MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (CHEMICAL ENGINEERING) END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: PROCESS DYNAMICS AND CONTROL [CHE3203]

REVISED CREDIT SYSTEM

Instructions to Candidates:

Time: 3 Hours

MAX. MARKS: 50

- ✤ Answer ALL questions.
- ✤ Use of log-log / linear graph sheet is permitted.
- Missing data may be suitably assumed.

1A	Explain the basic components of feedback control system with an example.	04
1B	What is the fundamental difference between "First principle modeling" and "Black box modeling"?	02
1C	Solve the differential equation using Laplace transform	04
	$\frac{d^2C}{dt^2} + 5\frac{dC}{dt} + 6C = f(t) \text{ given } f(t) = 1: C(0) = 1; C^I(0) = 0.$	
2A	What are the principal questions that arise during the design of feedback controller	02
2B	Most control valves are designed to operate with signals between 3 to 15 psig. A signal-to-Open valve will fully closed at 3 psig and fully open at 15 psig. If the maximum flow rate through the valve is 120 M ³ /hr, then what would be the average valve gain? Similarly, what would be the average valve gain for Signal-to-Close valve of the same size?	02
2C	Derive the transfer function model (which relates between output and input concentrations) for continuous stirred tank reactor in which second order reaction is taking place. $(-r_A = KC_A^2)$. State all the assumptions.	06
3 A	a) Describe the Ziegler-Nichols tuning methodology. This procedure is often called the "continuous cycling" tuning method. Why?b) Define a Bode stability criteria.	04
3B	 Consider the storage tank shown below. Suppose that we want to control the liquid level in the tank at the hieght of 5 m, by manipulating the effluent flow rate Q₂, according to the following proportional control law: Q₂= 10(5-h)+1 a). Develop the transfer function between h and Q₁ b). Determine the static gain and time constant of the tank, under control. c). Compute the dynamic response of the liquid level to a step change in Q₁ by 1 m²/min (i.e. find how h(t) changes with time) 	06



CHE3203

