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ECH-701

B. Tech.

(SEM. VII) (ODD SEM.) THEORY EXAMINATION, 2014-15
PROCESS MODELLING AND SIMULATION

Time : **3** Hours]   [Total Marks : **100**

1   Attempt any four parts :   5×4=20

a)   What is mathematical model? Discuss its applications in unit operations.

b)   Classify different models. Differentiate simple and rigorous models.

c)   Discuss about the numerical software's available for mathematical modeling and simulation.

d)   Explain why modeling assumptions are important in the building of a model.

e)   With a suitable example discuss the application of total continuity equation and component continuity equation in developing a mathematical model.

f)   Briefly explain the principles of formulation of mathematical models.

151701]   **1**   **[Contd...**

2   Attempt any two parts :   **10×2=20**

   a)   Consider a simple reactor with two components (biomass and substrate).   The reactor is perfectly mixed. The biomass is nothing but the cells that consume the substrate.   Let X_1 be the biomass concentration and X_2 be the substrate concentration. Derive the dynamic model by developing a material balance on the biomass and substrate.

   b)   Develop a mathematical model of jacketed tubular reactor.

   c)   Derive a model for absorber and state assumptions.

3   Attempt any two parts :   **10×2=20**

   a)   Explain distributed parameter model for packed bed.

   b)   Discuss the modeling of reactive separation processes.

   c)   Write a numerical method of analysis to solve differential equations code for MATLAB software.

4   Attempt any two parts :   **10×2=20**

   a)   Eloborate time dependent models and their applications.

   b)   Describe model reduction through orthogonal collocation.

   c)   i)   An ice cube is dropped into a glass of water at room temperature and then stirred. Develop a model describing the time varying behavior of the system with all the required assumptions.

151701]   **2**   **[Contd...**

ii) A tank is used to dissolve a solid into a liquid solvent. The tank is provided with an agitator. This tank acts as a batch system. Do the modelling with respect to liquid as well as solid phases.

5 Attempt any two parts : 10×2=20

a) Explain the flow sheet simulation with a model as example.

b) Discuss about artitioning and tearing.

c) Write a review of thermodynamic procedures and physical property data banks.

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