Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Sixth Semester

Chemical Engineering

CH3651- Process Dynamics and Control

Regulations - 2021

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Define the Laplace transform.	RE	1	2
2.	What is initial value theorem?	RE	1	2
3.	Illustrate the steps involved in linearizing the nonlinear systems.	UN	2	2
4.	A thermometer having a time constant of 1 min and is initially at 500C. it is immersed in a bath and maintained at 1000C at t = 0. Find the temperature reading at t = 1.2 min.	RE	2	2
5.	Compare pneumatic and electric actuators.	UN	3	2
6.	Classify the different types of process parameters to be considered in selection of control valves.	UN	3	2
7.	Recall the formula for IAE and ISE.	RE	4	2
8.	Compare Z-N and C-C methods of tuning.	UN	4	2
9.	What is the purpose of cascade control for heat exchangers?	RE	5	2
10.	Outline the importance of model predictive controller.	UN	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Find the Laplace Transform of	RE	1	13

$$\mathcal{L}[\cos at] = \frac{s}{s^2 + a^2} \qquad \mathcal{L}[\sin at] = \frac{a}{s^2 + a^2}.$$

Or

	b	Find the state space model for the system having transfer function.	RE	1	13

$$\frac{Y(s)}{U(s)} = \frac{1}{s^2 + s + 1}$$

12.	a	A temperature having a time constant of 0.5 min is placed in a temperature bath and after thermometer is placed in the temperature bath the temperature comes to equilibrium the temperature of the bath Ti increased linearly at the rate of 10^0C/ min. Estimate the difference between the indicated and bath temperature. i. 0.25 min after the changes in temperature begins. ii. 3 min after the changes in temperature begins. iii. What is the maximum deviation between the indicated and bath temperature and when does it occur. iv. Flow many minutes does the response lag after long enough time is elapsed.	EV	2	13
		Or			
	b	Explain in detail about the method used for linearization of non-linear system with one variable.	CR	2	13
13.	a	Develop the block diagram of a generalized feed back control system with one disturbance, incorporating in each block the appropriate transfer function and on each stream the appropriate variable.	AP	3	13
		Or			
	b	Develop mathematically servo and regulatory operation with an example for each.	EV	3	13
14.	a	Develop the asymptotic Bode diagram for (i) P - I controller. (ii) P - D controller.	CR	4	13
		Or			
	b	Discuss gain and phase margins in controller system design by frequency response analysis. Write the design specifications for gain and phase margins	CR	4	13
15.	a	Explain the use of cascade and feed-forward control strategy for distillation column feed control.	EV	5	13
		Or			
	b	Explain briefly the Smith algorithm for dead time compensation of a process.	EV	5	13

*PART – C (Marks 1*15 = 15)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
16.	a	Discuss feedback control and feed forward control systems for controlling the temperature of liquid inside the stirred tank, which is heated by steam passing through the steam coil immersed inside the tank. Identify different variables involved in the process.	CR	3	15
		Or			
	b	What is anaerobic digestion? Draw a diagram showing the components that typically make up a single stage mixed anaerobic digester including those that can use the products from the process or enhance their value. What is anaerobic digestion? Draw a diagram showing the components that typically make up a single stage mixed anaerobic digester including those that can use the products from the process or enhance their value. What is anaerobic digestion? Draw a diagram showing the components that typically make up a single stage mixed anaerobic digester including those that can use the products from the process or enhance their value. Develop the transfer function H(s)/Q(s) for the liquid level system shown below when (a) The tank level operates about the steady-state value of hs =1 ft. (b) The tank level operates about the steady-state value of hs =3 ft. The pump removes water at a constant rate of 10 cfm (cubic feet per minute); this rate is independent of head. The cross-sectional area of the tank is 1.0 ft^2 and the resistance R is 0.5 ft/cfm.	CR	2	15