Code No: **R41083** **R10** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February/March - 2018

PROCESS MODELING AND SIMULATION

(Chemical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) Define model? Explain how mathematical models can be useful in all phases of Chemical Engineering. [8]

b) Draw a flowchart showing the major steps in process modeling. Show the interrelations between the flowchart stages. [7]

2 a) Determine the mathematical model for isothermal CSTR with constant hold up. [8]

b) Derive a Mathematical Model for the Batch reactor in which the First order consecutive reactions to give the desired product B with the rate constants k_1 and k_2. [7]

3 a) Develop a model for Flash distillation column as show in figure 3 (a). Write modeling assumptions.

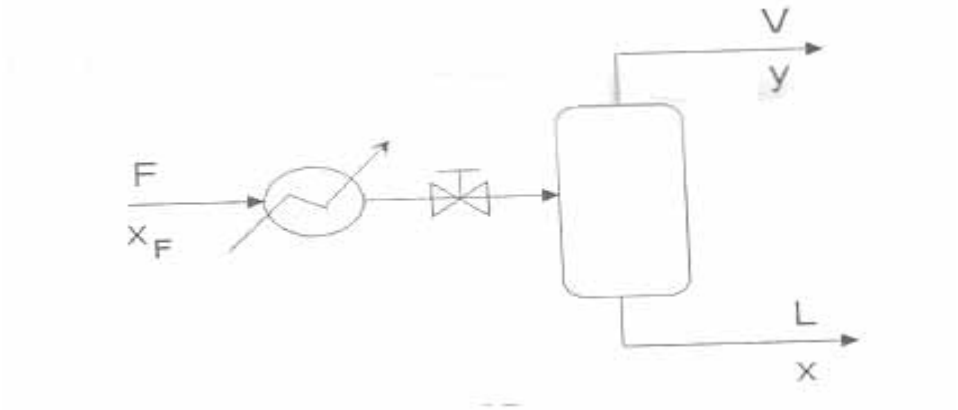

Figure 3 (a) [8]

b) Explain the steady state model and Liquid phase dynamics model for LPG vaporizer with a neat diagram. [7]

4 a) Find a root of $\mathbf{x\log_{10} x - 1.2 = 0}$ using Newton Raphson method correct to three decimal places. [8]

b) Find the real root of the equation $x^3 - 2x - 5 = 0$ by using false position method. [7]

5 a) Using modified Euler's method, find an approximate value of y corresponding to $x = 0.2$, given that $dy/dx = x^2 + y^3$ and $y = 1$ when $x = 0$. Use the step size $h = 0.1$. [8]

b) State different predictor-corrector method. For the initial value problem $dy/dx = y + x^2$, $y(0) = 1$, use Milne's prediction-corrector method to find $y(0.8)$ by taking $h = 0.2$ from following data.

x	0	0.2	0.4	0.6
y	1	1.2242	1.5155	1.9063

[7]

6 a) Develop a mathematical model for a gravity flow tank into which an incompressible liquid is pumped at a variable flow rate of F_o (m^3/s) .This inflow rate can vary with time because of changes in operations in the upstream The height of the liquid in the vertical cylindrical is h (m). The flow rate out of the tank is F (m^3/s).Discuss the Explicit first order Euler method for solving the modeled equations. [8]

b) Develop a mathematical model for a counter current double pipe heat exchanger process for predicting the transient response. Discuss an Euler algorithm for solving the model equations. Give a suitable flow chart for the simulation. [7]

7 a) Explain the applications of PDE'S for solving heat conduction in hot rod. [8]

b) A concentric tube heat exchanger uses water, which is available at 15°C, to cool ethylene glycol from 100 to 60°C. The water and glycol flow rates are each 0.5 kg/s. Determine the maximum possible heat transfer rate and effectiveness of the exchanger. Determine which is preferred, a parallel –flow or counter flow mode of operation. [7]

8 a) List out the software's available for process simulation. Explain any one in detail. [8]

b) Explain SIMPLER algorithm used for solving Navier Stoke's Equation. [7]