A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 54303

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Electrical and Electronics Engineering

15UEE403- CONTROL SYSTEMS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The output of the feedback control system must be a function of CO1- U

(a) Reference input (b) Reference output

(c) Output and feedback signal (d) Input and feedback signal

2. The overall transfer function from block diagram reduction for cascaded blocks is given by CO1-U

(a) Sum of individual gain (b) Product of individual gain

(c) Difference of individual gain (d) Division of individual gain

3. The steady state error in closed loop control systems is CO2 -U

(a) Zero (b) Unity (c) Infinity (d) Unpredictable

4. Root locus is used to calculate CO2 -R

(a) Marginal stability (b) Absolute stability

(c) Conditional stability (d) Relative stability

5. The unit adopted for magnitude measurement in Bode plots is CO3-R

(a) Degree (b) Decimal (c) Decibel (d) Deviation

6. Lead compensator network is used to improve CO3-R

(a) Transient response. (b) Bandwidth.

(c) Transient response and bandwidth (d) Steady state response

7. For Nyquist contour, the size of radius is CO4-R

(a) Zero (b) Unity (c) Infinity (d) Constant

8. The no. of roots of S3 + 5S2 + 7S + 3 = 0, in the right half of the s-plane is CO4-U

(a) 0 (b) 1 (c) 2 (d) 3

9. State space analysis is applicable even if the initial conditions are CO5- U

(a) Zero (b) Non-zero (c) Equal (d) Not equal

10. Kalman's test is for CO5 -R

(a) Observability (b) Controllability

(c) Optimality (d) Observability and controllability

PART – B (5 x 2= 10 Marks)

11. Compare open loop and closed loop control system. CO1- U

12. Mention the different time domain specifications of the system. CO2- R

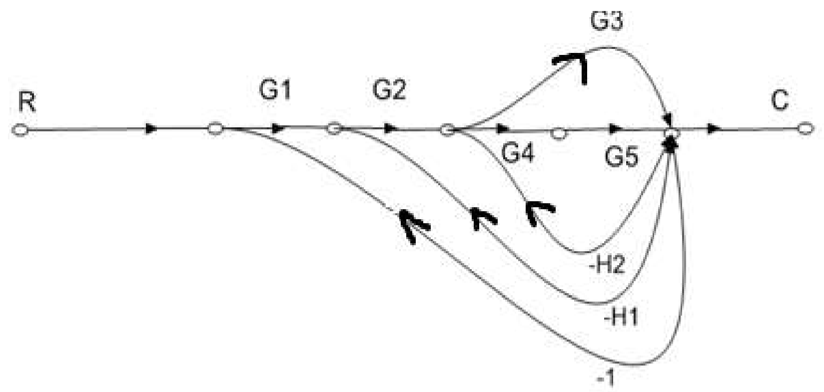
13. Give the advantages of frequency domain analysis. CO3- R

14. State the criterion for Nyquist stability. CO4- R

15. Differentiate SISO systems and MIMO systems. CO5-U

PART – C (5 x 16= 80 Marks)

16. (a) Determine the transfer function c(s)/r(s) of the system function shown using signal flow graph analysis. CO1- App (16)



Or

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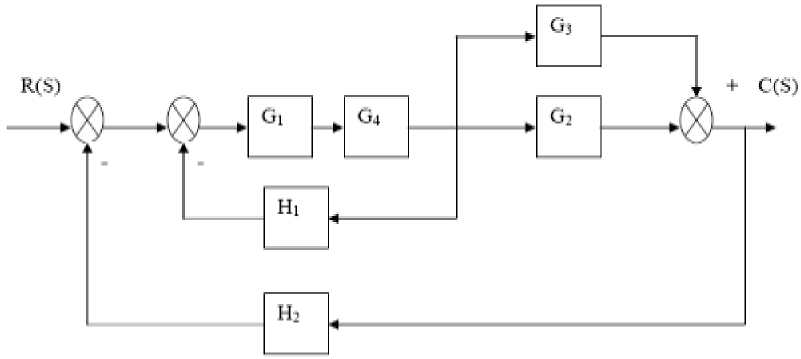
(b) Using block diagram reduction technique find closed loop transfer function C(s) / R(s). CO1- App (16)



17. (a) Derive the undamped response of a second order system for a unit step input. CO2- App (16)

Or

(b) For a unit feedback control system, the open loop transfer function is given by CO2 -App (16)

$$G(s) = \frac{10(s+2)}{s^2(s+1)}$$

(i) Find the positional, velocity and acceleration error coefficients.

(ii) Find steady state error when the input is

$$R(s) = \frac{3}{s} - \frac{2}{s^2} + \frac{1}{3s^3}$$

18. (a) Sketch the bode plot for the following transfer function and determine phase margin and gain margin. CO3- App (16)

$$G(s) = \frac{10}{s(1+0.5s)(1+0.1s))}$$

Or

(b) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{1}{s(1+s)(1+2s)}$ Sketch the polar plot and determine gain margin and phase margin. CO3- App (16)

19. (a) The open loop transfer function of a unity feedback system is given by $G_o(s) = \frac{5}{s(s+1)(s+2)}$. Draw the Nyquist plot and check the system stability. CO4- Ana (16)

Or

(b) (i) Using Routh criterion, determine the stability of the system represented by the characteristic equation. CO4- Ana (8)

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$$

(ii) Illustrate the usage of Nyquist plot in determining the stability of a closed loop system. CO4- Ana (8)

20. (a) The state model of the system is given by CO5- Ana (16)

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

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

(i) Find the transfer function for the given state model.

(ii) Determine whether the system is completely controllable and observable.

Or

(b) Obtain a state space model of the system with transfer function CO5- Ana (16)

$$\frac{Y(s)}{U(s)} = \frac{6}{s^3 + 6s^2 + 11s + 6}$$