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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, Band 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_o 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 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 = 1000Kg/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 F1 outflow F2 and concentration C1 which is connected to a CSTR where a first order reaction takes place with exit concentration C2 , outflow F3 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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