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Vellore Institute of Technology

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CHENNAI

23BME1177

Reg. No

Final Assessment Test(FAT) - Apr/May 2025

Programme	B.Tech.	Semester	Winter Semester 2024-25
Course Code	BMEE330L	Faculty Name	Prof. N.gobinath
Course Title	Control Systems	Slot	E1+TE1
		Class Nbr	CH2024250500602
Time	3 hours	Max. Marks	100

Instructions To Candidates

- Write only your registration number in the designated box on the question paper. Writing anything elsewhere on the question paper will be considered a violation.
- Two line graphs and one semi-log graph sheets are provided

Course Outcomes

CO1: Apply the concepts of control systems and modelling techniques
CO2: Develop various representations of system based on the first principles approach
CO3: Infer the domain specifications from the time and frequency response
CO4: Analyse the stability of closed-loop systems using different techniques
CO5: Demonstrate the state-space representation and modern control theory
CO6: Design appropriate control systems for different applications

Answer all Questions (10 × 10 Marks)

01. Identify and explain the function of key components of a control system in any practical application.

[10] (CO1/K2)

02. Using Mason's gain formula find the transfer function of the system in Figure 1

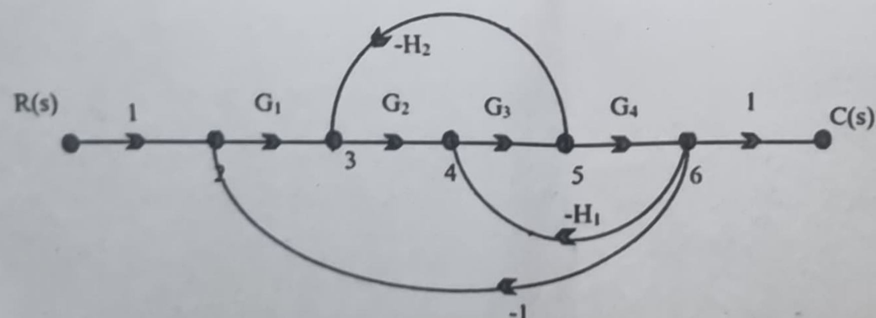

Figure 1.

[10] (CO2/K4)

03. Determine the transfer function $\frac{C(s)}{R(s)}$ for the given system in Figure 2

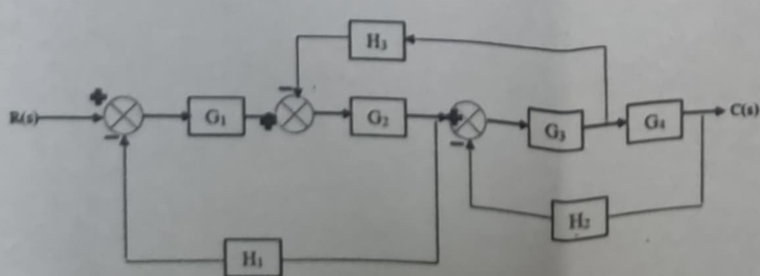

Figure 2.

[10] (CO2/K4)

04. Find the transfer function, $G(s) = \frac{X2(s)}{F(s)}$ for the translational mechanical system shown in Figure 3.

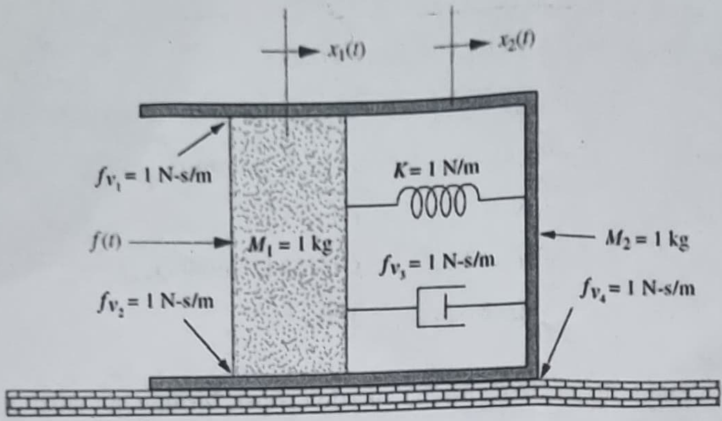

Figure 3.

[10] (CO2/K4)

05. Analyze the electrical network as given in figure 4 and derive its transfer function. Based on your findings, evaluate how the system responds to any one of the standard test signals.

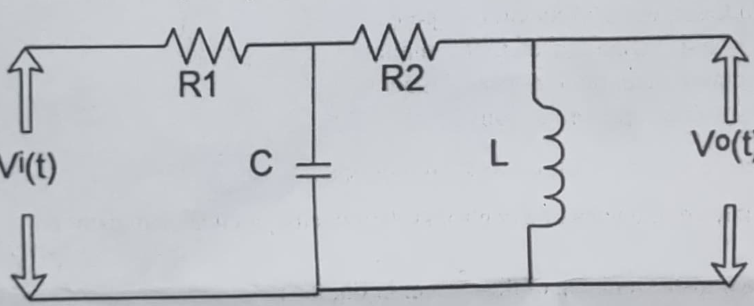

Figure 4.

[10] (CO3/K3)

06. Explain the effect of proportional (P), integral (I), derivative (D), and their combinations (PI, PD, and PID) on the transient and steady-state response of a control system.

[10] (CO6/K3)

07. The open loop transfer function of a unity negative feed back system is given by $\frac{K}{s(s^2+8s+32)}$. Draw the root locus as the value of k varies from zero to Infinity.

[10] (CO4/K4)

08. Sketch the polar plot of the function $G(s) = \frac{1}{s(1+s)(1+2s)}$. Also determine the gain margin, phase margin, H(s) = 1.

[10] (CO3/K4)

09. Draw the Nyquist plot for the system, whose open loop transfer function is $G(s)H(s) = \frac{K(1+0.s)(1+s)}{(10s+1)(s-1)}$. Determine the range of K for which the closed-loop system is stable.

[10] (CO4/K5)

10. Construct a state model for a system characterized by the differential equation,

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 6y + u = 0$$

Also give the block diagram representation of the state model

[10] (CO5/K5)

BL-Bloom's Taxonomy Levels - (K1-Remembering,K2-Understanding,K3-Applying,K4-Analysing,K5-Evaluating,K6-Creating)