R20 Regulation *Subject code: 3P5DB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

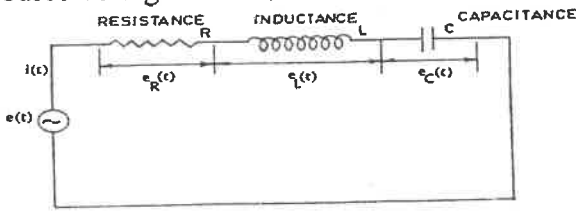
B.Tech V Semester Regular/Supplementary Examinations, February 2024

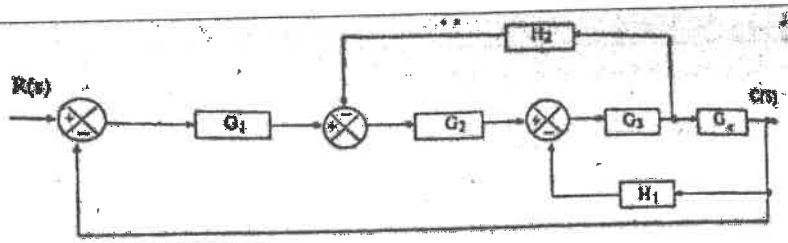
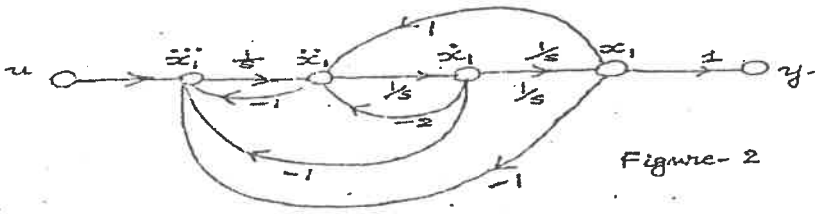
CONTROL SYSTEMS

(ELECTRONICS & COMMUNICATION ENGINEERING)

Maximum Marks: 70 Date:24.02.2024 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

	Part-A	CO	Bloom Tx
All the following questions carry equal marks (10x2M=20 Marks)			
1	What is a transfer function and what are its properties?	CO1	L2
2	List the properties of signal flow graph.	CO1	L1
3	Define accelerating error constant.	CO2	L1
4	State the effect of PD controller on system performance.	CO2	L2
5	Give the necessary condition for stability.	CO3	L1
6	Define Phase margin and gain margin.	CO3	L1
7	State Nyquist stability criterion.	CO4	L1
8	When is lead lag compensator required?	CO4	L2
9	List out the properties of State Transition Matrix.	CO5	L1
10	For a single input system $\dot{X} = AX + BU$ $Y = CX$ $A = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}; B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}; C = [1 \quad 1]$ Check the controllability and observability of the system.	CO5	L2
	Part-B		
Answer All the following questions. (5X10M=50Marks)			Bloom Tx level
11	a) Find system transfer function between the capacitance voltage to the source voltage in the RLC circuit shown below.  b) What are the advantages and disadvantages of closed loop control. system? (7+3)	CO1	L3
	OR		
12	For the system represented in the given figure, determine transfer function C(S)/R(S).	CO1	L4

	 (10)		
13	Find all the time domain specifications for a unity feedback control system whose open loop transfer function is given by G(S) = $\mathbf{25/S(S+5)}$.(10)	CO2	L4
	OR		
14	When a second-order system is subjected to a unit step input, the values of $\xi = 0.5$ and $\omega_n = 6$ rad/sec. Determine the rise time, peak time, settling time and peak overshoot.(10)	CO2	L3
15	With the help of Routh's stability criterion find the stability of the following systems represented by the characteristic equations: (a) $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$ (b) $9s^5 - 20s^4 + 10s^3 - s^2 - 9s - 10 = 0$(10)	CO3	L3
	OR		
16	a) Define and derive the expression for resonant frequency. b) Draw the magnitude bode plot for the system having the following transfer function: G(s) H(s) = $\mathbf{2000\ (S+1)/S(S+10)\ (S+40)}$(5+5)	CO3	L3
17	a) Sketch the polar plot for the open loop transfer function of a unity feedback system is given by G(s) = $\mathbf{1/S\ (1 + S)\ (1+ 2S)}$. Determine Gain Margin & Phase Margin. b) Explain the properties of minimum phase systems.(5+5)	CO4	L3
	OR		
18	Explain lead compensator? Derive the frequency response of lead compensator. 10M	CO4	L3
19	Construct the state space model of the system whose signal flow graph is shown in figure-2.  Figure- 2 10	CO5	L4
	OR		
20	a) Derive the expression for the transfer function and poles of the system from the state model $\dot{X} = Ax + Bu$ and $y = Cx + Du$ b) Diagonalize the following system matrix $A = \begin{pmatrix} 4 & 1 & -2 \\ 1 & 0 & 2 \\ 1 & -1 & 3 \end{pmatrix}$ (5+5)	CO5	L4