Question Paper Code:95B03

B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Fifth Semester

Biomedical Engineering

19UBM503 – BIO CONTROL SYSTEM

(Regulation 2019)

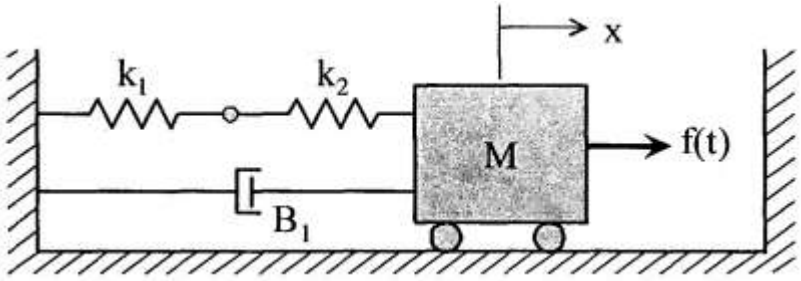
Duration: Three hours | Maximum: 100 Marks

PART – A (10 x 2 = 20 Marks)

1.	Why negative feedback is invariably preferred in closed loop control system?	CO1 - U
2.	Compare the block diagram representation and signal flow graph.	CO1 - U
3.	What is the difference between steady state response and transient response of a control system?	CO1 - U
4.	Give the effect of addition of poles on the root locus.	CO1-U
5.	A unity feedback system has the transfer function $G(s) = \frac{10}{s(s+6)}$. Determine the resonant peak and resonant frequency.	CO2 - U
6.	How phase margin determined from bode's plot?	CO1-U
7.	What are the advantages of state space representation?	CO1-U
8.	List out the properties of State transition matrix.	CO1-U
9.	Which type of feedback is highly common in physiological systems? Explain with example.	CO1-U
10.	Write any four examples of physiological control system.	CO1-U

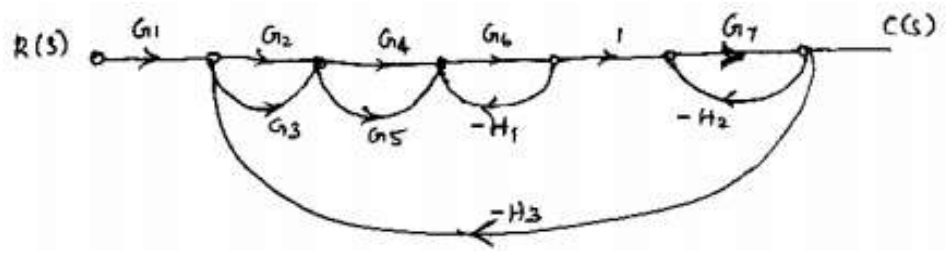
PART – B (5 x 16 = 80 Marks)

11.	a)	(i) For the mechanical system shown in fig, draw the force voltage and force current electrical analogous circuits.	CO2-Ap	(8)



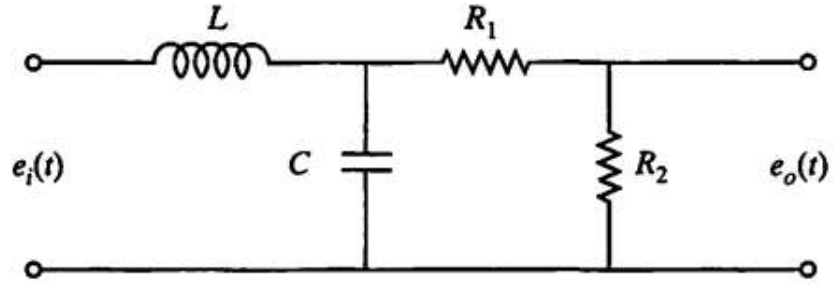
		(ii) For the given signal flow graph find C(s)/R(s) using Mason's gain	CO2-Ap	(8)

formula.

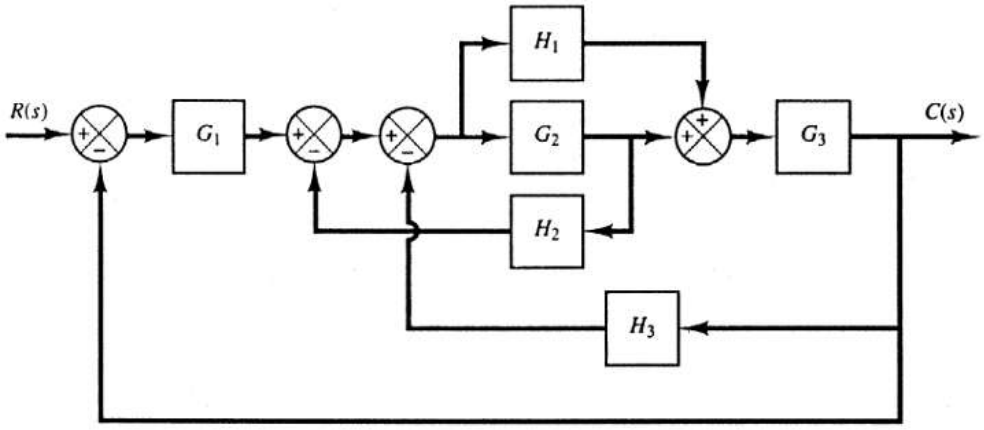


(OR)

b) (i) Examine the given electrical network and deduce the transfer function. CO2-Ap (8)



(ii) Draw the signal flow graph and find C(s)/R(s) for the system shown in fig. CO2-Ap (8)



12. a) (i) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{1}{s(1+s)}$. Determine the generalized error coefficients and steady state error of the system for the input $r(t) = 4 + 6t + 2t^3$. CO3-E (8)

(ii) Using Routh stability criterion method comment on the stability of the unity feedback system, whose open-loop transfer function is given by $G(s) = \frac{K}{s(s+5)(s+10)}$. Find the range of K values at which the system is stable. CO4-An (8)

(OR)

b) (i) The closed loop Transfer function of the system is $\frac{25K}{(s^2 + (5 + 500K_t)s + 25K)}$. Find the value of K and K_t so that the maximum overshoot of the output is approximately 25 percent and the rise time is 0.1 sec. CO3-E (8)

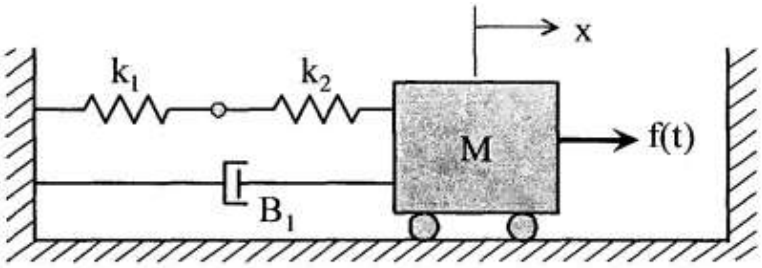
(ii) Determine the approximate root locus diagram for a closed loop system whose loop transfer function is given by G(S) H(S) = $\frac{K}{s(s+5)(s+10)}$. CO4-An (8)

13. a) The open loop transfer function of a unity feedback system is given by G(s) = $\frac{K}{s(1 + 0.5s)(1 + 0.2s)}$. Using bode plot find the value of K so that (i) The gain margin of the system is 6 db and (ii) The phase margin of the system is 25º. CO3-E (16)

(OR)

b) The open loop transfer function of a unity feedback system is given by G(s) = $\frac{K}{s(s^2+s+4)}$. Using polar plot, determine the value of K so that phase margin is 50º. What is the corresponding gain margin? CO3-E (16)

14. a) (i) Find the state model of the mechanical system shown below. CO5-Ap (8)



(ii) A system is represented by the state equation $\dot{X}$= AX+BU; Y = CX where, A = $\begin{bmatrix}0 & 1 & 0\\0 & -1 & 1\\0 & -1 & -10\end{bmatrix}$, B = $\begin{bmatrix}0\\0\\10\end{bmatrix}$ and C = $[1 \quad 0 \quad 0]$. Determine the transfer function of the system. CO5-Ap (8)

(OR)

b) (i) Obtain the state model of the system described by the following transfer function $\frac{Y(s)}{U(s)} = \frac{5}{s^3+6s+7}$. CO5-Ap (8)

(ii) A Linear Time Invariant system is characterized by the state equation CO5-Ap (8)

$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$; where u is a unit step function. Compute the solution of this equation assuming initial condition $x_0 = \begin{bmatrix}1\\ 0\end{bmatrix}$. Use inverse Laplace transform technique.

15. a) (i) Differentiate physiological control system with an engineering control system. CO1-U (8)

(ii) With a neat diagram explain the linear model of any one physiological system. CO1-U (8)

(OR)

b) (i) Analyze the various properties of generalized biological system and explain how to create models with combinations of system elements. CO1-U (8)

(ii) Explain with suitable examples the need for modeling in physiological system. CO1-U (8)