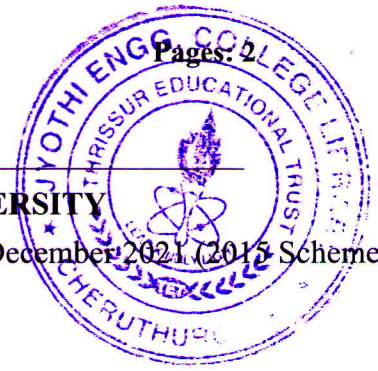


Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Seventh Semester B.Tech Degree Regular and Supplementary Examination December 2021 (2015 Scheme)

**Course Code: CH467****Course Name: PROCESS MODELING AND SIMULATION**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) Explain the classification of modelling techniques. (8)
- b) Develop model equations for a CSTR (continuous stirred-tank reactor) in which a component A reacts irreversibly and at a specific reaction rate  $k_1$  to form B and component B reacts irreversibly to form C at a rate  $k_2$  as a first order reactions. Let the concentration of component A, B and C in the inflowing feed stream be  $C_{AO}$ ,  $C_{BO}$  and  $C_{CO}$  (moles per unit volume) and in the reactor be  $C_A$ ,  $C_B$  and  $C_C$ . Let the inlet flow rate is  $F_0$  and outlet flow rate be  $F$  (volume/sec) and  $V$  be the volume of tank. (7)
- 2 a) What is modelling and what are the basic modelling principles? (7)
- b) Discuss the equations of state, chemical kinetics, transport equations and equilibrium. (8)
- 3 a) What are the uses of mathematical modelling? (8)
- b) A stream of water flowing horizontally with a speed of 15 m/s pushes out of a tube of cross sectional area  $1 \text{ m}^2$  and hits at a vertical wall nearby. What is the force exerted on the wall by the impact of water, assuming that it does not rebound? Density of water =  $1000 \text{ Kg/m}^3$  (7)

**PART B***Answer any two full questions, each carries 20 marks.*

- 4 a) Develop the model for batch distillation. (10)
- b) Develop the model for mixing vessel with irreversible reaction. (10)
- 5 a) Develop the model for enclosed vessel boiling (10)
- b) Develop the model for a continuous flow tank with level  $Z$ , inflow  $F_1$  outflow  $F_2$  and concentration  $C_1$  which is connected to a CSTR where a first order reaction takes place with exit concentration  $C_2$ , outflow  $F_3$  and volume  $V$ . (10)

- 6 a) Develop the model for hydraulic transients between reservoirs. (10)  
b) Develop the model of mixing vessel with a jacket supplying heat at a rate  $Q$ . (10)

**PART C**

*Answer any two full questions, each carries 15 marks.*

- 7 a) Develop the model of Ideal binary distillation column. (8)  
b) Write an algorithm for the simulation of Gravity flow tank. (7)
- 8 a) Develop the model for jacketed tubular reactor with a unimolecular reaction taking place on the surface of catalyst bed (8)  
b) Write an algorithm for the simulation of nonisothermal CSTR (7)
- 9 a) Develop the model for counter current liquid liquid heat exchanger. (7)  
b) Write an algorithm for the simulation of binary distillation column. (8)

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