C **Reg. No**. : | | | | | | | | | | | | |

Question Paper Code: U9401

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2024

Elective

Electronics and Communication Engineering

21UEC901- LINEAR CONTROL ENGINEERING

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. In closed loop control system, with positive value of feedback gain the overall gain of the system will_____ CO1-U

   (a) Decrease (b) Increase (c) be unaffected (d) None of the above

2. The type 0 system has _____ at the origin. CO1-U

   (a) No pole (b) Net pole (c) Simple pole (d) None of the above

3. The steady state error of a stable 'type 0' unity feedback system for a unit step function is CO1-U

   (a) 0 (b) $\frac{1}{1+K_p}$ (c) ∞ (d) $\frac{1}{K_p}$

4. The type 2 system has_____at the origin. CO1 - U

   (a) No net pole (b) Net pole (c) Simple pole (d) two poles

5. State space analysis is applicable even if the initial conditions are _____ CO1 - U

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

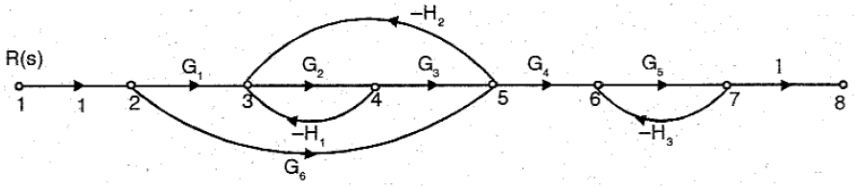
PART – B (5 x 3= 15 Marks)

6. State Mason's gain formula. CO1-U
7. List the time domain specifications. Define peak overshoot. CO1-U
8. Define Phase margin & gain margin. CO1-U
9. Illustrate any two limitations of Routh-stability criterion. CO1-U

10. What is Nyquist stability criterion? CO1-U

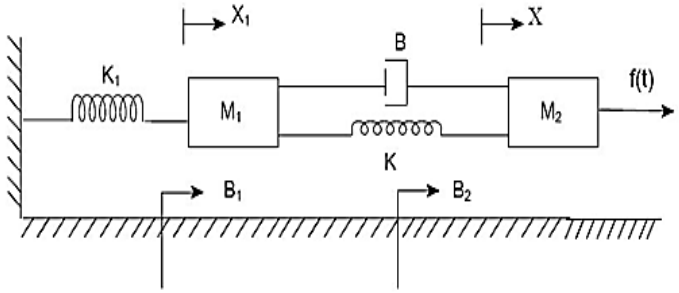
PART – C (5 x 16= 80 Marks)

11. (a) Using signal flow graph, analyze the overall Transfer function for the system shown in the fig. CO2-App (16)



Or

(b) Demonstrate the differential Equations governing the mechanical system shown in the figure and determine the transfer function. Also draw the force –voltage analogy of the given mechanical system. CO1-U (16)



12. (a) Derive the response of under damped and critically damped second order system for unit step input. CO1-U (16)

Or

(b) Design a PD and PID controllers for the feedback control system with example. CO1-U (16)

13. (a) The open loop transfer function of a unity feedback system is given by CO2-App (16)

$G(s) = \dfrac{K}{s(1+0.2s)(1+0.05s)}$. Sketch the polar plot and determine the value of K such that (i) gain margin is 18 db (ii) phase margin is 60^o

Or

(b) Consider a unity feedback system having an open loop transfer function $G(s) = \dfrac{K}{s(s+0.5s)(1+4s)}$. Outline the polar plot and determine the value of K so that (i) Gain margin is 20 db (ii) Phase margin is 30°. CO2-App (16)

14. (a) Analyze the stability of a system with characteristics equations $s^4+s^3+20s^2+9s+100=0$, using Routh Hurwitz criterion. CO3-Ana (16)

Or

(b) The characteristic polynomial of a system is $s^7+9s^6+24s^5+24s^4+24s^3+24s^2+23s+15=0$. Analyze the location of roots on s-plane and hence the stability of the system. CO3-Ana (16)

15. (a) A system is characterised by the transfer function $\frac{V(S)}{U(S)}=\frac{2}{S^3+6S^2+11S+6}$. Analyze the controllability and Observability of the system. CO3-Ana (16)

Or

(b) A system is represented by State equation $\dot{X}$ = AX+BU; Y = CX where $A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -1 & -2 & -3\end{bmatrix}$, $B=\begin{bmatrix}0\\0\\1\end{bmatrix}$ and $C=[\,1\quad 0\quad 0]$. Inspect the Transfer function of the system and analyze the state variables of the system. CO3-Ana (16)