



**CONTROL SYSTEMS**  
 (ECE)

Maximum Marks: 70

Date:22.07.2022 Duration: 3 hours

- Note: 1.This question paper contains two parts A and B.  
 2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.  
 3. Part B consists of 5 Units. Answer any one full question from each unit.  
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 Define transfer function. What are its limitations?
- 2 Discuss the effect of feedback on over all gain.
- 3 Find the damping ratio for the characteristic equation  $s^2+2s+1=0$ .
- 4 What are the effects of integral control action?
- 5 What are the limitations of Routh's stability?
- 6 What is the effect of adding zeros to  $G(s)$   $H(s)$  on the root loci?
- 7 Draw the pole-zero plot of Lag compensator.
- 8 Draw the polar plot of  $G(s)=\frac{1}{1+sT}$ .
- 9 What is meant by state in control system?
- 10 Define state transition matrix.

Part-B

Answer All the following questions.

(10M X 5=50Marks)

- 11 A). Determine the transfer function for the block diagram shown in Figure 1.

6+4

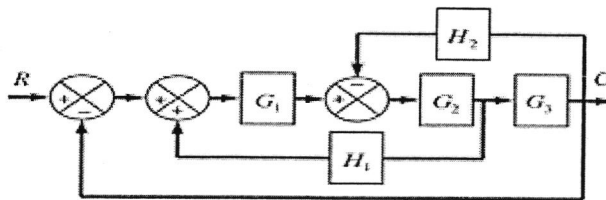


Figure:1

B. Distinguish between Open loop control system and closed loop control system.

OR

- 12 Obtain the transfer function for the following mechanical translational system Figure 2.

10

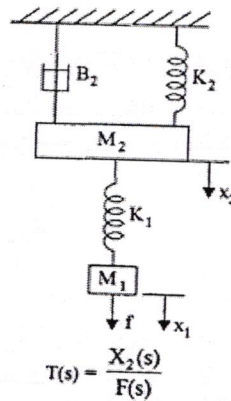


Figure:2

- 13 A. For unity feedback control system the open loop transfer function  $G(s) = \frac{10(s+2)}{s^2(s+4)}$ . Find the  $e_{ss}$  when the input is  $r(t) = 3 + 2t + 3t^2$ . And find  $K_p$ ,  $K_v$ , and  $K_a$ . 5+5  
 B. Explain the effect of Proportional control action on the Performance of a second order system

OR

- 14 A. Sketch the time response of the first order system when excited with unit step input. 5+5  
 B. A unity feedback system is characterized by an open-loop transfer function  $G(s) = \frac{K}{s(s+5)}$ . Determine the gain 'K' so that the system will have a damping ratio of 0.5. For this value of 'K' determine settling time, peak overshoot and time to peak overshoot for a unit-step input

- 15 Sketch the root locus plot of  $G(S) H(S) = \frac{K}{s(s+4)(s+11)}$ . Also find range of 'K' for system to be stable. 10

OR

- 16 Draw the Bode magnitude and phase angle plots for the transfer function  $G(S) = \frac{2000(s+1)}{s(s+10)(s+40)}$  10  
 17 Sketch the polar plot and hence find the frequency at which the plot intersects the positive imaginary axis for the system  $G(S) = \frac{0.1}{s(s+1)(0.1s+1)}$ . Also find the corresponding magnitude. 10

OR

- 18 A. State and explain Nyquist stability criterion. 5+5  
 B. Draw the electrical circuit diagram that represents the Lead-Lag compensator and explain in detail.

- 19 Given  $X(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$ . Find the unit step response when,  $X(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ . 10

OR

- 20 A. What is observability? Explain the tests for observability. 4+6  
 B. Check whether the system represented by

$$X(t) = \begin{bmatrix} 0 & 5 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(t) \text{ and } y = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} \text{ is observable or not.}$$