

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), November 2017

B. Tech Chemical Engineering, Semester V

Roll No.....

CHE503 : Process Modelling and Simulation

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	Which of the following is dependent variable in a CSTR: a) Pressure b) Temperature c) Concentration of product d) Feed flow rate	
ii.	System with C components are having potential equal to: a) C+2 b) C+3 c) 0 d) None	
iii.	Which of the following is not a type of process simulation? a) Predictive simulation b) Dynamic simulation c) Steady state simulation d) None of above	
iv.	In a gravity flow tank height "h" represents: a) State variable b) Constant c) Input value d) Dynamic variable	
v.	Which is true for fully developed laminar flow in pipes: a) average velocity is one fourth of maximum velocity b) average velocity is one half the maximum velocity c) average velocity is equal to maximum velocity d) None of the statement is correct	
vi.	In a dynamic simulation, time depended behavior of process with no control is known as: a) Closed loop response b) Open loop response c) Steady state response d) None of the above	
vii.	In an heat exchanger steam flow rate is a: a) Controlled variable b) Uncontrolled variable c) Manipulated variable d) Load disturbance	
viii.	Degree of freedom can be defined as: a) Total number of variables minus number of equations b) Total number of independent variables minus no. of dependent variables c) Total number of equations in a process d) All the above	

ix.	Unit of thermal conductivity is:	
	a) W/m.K	b) W.m/K
	c) W.K/m	d) W/m ² .K
x.	COMSOL solver is based on :	
	a) Finite element method	b) Finite volume method
	c) Both of them	d) None of them

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

1. State the fundamental laws of modelling.
2. Outline the various transport equations for a microscopic system.
3. Explain the condition of equilibrium in a binary system.
4. What are the different types of models and their components?

Q.3A Define simulation. Outline various steps of simulations with a flow chart. 05

Q.3B Discuss process flow diagram and information flow diagram using suitable example. 05

Q.4A Discuss the mathematical model for heat conduction in Bar. 05

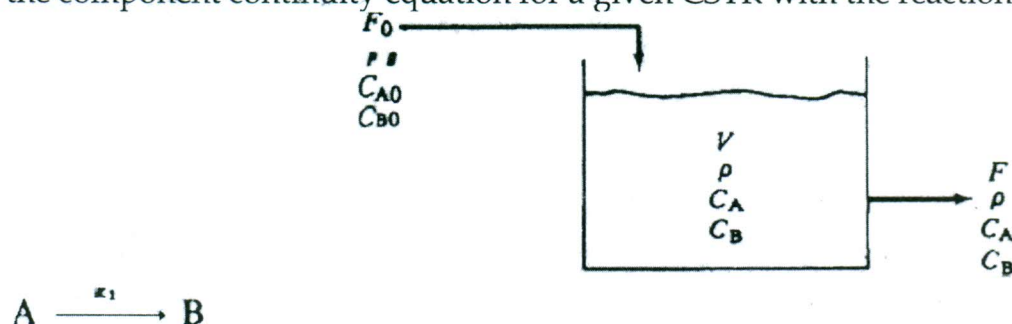
Q.4B Write the component continuity equation for plug flow reactor with reaction:
A → B → C (k₁ and k₂ are rate constants in step 1 and 2) 05

Q.5A Discuss the component balance in batch reactor . 05

Q.5B Model and discuss the state variable equation for gravity flow tank. 05

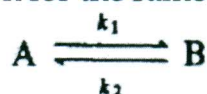
Q.6A Discuss the principals of process analysis. 05

Q.6B Write the component continuity equation for a given CSTR with the reaction : 05



OR

Q.6B Write the component equation for the same CSTR using equation: 05



Q.7A Derive and explain Clausius-Calpeyron equation. 05

Q.7B Write and explain the mathematical model for non isothermal PFR. 05

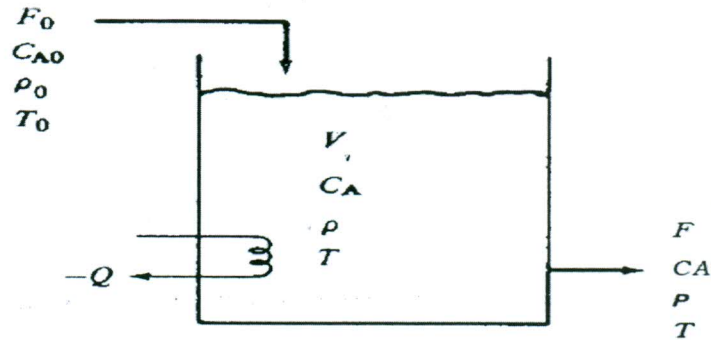
OR

Q.7B Write and explain the mathematical model for laminar flow in a pipe. 05

Q.8A What do you mean by dew points and bubble points in VLE characteristics? Explain its significance. 10

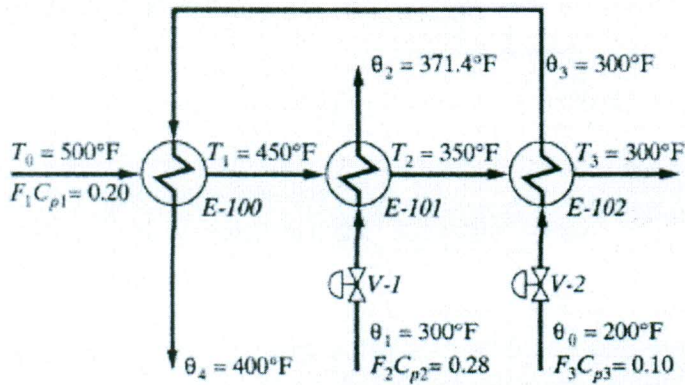
Q.9A Discuss the types of absorbers, their functions and model a continuity equation for a simple counter current absorber. 10

Q.9B Frame and discuss the energy equation for the given CSTR where a coil removing exothermic heat of reaction. 10



OR

Q.9B Observe the given heat exchanger network and write down the heat transfer equations at each step and also find out the degree of freedom in this network. 10



***** Best of Luck *****