor

7C. Correction factors in Bernoullis Equation

7D. Hydraulically smooth pipe

(5 marks × 4 = 20 marks)