

**G82****B. Tech. EXAMINATION, 2020**

(Seventh Semester)

(B Scheme)

(Re-appear Only)

CHE

CHE403B

Process Dynamics and Control

Time : 3 Hours]

[Maximum Marks : 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

**Note** : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

**Unit I**

1. (a) Find the solution of the following set of equations : 7½

$$\frac{dx_1}{dt} = 2x_1 + 3x_2 + 1 \text{ with } x_1(0) = 0$$

$$\frac{dx_2}{dt} = 2x_1 + x_2 + e^t \text{ with } x_2(0) = 0$$

- (b) Solve the following equation, using Laplace transform :

$$\frac{d^3x}{dt^3} + 2\frac{d^2x}{dt^2} - \frac{dx}{dt} - 2x = 4 + e^{2t}$$

where  $x(0) = 1$ ,  $x'(0) = 0$ ,  $x''(0) = -1$ .

7½

2. Derive transfer function for two tanks in series for : 7½×2=15
- (a) Interacting
- (b) Non-interacting.

### Unit II

3. Define open loop and closed loop system by giving suitable examples. Also differentiate between open loop and closed loop systems by giving suitable examples. 15
4. What are various types of Controllers ? What are their relative advantages, disadvantages and application ? 15

### Unit III

5. (a) Sketch the root locus for both system with  $G(s)H(s) = \frac{K}{s(s^2 + 2s + 2)}$ . 7½
- (b) Using Routh's criterion, investigate the stability of a unity feedback system whose open loop transfer function is  $G(s) = \frac{e^{-sT}}{s(s+1)}$ . 15
6. Discuss the construction and working of control valve in detail. Also discuss various characteristics of control valve. 15

### Unit IV

7. Describe the following : 7½×2=15
- (a) Ziegler-Nicholas Rules
- (b) Cohen and Coon rules.
8. A unity feedback control system has  $G(s) = \frac{242(s+5)}{s(s+1)(s^2+5s+121)}$ . Draw the Bode Plot. Determine gain margin and phase margin. Also comment on stability. 15