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Question Paper Code:AECC21

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
(Dundigal-500043, Hyderabad)

B.Tech V SEMESTER END EXAMINATIONS (REGULAR) - DECEMBER 2022
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) Find the transfer function of a series RLC circuit. Compare open loop and closed loop control systems with suitable examples. [BL: Understand| CO: 1|Marks: 7]

   (b) Determine the transfer function $\frac{X_2(s)}{F(s)}$ for the block diagram shown in Figure 1

   [BL: Apply| CO: 1|Marks: 7]

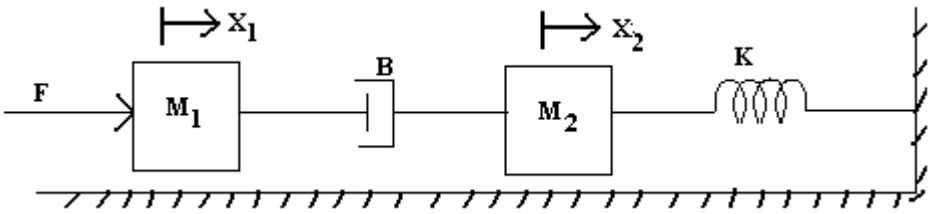

Figure 1

MODULE – II

2. (a) What is meant by step, ramp, parabolic and impulse inputs ? List various rules in block diagram algebra. [BL: Understand| CO: 2|Marks: 7]

   (b) Compute the time domain specifications in the unit step response of given second order system.
   $\frac{C(S)}{R(S)} = \frac{36}{s^2+2s+36}$ [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Mention the advantages and limitations of Routh Hurwitz criteria. Explain the Routh's criteria with an example. [BL: Understand| CO: 3|Marks: 7]

   (b) Comment the statbility for a given characteristic equation by Routh-Hurwitz criterion
   $4S^4 + 10S^3 + 2S^2 + 3S + 6 = 0$ [BL: Apply| CO: 3|Marks: 7]

4. (a) Interpret the effect of addition of poles on root locus. Write the steps to determine the breakaway point on the root locus. [BL: Understand| CO: 4|Marks: 7]

(b) Sketch the root locus plot of a unity feedback system with open-loop transfer function $G(S) = \dfrac{10}{s(s+2)(s+4)}$ [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Describe the steps to determine gain margin and phase margin for a open loop transfer function. [BL: Understand| CO: 5|Marks: 7]

(b) Consider a unity feedback system having an open loop transfer function $G(S) = \dfrac{k}{s(1+0.2s)(1+0.05s)}.$, Sketch the magnitude and phase plot

[BL: Apply| CO: 5|Marks: 7]

6. (a) State the difference between polar plot and Nyquist plot. Write a note on correlation between time and frequency responses. [BL: Understand| CO: 5|Marks: 7]

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

MODULE – V

7. (a) Describe in detail about lead, lag compensators. Determine the formula for the frequency at which the maximum phase lead occurs for a lead compensator. [BL: Understand| CO: 6|Marks: 7]

(b) Determine whether the following system is controllable and observable

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

$$A = \begin{bmatrix} -5 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & -2 \end{bmatrix} \qquad B = \begin{bmatrix} 0 \\ -1.414 \\ 0 \end{bmatrix} \qquad C = \begin{bmatrix} -0.534 & -1.414 & 0.7071 \end{bmatrix} \qquad D = \begin{bmatrix} 0 \end{bmatrix}$$

8. (a) Distinguish between transfer function model and state space model. Explain various methods of evaluation of state transition matrix [BL: Understand| CO: 6|Marks: 7]

(b) Obtain the state model in controllable canonical form for the system described by the differential equation $3y'' + y' + 2y = u' - 2u$ [BL: Apply| CO: 6|Marks: 7]

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