Hall Ticket No | | | | | | | | | | | Question Paper Code: AEEC12

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech IV SEMESTER END EXAMINATIONS (REGULAR / SUPPLEMENTARY) - AUGUST 2023
Regulation: UG-20
CONTROL SYSTEMS

Time: 3 Hours (ELECTRICAL AND ELECTRONICS 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) Illustrate the force-current analogy by taking appropriate mechanical and electrical circuits. [BL: Understand| CO: 1|Marks: 7]

   (b) Determine the transfer function of the mechanical system shown in Figure 1 in terms of u (force input) and x_2 (displacement output). [BL: Apply| CO: 1|Marks: 7]

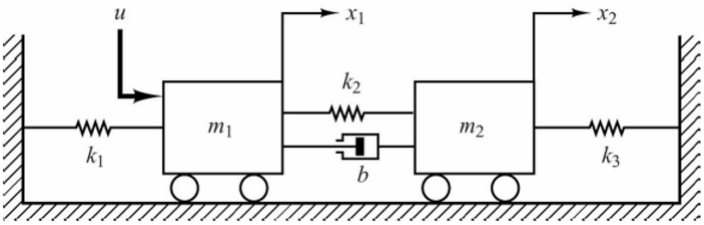

Figure 1

MODULE – II

2. (a) Distinguish between block diagram reduction technique and signal flow graph. Mention the various rules followed in block diagram reduction technique. [BL: Understand| CO: 2|Marks: 7]

   (b) Determine the overall transfer function of the signal flow graph shown in Figure 2. [BL: Apply| CO: 2|Marks: 7]

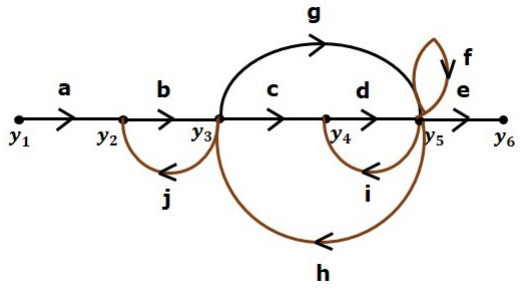

Figure 2

MODULE – III

3. (a) Demonstrate the steps to be followed for Routh - Hurwitz criterion with an example. [BL: Understand| CO: 3|Marks: 7]

   (b) Determine the stability of the system whose closed loop transfer function is given as $\frac{10}{s^5+2s^4+3s^3+6s^2+5s+3}$ [BL: Apply| CO: 3|Marks: 7]

4. (a) Explain briefly about the steps to be followed to construct a root locus plot of a given transfer function. [BL: Understand| CO: 4|Marks: 7]

   (b) Draw the root locus of the control system having open loop transfer function $\frac{k}{s(s+5)(s+1)}$. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) List the steps involved in plotting Nyquist plot. Write short notes on various frequency domain specifications. [BL: Understand| CO: 5|Marks: 7]

   (b) Sketch the polar plot for the open loop transfer function of a unity feedback system is given by G(s) $= \frac{1}{s(1+s)(2s+1)}$ Determine gain margin and phase margin. [BL: Apply| CO: 5|Marks: 7]

6. (a) Outline the followings terms:
   i) Resonant peak ii) Bandwidth iii) Gain Marin iv) Phase margin v) Gain cross over frequency vi) Phase cross over frequency vii) Stability [BL: Understand| CO: 5|Marks: 7]

   (b) For a second order system with unity feedback G(s) $= \frac{200}{s(s+6)}$, find various frequency domain specifications. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) State and explain controllability and observability. List the properties of state transition matrix. [BL: Understand| CO: 6|Marks: 7]

   (b) A state variable description of a system is given by the matrix equation

   $$\dot{X} = \begin{bmatrix} -1 & 0 \\ 1 & -2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

   $$Y = \begin{bmatrix} 1 & 1 \end{bmatrix} X$$

   Find the
   i) Transfer function
   ii) The state transition matrix
   iii) State diagram [BL: Apply| CO: 6|Marks: 7]

8. (a) What is a lead compensator? How do you build using electrical components. Find its transfer function. [BL: Understand| CO: 6|Marks: 7]

   (b) Obtain a state model for the system whose transfer function is given by $\frac{7s^2+12s+8}{s^3+6s^2+11s+9}$ [BL: Apply| CO: 6|Marks: 7]

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