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EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY
An Autonomous Institution Affiliated to Visvesvaraya Technological University (VTU) Belagavi

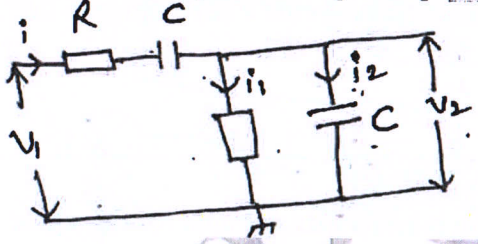
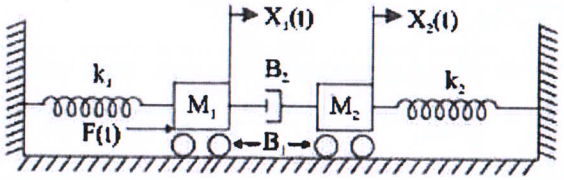
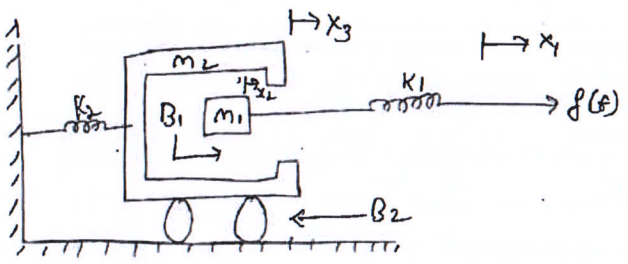
USN | | | | | | | | | | |

24EC44

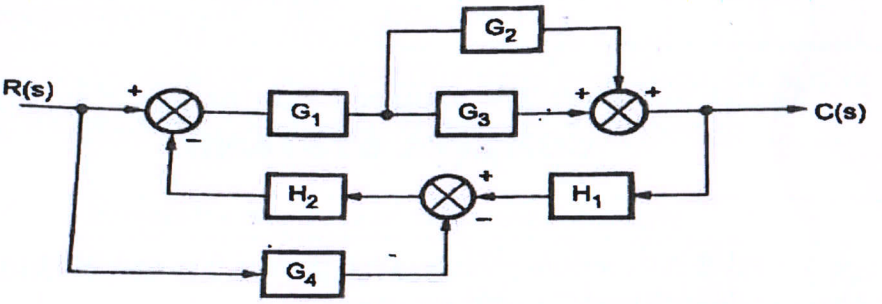
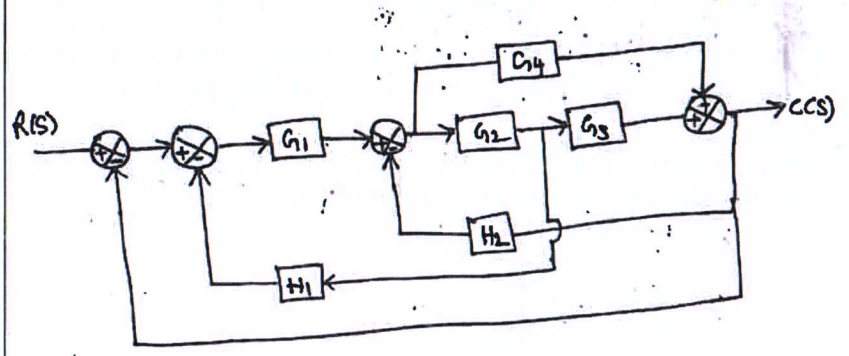
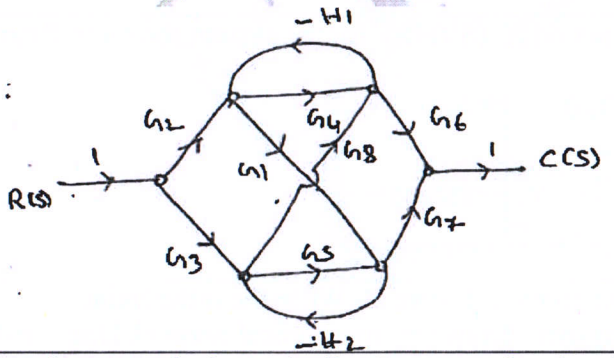
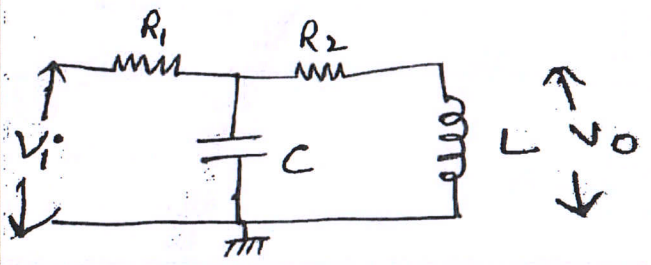
Fourth Semester B.E. Degree Examination, May 2026
CONTROL SYSTEMS

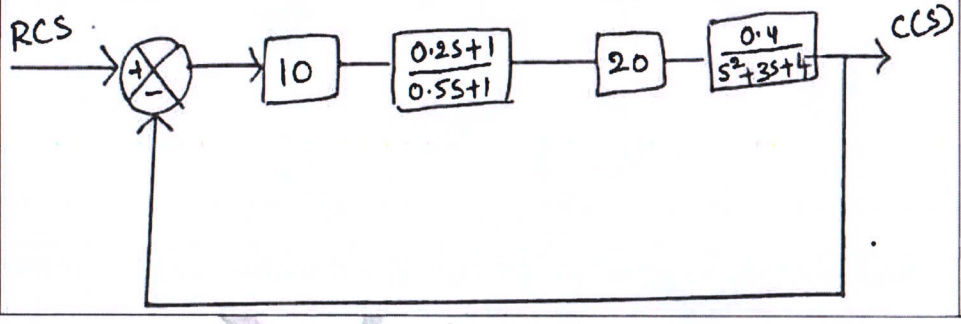
TIME:3 hrs. Max.Marks:100

Note: 1. Answer **any FIVE** full questions, choosing **ONE** question from **each MODULE.**
2. M: Marks, L: Bloom's level,C: Course outcomes.
3. Assume missing data suitably.

		Module-1	M	L	C
Q.1	a	Define Control System, with neat diagram , distinguish between open loop and closed loop systems with examples. Mention its advantages and disadvantages	10	L2	CO1
	b	For the network shown in Fig. derive the transfer function with the voltages V_1 and V_2 as the input and output respectively 	10	L3	CO1
		OR			
Q.2	a	Determine the transfer function X1(S)/F(S) for the system shown in figure 	10	L3	CO1
	b	For the mechanical system given in Figure .Write the differential equations describing the system. Draw the mechanical network Draw F-V and F-I analogy circuits for the mechanical network shown in figure 	10	L3	CO1

Module–2

Q.3	a	Obtain the closed loop transfer function of the system shown in Fig. Using block diagram reduction technique. 	10	L3	CO2
	b	Convert block diagram into Signal flow graph and determine the transfer function using Mason's Gain formula 	10	L3	CO2
		OR			
Q.4	a	Obtain the transfer function using masons gain formula for the signal flow graphs given in Figure 	10	L3	CO2
	b	For the network shown in fig. Construct the signal flow graph and obtain the transfer function 	10	L3	CO2

		Module–3			
Q.5	**a**	Draw the time domain specification graph for the Second order System and derive the expression for i) rise time ii) peak time iii)maximum overshoot for second order system for a unit step input	**10**	**L3**	**CO3**
	b	The open loop transfer function of a unity feedback system is given by $G(s)=\frac{K}{S(ST+1)}$ Where K and T are positive constant. By what factor should the amplifier gain K br reduced, so that the peak overshoot of unit step response of the system is reduced from 75% to 25%	**6**	**L3**	**CO3**
	c	Draw the block diagram of PID controller and explain briefly	**4**	**L3**	**CO3**
		OR			
Q.6	**a**	A unity feedback control system has an amplifier with gain KA=10 and gain ratio G(s)=1/S(S+2) in the feedback forward path. A derivative feedback H(S)=SKo is introduced as a minor loop around G(S). Determine the derivative feedback constant, Ko. So that the system damping factor is 0.6	**7**	**L3**	**CO3**
	b	A unity feedback system as the forward transfer function $G(S)=\frac{K_1(2S+1)}{S(5S+1)(1+S^2)}$ The input r(t)=1+6t is applied to the systems. Determine minimum value of K_1 if the study state error less than 0.1	**6**	**L3**	**CO3**
	c	For the unity feedback system shown in fig. Find the steady state error for (i) a unit step input (ii) a unit velocity input and (iii) a unit acceleration input 	**7**	**L3**	**CO3**
		Module–4			
Q.7	**a**	An unity feed back control system has open loop transfer function $G(S)=\frac{K}{S(1+T_1S)(1+T_2S)}$. Find the value of K, if the system is stable (T_1 & T_2 >0)	**8**	**L3**	**CO4**
	b	A –ve feedback control system is characterized by $G(s)H(s)=\frac{K}{S(S+1)(S+2)(S+3)}$ sketch the root locus. Plot for values of K ranging from 0 to∞. Mark all the salient points on the root locus	**12**	**L3**	**CO4**
		OR			
Q.8	**a**	The system with Characteristics equation of a system Determine the $S^6+2S^5+8S^4+12S^3+20S^2+16S+16=0$Stability of the system using Routh – Hurwitz Criterion	**8**	**L3**	**CO4**
	b	A –ve feedback control system is characterized by $G(s)H(s)=\frac{K}{S(S+1)(S+2)(S+3)}$ sketch the root locus. Plot for values of K ranging from 0 to∞. Mark all the salient points on the root locus	**12**	**L3**	**CO4**

		Module–5			
Q.9	**a**	Plot the Bode diagram for the following transfer function and obtain the gain, phase margin, gain crossover frequency and phase crossover frequency $G(s)=\frac{10(1+0.126S)}{S(1+0.5S)(1+0.25S)}$ & H(S)=1	**10**	**L3**	**CO5**
	b	For a certain control system $G(S)H(S)=\frac{K}{S(S+2)(S+10)}$ Sketch the Nyquist plot and hence calculate the range of values of 'K' for stability.	**10**	**L3**	**CO5**
		OR			
Q.10	**a**	State and Explain the properties of state transition matrix	**5**	**L3**	**CO5**
	b	The state model of the system given by $\begin{bmatrix}x1\\x2\end{bmatrix}=\begin{bmatrix}0 & 1\\-3 & -4\end{bmatrix}\begin{bmatrix}x1\\x2\end{bmatrix}+\begin{bmatrix}0\\1\end{bmatrix}u$ find the state transition matrix	**10**	**L3**	**CO5**
	c	Obtain the state model for the system represented by the differential equation $d^3y/dt^3+4d^2y/dt^2+7dy/dt+2y(t)=5u(t)$	**5**	**L3**	**CO5**

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