Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY ME – SEMESTER II (New) EXAMINATION – SUMMER - 2017

Subject Code: 2723011 Subject Name: Process Modelling & Simulation Time: 02:30 PM To 05:00 PM **Total Marks: 70 Instructions:** 1. Attempt all questions. 2. Make suitable assumptions wherever necessary. 3. Figures to the right indicate full marks. Q.1 With respect to the principle of mathematical formulation, describe the (a) followings, (i) Basis, (ii) Assumptions, (iii) Mathematical Consistency of Model, (iv) Solution of mathematical equations, (v) Verification. Write a short note on Law of Mass Action and Arrhenius Temperature **(b)** Dependence. An isothermal, irreversible reaction, $A \rightarrow B$ with rate constant *k*, takes place in **Q.2** (a) the liquid phase in a constant-volume reactor. The mixing is not perfect. Assuming F and $F + F_R$ FR, are constant, V_1 V_2 F write the equations CAI C_{A2} CAD CA2 describing F. system. Describe the black-box model based modeling approach. **(b)** OR Write the component continuity equations for a perfectly mixed batch reactor **(b)** (no inflow or outflow) with first-order isothermal reactions given as, (i) Consecutive, (ii) Simultaneous, (iii) Reversible Describe in details the equation of total continuity and equation of component **Q.3** (a) continuity with example of perfectly mixed CSTR. Write a short note on Phase Equilibrium. **(b)**

OR

- **Q.3** Describe equation of energy with example of CSTR with heat removal. 07 (a)
 - Write down transport laws for heat, mass and momentum. Identify flux, driving **(b)** 07 force, and property used to correlate flux with driving force.
- Sketch single component vaporizer, and write the modeling equations for 07 **Q.4** (a) steady-state model.
 - Write a short note on degree of freedom analysis of ideal binary distillation 07 **(b)** column.

OR

- Sketch multi component flash drum, and write the modeling equations for 07 0.4 (a) steady-state model.
 - Write the modeling equations for series of isothermal constant-holdup CSTRs. 07 **(b)**
- Q.5 Compare and contrast any two chemical process flow-sheet simulators, with 07 (a) respect to features, capability, limitations.
 - Explain in details the modular approaches for flow-sheet solutions. **(b)**

OR

Write a short note on validation of simulation. Q.5 07 (a) Explain in details the equation solving approaches for flow-sheet solutions. 07 **(b)**

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