Hall Ticket No | | | | | | | | | | |

Question Paper Code: AECC21

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech V SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024
Regulation: UG20
CONTROL SYSTEMS

Time: 3 Hours **(ELECTRONICS AND COMMUNICATION ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Compare open loop system with closed loop system. Explain the concept of negative feedback system with real time applications. [BL: Understand| CO: 1|Marks: 7]

   (b) Draw the force voltage and force current analogous circuit for the mechanical system shown in Figure 1. [BL: Apply| CO: 1|Marks: 7]

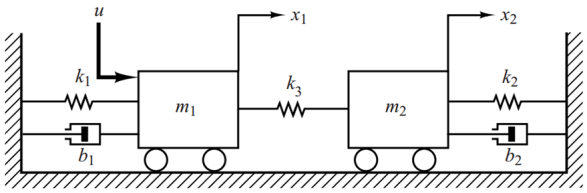

Figure 1

MODULE – II

2. (a) Obtain an expression for first order system subjected to unit step input and sketch the response of the system. [BL: Understand| CO: 2|Marks: 7]

   (b) Determine the transfer function of the system shown in Figure 2 using block diagram reduction technique. [BL: Apply| CO: 2|Marks: 7]

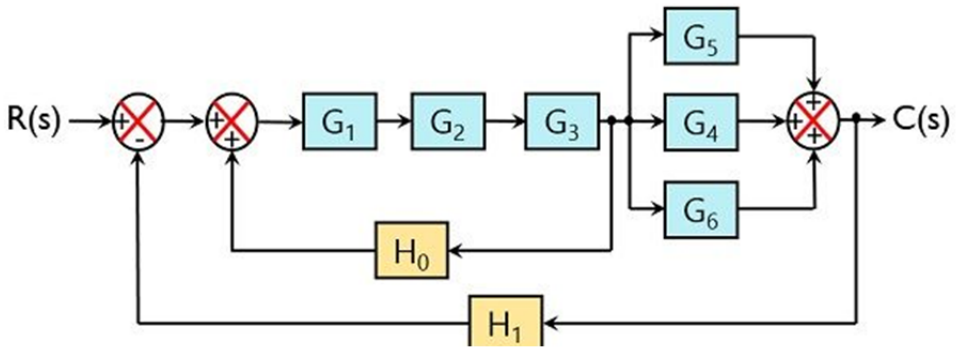

Figure 2

MODULE – III

3. (a) Explain the limitations in Routh Hurwitz criterion and summarize the methods to overcome those limitations with examples. [BL: Understand| CO: 3|Marks: 7]

   (b) Determine the stability of the system whose characteristic equation is given by $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16=0$. Comment on the location of poles in s-plane using Routh Hurwitz criterion. [BL: Apply| CO: 3|Marks: 7]

4. (a) How will you find the gain K at a point on root locus? Enumerate the concept of relative stability and BIBO with examples. [BL: Understand| CO: 4|Marks: 7]

   (b) Sketch the root locus for a unity feedback control system whose open loop transfer function is given by $G(S)=\frac{K}{(s+2)(s+4)}$. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) What is frequency response? Explain the various frequency domain specifications with examples. [BL: Understand| CO: 5|Marks: 7]

   (b) Sketch the Bode plot for a unity feedback control system whose open loop transfer function is given by $G(s)= \frac{1}{s(s+10)}$ [BL: Apply| CO: 5|Marks: 7]

6. (a) Summarize the procedure for investigating stability using Nyquist stability criterion. [BL: Understand| CO: 5|Marks: 7]

   (b) Check the stability of the system using Nyquist plot whose open loop transfer function is given by $G(s)=\frac{1}{s(1+2s)(1+s)}$ [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Explain the pole zero plot of lag compensator and explain its properties. Distinguish between lead and lag compensators. [BL: Understand| CO: 6|Marks: 7]

   (b) Obtain the transfer function for the given state model [BL: Apply| CO: 6|Marks: 7]

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

8. (a) State the duality between controllability and observability. Outline the concept of observability and controllability with examples. [BL: Understand| CO: 6|Marks: 7]

   (b) Find the state transition matrix whose system matrix is given by

$$A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad C= \begin{bmatrix} 1 & 0 \end{bmatrix} \text{ and } D=[0].$$

[BL: Apply| CO: 6|Marks: 7]

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