Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

II SEMESTER M.TECH(CHEMICAL) END SEMESTER EXAMINATIONS APRIL, 2018

SUBJECT: PROCESS MODELLING ANALYSIS AND SIMULATION [CHE5202]

REVISED CREDIT SYSTEM
(19/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Draw **Information Flow Diagram** wherever necessary.

1A. Develop the model equations for a first order reaction $A \xrightarrow{K} B$, in a tubular reactor, taking into consideration the existence of axial dispersion due to turbulent mixing effects in the reactor. The velocity profile is assumed to be plug flow. Briefly give the solution procedure. **05**

1B. A sewage disposal plant has a big concrete holding tank of 1,00,000 m^3 capacity. It is ¾ full of liquid to start with and contains 60,000 kg of organic material in suspension. Water runs into holding tank at a rate of 20,000 m^3/hr and the solution leaves at a rate of 15,000 m^3/hr. How much organic material is in the tank at end of 3 hr ? **05**

2. Develop a model for an enclosed tank where the following reversible reaction takes place:

$$A+B <=> C+D.$$

K_1 and K_2 are rate constant for forward and backward reaction respectively. The inflow F_1 passes through a fixed inlet valve from a pressure source P_1 and the pressure downstream side is P_2. Whereas the pressure, upstream and downstream side of the outlet valve is P_2 and P_3 respectively with a flow rate of F_2. The flow is influenced by level Z and the pressure P_o(pressure in the gas space) and P_3. Derive equations for flow rate and pressure across the valve , and the temperature and volume . **10**

3A. A fluid at a velocity V is flowing through the unsteady state heat exchanger of diameter D. The heat exchanger is steam heated. Neglect the wall resistance. Derive the explicit centered difference equations and develop a dynamic response for such exchangers. Give briefly solution procedure. **07**

3B. Write down the benefits of process modeling and simulation. **03**

4. Derive the design equations for a multi component pipe line flasher. Discuss about the model for establishing temperature in the flasher and how the overall heat transfer coefficient is found. **10**

5. Write the general modeling equations for a ternary equilibrium column of five stages including condenser and reboiler for a multi-component distillation column. Draw a neat information flow diagram for feed tray , reboiler and condensor. List out the assumptions used. **10**

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