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Question Paper Code: R4302

B.E. / B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Electrical and Electronics Engineering

R21UEE402 CONTROL SYSTEMS

(Regulations R2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. If a signal is passed through an integrator, it _____the amplitude of noise signal. CO1-U

   (a) Enhances (b) Reduces (c) Stabilizes (d) Factorizes

2. $(S+2)(S+1)/S^2(S+3)(S+4)$ is a ________. CO3-App

   (a) Type- 0 (b) Type -1 (c) Type -2 (d) Type – 3

3. An increase in gain, in most systems, leads to CO1-U

   (a) smaller damping ratio (b) larger damping ratio

   (c) constant damping ratio (d) none of the above

4. In a stable control system saturation can cause which of the following? CO1-U

   (a) Low-level oscillations (b) High-level oscillations

   (c) Conditional stability (d) Over damping

5. Which one of the following is test for controllability and Observability? CO1-U

   (a) Kalman's test (b) Gilbert's test

   (c) None of the above (d) Both (a) & (b)

PART – B (5 x 3= 15 Marks)

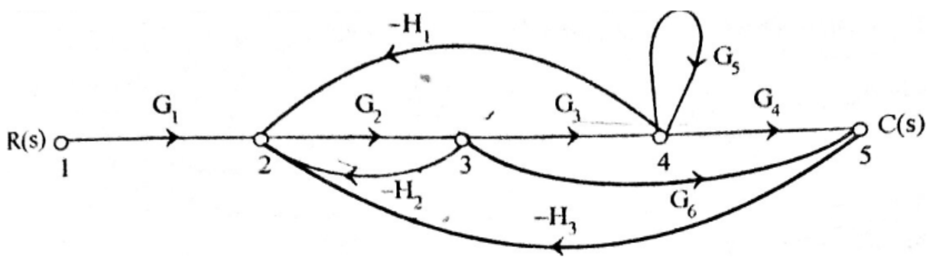
6. Why negative feedback is preferred in closed loop control systems? CO1-U
7. Determine the type and order of the system $G(s)\,H(s)=10(S+3)/S^2(S+4)$. CO2-App
8. Evaluate the Phase angle of the given transfer function $G(S) = 10 / S\,(1+0.4S)(1+0.1S)$. CO3-App

9. Explain the need and sufficient condition for stability in Routh Hurwitz criterion — CO1-U

10. Define state equation. — CO1-U

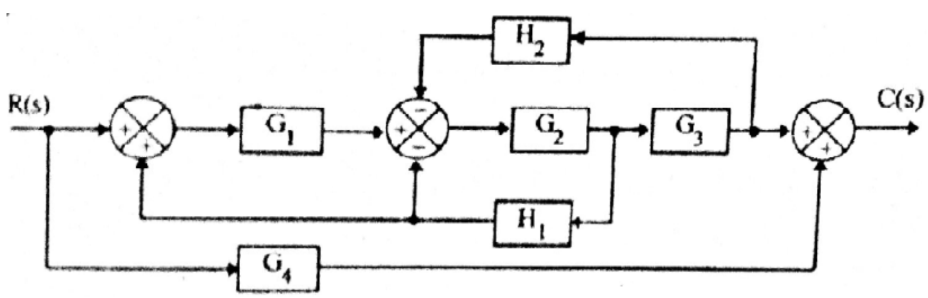
PART – C (5 x 16= 80 Marks)

11. (a) Build the overall gain C(s)/R(s) for the signal flow graph shown in figure. — CO2-App (16)



Or

(b) Develop the closed loop transfer function C(s)/R(s) of the system whose block diagram is shown in figure. — CO2-App (16)



12. (a) The Unity feedback system is characterized by a open loop transfer function G(s)=K/S(S+10). Determine the gain K. So that this system will have a damping ratio of 0.5 for this value of K, settling time, peak overshoot, peak time of the system for unit step input — CO3-App (16)

Or

(b) The open loop transfer function of unity feedback system is given by G(s) =K/S(ST+1),where K and T are positive constants. By what factor the amplifier gain K be reduced, so that the peak overshoot of unit step response of the system is reduced from 75% to 25% — CO3-App (16)

13.	(a)	Analyze the Bode plot for the given transfer function by determining the magnitude and phase response, and identifying the gain and phase crossover frequencies, while discussing their implications for system stability and performance. $$G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}$$	CO4-Ana	(16)
		Or		
	(b)	Construct the polar plot for the following transfer function and find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin. Analyze its stability $$G(s) = \frac{1}{s(1+s)(1+2s)}$$	CO4-Ana	(16)
14.	(a)	Construct Routh array and Examine the stability of the system represented By the characteristic equation, $$S^7 + 5S^6 + 9S^5 + 9S^4 + 4S^3 + 20S^2 + 36S + 36 = 0$$ Comments on the location of roots.	CO5-Eva	(16)
		Or		
	(b)	(i) Using Routh criterion, determine the stability of the system represented by the characteristic equation $S^4+8S^3+18S^2+16S+5=0$.Comment on the location of the roots of characteristic equation.	CO5-Eva	(8)
		(ii) By Routh stability criterion, determine the stability of the system represented by the characteristic equation ,$9S^5-20S^4+10S^3-S^2-9S+10=0$.Comment on the location of roots of characteristic equation.		(8)
15.	(a)	Develop the state transition matrix for the state model whose system matrix A is given by $$A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$$	CO3-App	(16)
		Or		

(b) The state space representation of a system is given by CO3-App (16)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -2 & 1 & 0 \\ 0 & -3 & 1 \\ -3 & -4 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$Y = \begin{bmatrix} 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Develop the Transfer function.