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

Question Paper Code: 94302

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

Electrical and Electronics Engineering

19UEE402 – Control Systems

(Regulations 2019)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

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

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

2. In a signal flow graph, nodes are represented by small _____ CO1- R

   (a) Circles (b) Squares (c) Arrows (d) Pointers

3. $(S+2)(S+1)/S^2(S+3)(S+4)$ is a _____. CO2-App

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

4. Transfer function of a system is used to calculate which of the following? CO2-U

   (a) The order of the system (b) The time constant

   (c) The output for any given input (d) The steady state gain

5. Phase margin of a system is used to specify which of the following? CO2-R

   (a) Frequency response (b) Absolute stability

   (c)Relative stability (d) Time response

6. The frequency at which the two asymptotic meet in a magnitude plot is called_____ CO2- U

   (a) Resonant peak. (b) Band width (c) corner frequency (d) Resonant frequency

7. Technique is not applicable to nonlinear system? CO3- R

(a) Nyquist Criterion (b) Quasi linearization

(c) Functional analysis (d) Phase-plane representation

8. Addition of zeros in transfer function causes which of the following? CO3- U

(a) Lead-compensation (b) Lag-compensation

(c)Lead-lag compensation (d) None of the above

9. Which among the following is a unique model of a system? CO4- U

(a) Transfer function (b) State Variable (c) Both a&b (d) None of these

10. State space analysis is applicable to CO4- R

(a) Linear system (b) Non linear system

(c) MIMO (d) All of these

PART – B (5 x 2= 10 Marks)

11. When defining the transfer function, what happens to the initial conditions of the system? CO1- Ana

12. Explain the effect of PI controller on the system performance. CO2- U

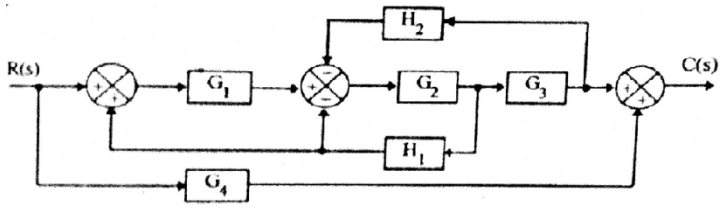
13. What is gain cross over frequency CO2- R

14. Explain the necessary and sufficient condition for stability. CO2- U

15. Consider system given by Y(s) / U(s) = (s+3) / (s^3+3s+2). Obtain state space representation in controllable form. CO4 -App

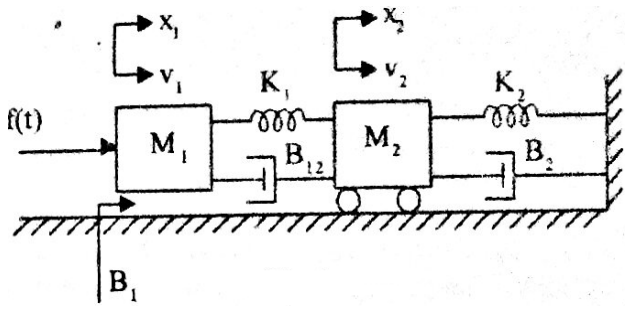
PART – C (5 x 16= 80Marks)

16. (a) Develop the closed loop transfer function C(s)/R(s) of the system whose block diagram is shown in figure. CO1- App (16)



Or

(b) Write the differential equations governing the mechanical system shown in figure. Construct the force – voltage and force – current electrical analogous circuits and verify by writing mesh and node equations. CO1- App (16)



17. (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. CO2- App (16)

Or

(b) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{K(s+9)}{s(s^2+4s+11)}$. Sketch the root locus of the system. CO2- App (16)

18. (a) Construct the Bode plot for the following transfer function and obtain the gain and phase cross over frequencies whose CO2- App (16)

$$G(s) = \frac{20}{s(1+3s)(1+4s)}$$

Or

(b) Construct the Polar plot for the following transfer function and obtain the gain margin and phase margin whose CO2- App (16)

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

19. (a) Construct Routh array and Analyze the stability of the system whose characteristic equation is $S^6+2S^5+8S^4+12S^3+20S^2+16S+16=0$. Also determine the number of roots lying on right half of S-plane, left half of s-plane and on imaginary axis. CO2- App (16)

Or

(b) For a certain system, $G(s) = \frac{0.025}{s(1+0.5s)(1+0.05s)}$. Design a suitable lag compensator to give, velocity error constant = 20sec^{-1} and phase margin = 40°. CO3- C (16)

20. (a) Develop the state transition matrix for the state model whose system matrix A is given by CO4- App (16)

$$A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$$

Or

(b) The state space representation of a system is given by CO4- 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.