Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. END SEMESTER EXAMINATIONS DEC 2018

SUBJECT: MOMENTUM TRANSFER [CHE 2102]

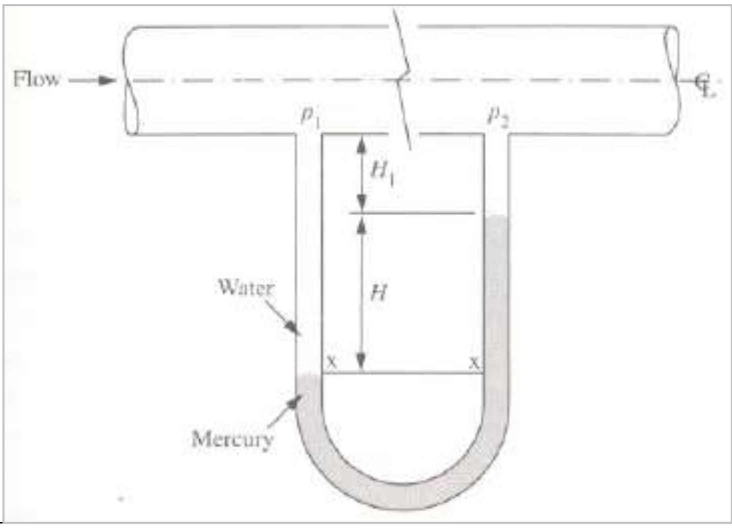
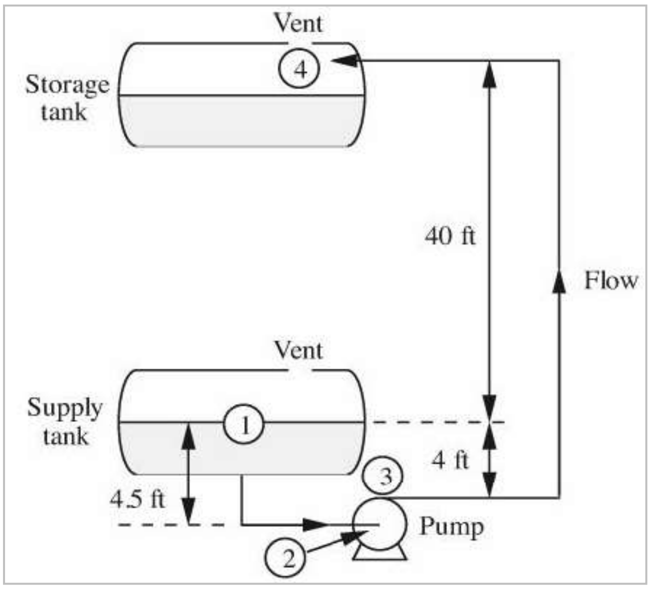
REVISED CREDIT SYSTEM

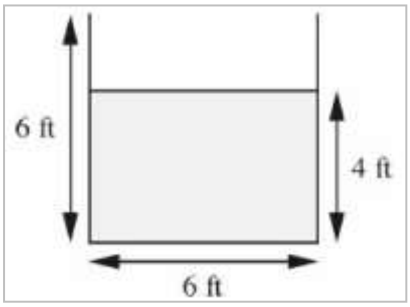
(22/12/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

☑ Answer **ALL** the questions. ☑ Assume any missing data suitably.

1A.	Derive an expression for pressure difference between two tapping points on a pipe carrying water for a differential manometer (refer the figure), and determine the pressure drop in the pipe if a differential head of 20 cm of mercury is recorded. The specific gravity of mercury is 13.6. 	**3**
1B.	For a gas of molecular weight Mw, investigate how the pressure p varies with elevation z if p = p_0 at z = 0. Assume that the temperature T is constant. What approximation may be made for small elevation increases? Explain how you would proceed for the non-isothermal case, in which T = T (z) is a known function of elevation.	**4**
1C.	Explain the rheological classification of fluids.	**3**
2A.	Fig. shows an arrangement for pumping n-pentane (ρ = 39.3 lb/ft^3) at 25 °C from one tank to another, through a vertical distance of 40 ft. All piping is 3-in. I.D. Assume that the overall frictional losses in the pipes are given by: $F = 2.5\, u_m^2 \;\; ft^2/s^2$. For simplicity, however, you may ignore friction in the short length of pipe leading to the pump inlet. Also, the pump and its motor have a combined efficiency of 75%. If the mean 	

	velocity u_m is 25 ft/s, determine the following: (i) The power required to drive the pump. (ii) The pressure at the inlet of the pump, and compare it with 10.3 psia, which is the vapor pressure of n-pentane at 25 °C. (iii) The pressure at the pump exit.	**6**
2B.	Derive Bernoulli's equation with the help of a neat schematic diagram. Clearly mention all the assumptions considered.	**4**
3A.	Derive Hagen-Poiseuille law for pipe flow with the help of a neat schematic diagram. Clearly mention all the assumptions considered.	**5**
3B.	The irrigation ditch shown in Fig. has a cross section that is 6 ft wide × 6 ft deep. It conveys water from location 1 to location 2, between which there is a certain drop in elevation. With a flow rate of Q = 72 ft^3/s of water, the ditch is filled to a depth of 4 ft. If the same ditch, transporting water between the same two locations, were completely filled to a depth of 6 ft, by what percentage would the flow rate increase? Start by applying the overall energy balance between points 1 and 2, and assume that the friction factor remains constant. 	**5**
4A.	Plot Head Vs Volume flowrate curve for single pump, pumps connected in series and parallel. Describe the nature of the plot.	**3**
4B.	A polymer flows steadily in the horizontal pipe under the following conditions: ρ = 900 kg/m^3, μ = 0.01 Pa s (kg/m s), D = 0.02 m, and u_m = 0.5 m/s. Evaluate the following, clearly indicating the units: (i) The Reynolds number. (ii) The frictional dissipation per meter per kg flowing. (iii) The pressure drop per meter.	**4**
4C.	Draw and write down the salient features of Fanning friction factor-Reynolds number plot.	**3**
5A.	Explain the working principle of centrifugal pump with the help of a neat schematic.	**4**
5B.	List out the differences between positive-displacement reciprocating and rotary pumps.	**3**
5C.	Describe the fluid dynamics in a fluidized bed with the help of a neat plot.	**3**

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