

B.TECH SEM – VII (2007 COURSE) (CHEMICAL ENGG.) :

SUMMER - 2018

SUBJECT : PROCESS MODELING & SIMULATION

Day : **Friday**
Date : **25/05/2018**

S-2018-2751

Time : **02.30 PM TO 05.30 PM**
Max. Marks : 80

N. B. :

- 1) **Q. NO. 1 and Q. NO. 5 are COMPULSORY.** Out of remaining attempts **ANY TWO** questions from each sections
- 2) Figures to right indicate **FULL** marks.
- 3) Answers to both sections should be written in **SEPARATE** answer books.
- 4) Use of non programmable **CALCULATOR** is allowed.
- 5) Assume suitable data if **NECESSARY**.

SECTION - I

- Q.1** a) Classify the mathematical models. (04)
b) What are different transport equations applied in chemical systems? Give analogy among them. (05)
c) Enlist the assumptions for modeling of ideal binary distillation column. (05)
- Q.2** a) Explain the steps involved in modeling and simulation of chemical system. (06)
b) How modeling and simulation helps in expansion and optimization of existing chemical plant? Explain. (07)
- Q.3** a) Apply material balance equation to $A \xrightleftharpoons[k_2]{k_1} B$ reversible first order isothermal reaction in PFR to get component continuity equations. (07)
b) Illustrate the application of energy equation to a microscopic system using suitable example. (06)
- Q.4** Postulate a steady state and practical model for multicomponent flash vaporizer. Adiabatic conditions are assumed. State the assumptions made. Check the degrees of freedom for final model equations. (13)

SECTION - II

- Q.5** a) State the assumptions which are to be specified for modeling of evaporator (05)
b) Enlist the basic fundamental laws applied in modeling of bioreactor. (04)
c) If exact solution of model equation is not possible, Which numerical methods are adopted for different types of equations? (05)
- Q.6** a) Write the modeling procedure for the heat exchanger. (05)
b) A tank is used to dissolve a solid into a liquid solvent. The tank is provided with agitator. This tank acts as a batch system which means no inflow & no outflow. The total mass of system remains constant. Develop the modeling equations for this system (08)
- Q.7** Develop a mathematical model for bioreactor. Write all assumptions with due justification. (13)
- Q.8** a) Write the algorithm for modeling of distillation column. (05)
b) Solve the following equation using modified Euler's method (08)
 $\frac{dy}{dx} = 1 + xy$; with $y = 0$ at $x = 0$
Find y at $x = 0.1$ and $x = 0.2$ use step size of 0.1
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