



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



III SEMESTER B.TECH (CHEMICAL ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: MOMENTUM TRANSFER [CHE 2102]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 100

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.

1A.	Find the pressure and density at a height of 7 Km, if the corresponding values at sea level are 101 KN/m ² and 1.235 Kg/m ³ assuming the isothermal conditions. Derive the equation used here.	08
1B.	What diameter pipe will deliver oil at a Reynolds number of 2000 and at 170 liters per minute? The kinematic viscosity of oil is $2.3 \times 10^{-2} \text{ m}^2/\text{hr}$.	06
1C.	Derive Prandtl's 1/7 th power law for turbulent flow through a circular pipe. State all the assumptions.	06
2A.	Derive the equations for shear stress and velocity distribution in a steady, incompressible, laminar flow in between a flat plate. Prove that the average velocity is 2/3 the maximum velocity.	10
2B.	Define Newton's law of viscosity. Find the kinematic viscosity of oil of density 981 kg/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	05
2C.	Explain Buckingham π theorem of dimensional analysis.	05
3A.	An orifice meter is used to measure the rate of air flow through a 2m pipeline The velocity of air through the pipe line is $15m/s$ and a water tube manometer across the orifice meter indicates the reading of 50mm at this velocity. Determine the diameter of the orifice if the co efficient of orifice is 0.64 and the density of air is 1.2 kg/m^3 . Derive the equation used here.	10
3B.	What is fluidization? Explain the different types of fluidization?	06
3C.	Briefly explain the friction factor charts.	04
4A.	State and derive Kozeny Carmen equation for the fluid flow through packed beds. State all the assumptions.	10

4B.	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° C, at what Mach number does the flow takes place? Assume n=1 for hydrogen gas.	04
4C.	Differentiate between centrifugal and reciprocating pump.	06
5A.	Derive an equation for compressible isentropic flow through a convergent divergent nozzle. Prove that the velocity is sonic under maximum discharge conditions	10
5B.	Water is to be pumped from ground level tank to a cooling tower. The difference between the level of water in the tank and discharge point is 15 meters. The velocity of water through 40mm internal diameter discharge pipe is 3m/s. The length of the entire pipe is 30 m. Calculate the power required to pump if the efficiency of the pump is 60%. Use appropriate equation for calculating friction factor.	10