Q. Code:118524

Reg. No. | | | | | | | | | | | | | |

M.E./ M.TECH. DEGREE EXAMINATIONS, MAY 2024

Second Semester

CL22202 – ADVANCED PROCESS CONTROL

(Chemical Engineering)

(Regulation 2022)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Describe the dynamic response of advanced control systems.	**3**
CO 2	Develop and design Internal Model based PID control system.	**3**
CO 3	Enumerate the control loop interaction and multi-variable control strategies.	**3**
CO 4	Acquire knowledge on discrete-time response of dynamic system.	**3**
CO 5	Design of digital feedback controllers.	**4**

PART- A(20x2=40Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Differentiate feed forward from feedback control.	**1**	**2**
2.	Interpret the application of controller parameter gain scheduling.	**1**	**3**
3.	State reset time and settling time.	**1**	**2**
4.	State the significance of automatic tuning rule.	**1**	**2**
5.	Distinguish Internal Model Control with dead time compensator.	**2**	**2**
6.	Highlight the importance of model based in chemical industries.	**2**	**2**
7.	Prove that the IMC for first order with delay is lead-lag form.	**2**	**3**
8.	Elucidate the application of filters in IMC.	**2**	**3**
9.	Give any two examples of multivariable control.	**3**	**2**
10.	Show the paring option of 2x2 multivariable control system.	**3**	**3**
11.	List the importance of RGA in multivariable system.	**3**	**2**
12.	Comment on the decoupling of control loop.s	**3**	**3**
13.	State initial value theorem in Z-Transforms.	**4**	**2**
14.	List the need of sampler in digital control system.	**4**	**2**
15.	State pulse transfer function.	**4**	**2**
16.	Differentiate first order hold with zero order hold.	**4**	**2**
17.	Write the significance of Dahlin Algorithm in sampled data control system.	**5**	**2**
18.	Compare ISE and IAE in controller evaluation.	**5**	**2**
19.	Write digital equivalent PID Controller in position form of the control algorithm.	**5**	**2**
20.	State Schur-Cohn stability criterion in digital control system.	**5**	**2**

PART- B (5x 10=50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	Describe the stirred tank reactor temperature based cascade control and derive the closed loop relationship for primary set point change.	**(10)**	**1**	**3**

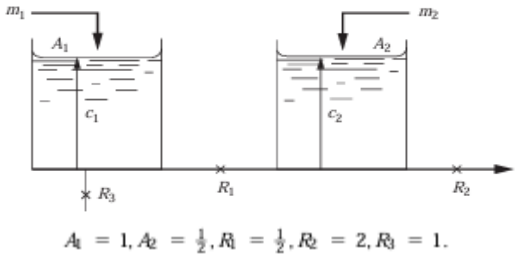
(OR)

(b)	Explain the feed forward control with the suitable example and highlight the requisites for employing a successful feed forward control.	**(10)**	**1**	**3**
22. (a)	Illuminate the IMC filter design for improved disturbance rejection and derive the Output response of a second order system.	**(10)**	**2**	**3**

(OR)

(b)	Design an IMC controller for a process which is first-order with transport lag $G = K\frac{e^{-\tau_d s}}{\tau s + 1}$	**(10)**	**2**	**3**
23. (a)	Analyse the various decoupling strategies in multivariable control schemes with examples.	**(10)**	**3**	**4**

(OR)

(b)	For the two-tank interacting liquid-level system (2 x 2 MIMO system) shown below, develop the closed block diagram with transfer function and record the open loop response. a). For a step change in tank 1. b). For a step change in tank 2  $A_1 = 1, A_2 = \frac{1}{2}, R_1 = \frac{1}{2}, R_2 = 2, R_3 = 1.$	**(10)**	**3**	**4**
24. (a)	Compare the continuous systems and discrete systems in process control with suitable examples.	**(10)**	**4**	**3**

(OR)

(b)	Find the pulse transfer function of two tank non interacting level system with the transfer function, G(s) = 1/(s+1)(s+2)	**(10)**	**4**	**3**
25. (a)	Explain the "ringing" phenomena in digital controller design. Compute the ringing free transfer function for $D(z) = K(1-0.5\ Z^{-1})/(1+0.6Z^{-1})(1-Z^{-1})(1-0.7Z^{-1})$	**(10)**	**5**	**4**

(OR)

(b)	Exemplify the design procedure of digital feedback control loops and analyse the stability constraints.	**(10)**	**5**	**4**

PART- C(1x 10=10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Assess the development of Internal Model Control and compare the closed loop response for perfect model with no disturbances.	**(10)**	**2**	**5**

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