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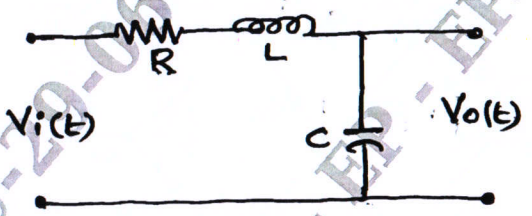
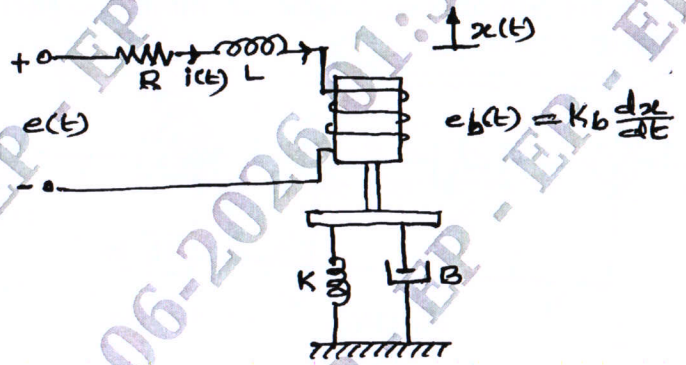
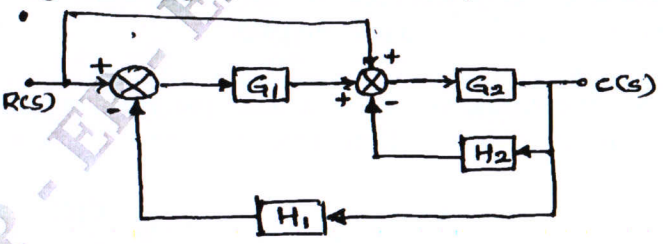
CBCS SCHEME

USN | 1 | EP | 24 | EC | 408 | **BEC403**

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2026
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Sketch the block diagram of closed loop control system and explain with a suitable example. Also mention advantages and disadvantages.	10	L2	CO1
	b.	Determine the transfer function of the system shown in Fig.Q1(b).  Fig.Q1(b)	10	L3	CO1
		OR			
Q.2	a.	Explain Force voltage and Force current analogy with necessary diagram/equations.	10	L2	CO1
	b.	Refer to electro-mechanical system shown in Fig.Q2(b). Determine the transfer function X(s)/E(s).  Fig.Q2(b)	10	L3	CO1
		Module – 2			
Q.3	a.	Obtain the transfer function C(s)/R(s) for the block diagram shown in Fig.Q3(a), using block diagram reduction technique.  Fig.Q3(a)	10	L3	CO1

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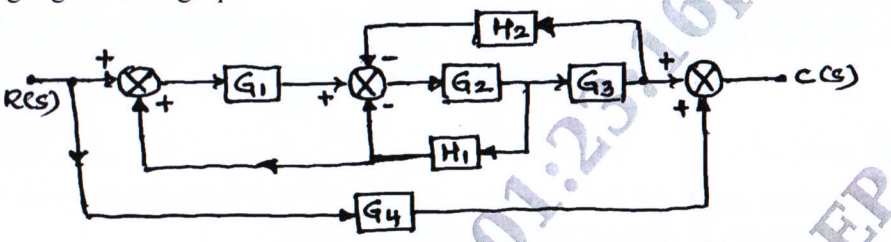
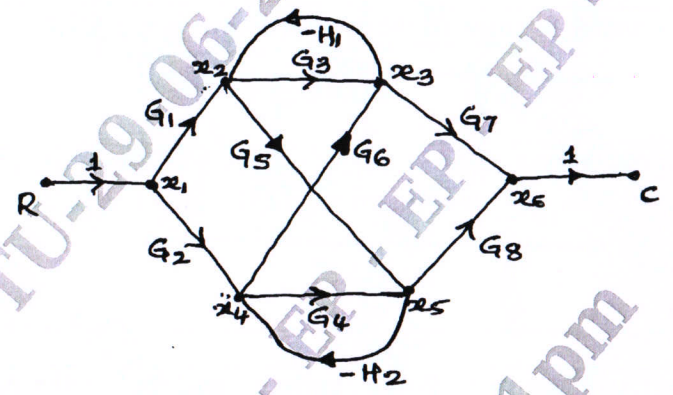
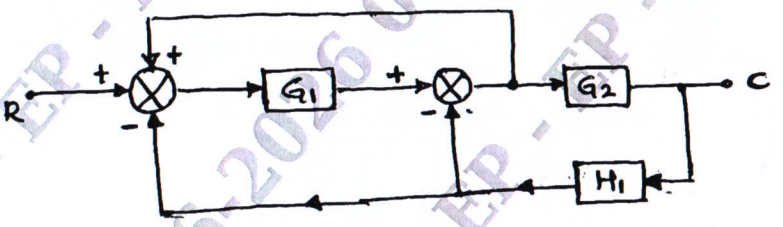
Q.3	**b.**	Obtain the transfer function of the control system shown in Fig.Q3(b), using signal flow graph.  Fig.Q3(b)	**10**	**L3**	**CO1**
		OR			
Q.4	**a.**	Obtain the overall transfer function C/R for the signal flow graph shown in Fig.Q4(a).  Fig.Q4(a)	**10**	**L3**	**CO1**
	b.	Compare Block diagram and Signal flow graph.	**05**	**L2**	**CO1**
	c.	Derive the transfer function of block diagram shown in Fig.Q4(c), using block diagram reduction technique.  Fig.Q4(c)	**05**	**L3**	**CO1**
		Module – 3			
Q.5	**a.**	Sketch the time response specification curve and deliberate on specification parameters.	**07**	**L2**	**CO2**
	b.	Obtain the response of unity feedback system, whose open loop transfer function is $G(s) = 3/s(s+4)$ for a unit-step input.	**07**	**L3**	**CO2**
	c.	The closed loop transfer functions of certain second order unity feedback control systems are given below. Determine the type of damping in the system. (i) $\frac{C(s)}{R(s)} = \frac{8}{s^2+3s+8}$ (ii) $\frac{C(s)}{R(s)} = \frac{2}{s^2+4s+2}$ (iii) $\frac{C(s)}{R(s)} = \frac{2}{s^2+4}$	**06**	**L2**	**CO2**

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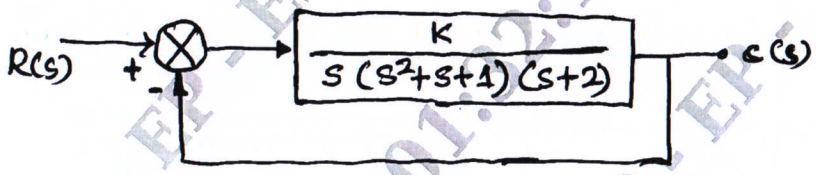
		OR			
Q.6	**a.**	Determine the nature of response of the closed loop system for unit step input. The open loop transfer function of unity feedback system is 4/s(s+1). Also find rise time, peak time, peak overshoot and settling time.	**10**	**L3**	**CO2**
	b.	Develop the transfer function first order system. And sketch the time response curve subjected to step-input and unit ramp.	**10**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Examine the stability of characteristic equation $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 6 = 0$ using Routh's method.	**08**	**L3**	**CO2**
	b.	Sketch the root locus plot for a closed loop system having an open loop transfer function $G(s)H(s) = \frac{K(s+2)(s+1)}{s(s-1)}$ For all values of K ranging from 0 to ∞. Find the range of values of K for closed loop stability.	**12**	**L4**	**CO3**
		OR			
Q.8	**a.**	Determine the value of 'K' for which the system is stable. The transfer function of system is as below Fig.Q8(a).  Fig.Q8(a)	**08**	**L3**	**CO2**
	b.	Sketch the root locus plot for a negative feedback control system characterized by $G(s)H(s) = \frac{K}{s(s^2+6s+12)}$	**12**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Using Nyquist stability criterion, investigate the stability of closed loop system, whose open lopp transfer function is given by $G(s)H(s) = \frac{K}{(s+1)(s+2)}$	**10**	**L3**	**CO4**
	b.	Sketch the Bode plot for the forward path transfer function of unity feedback system given below. Also comment on stability. $G(s) = \frac{10e^{-0.1s}}{s(0.1s+1)^2}$	**10**	**L3**	**CO4**

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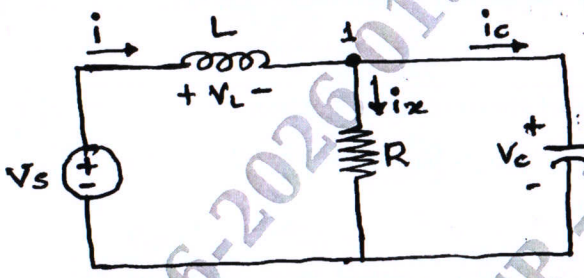
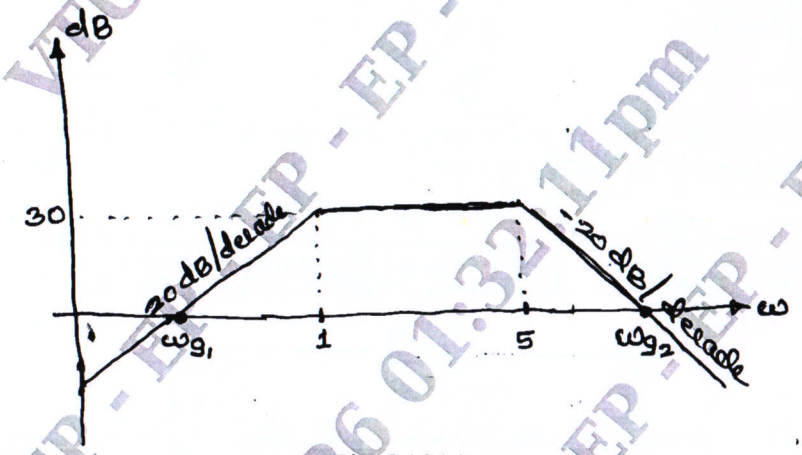
		OR			
Q.10	**a.**	List and explain procedure for applying state variable method to electrical circuits. And also mention advantages of state space techniques.	**07**	**L2**	**CO5**
	b.	Find state space representation for the circuit shown in Fig.Q10(b). Take V_s as the input and i_x as the output.  Fig.Q10(b)	**07**	**L2**	**CO5**
	c.	Refer to the Bode plot shown in Fig.Q10(c). Find the open loop transfer function G(s)H(s) and gain cross over frequencies ω_{g_1} and ω_{g_2}.  Fig.Q10(c)	**06**	**L3**	**CO4**

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