Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN											Course Code	2	2	E	C	4	3

Fourth Semester B.E. Degree Examination – September 2024

CONTROL SYSTEMS

Duration: 3 hrs **Max. Marks: 100**

Note: ***1. Answer any* FIVE *full questions choosing ONE full Question from each Module.***
2. Missing data, if any, may be suitably assumed

Q. No		***Question***	***Marks***	*(RBTL:CO:PO)*
		Module-1		
1.	**a.**	Define Control System. Explain different types of control systems.	**07**	2.1.2
	b.	Derive the Force-Voltage analogy for the translational mechanical system shown in fig 1 and draw its analogous electrical circuit.	**06**	3.1.2

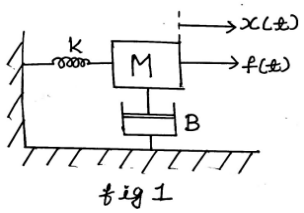
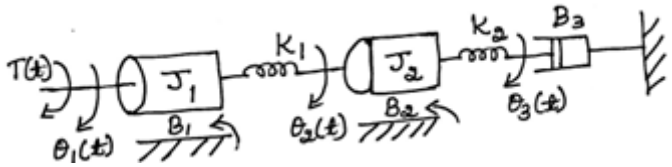


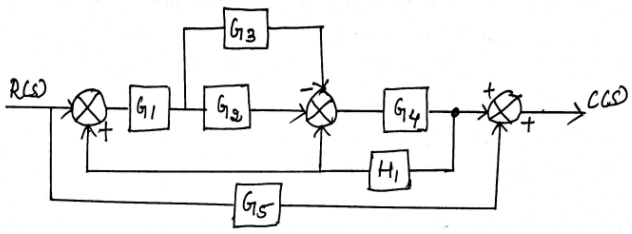
fig 1

	c.	Determine equivalent mechanical system and find electrical analogous circuits using: i) T-V Analogy ii) T-I Analogy for given rotational mechanical system shown in figure.	**07**	3.1.2

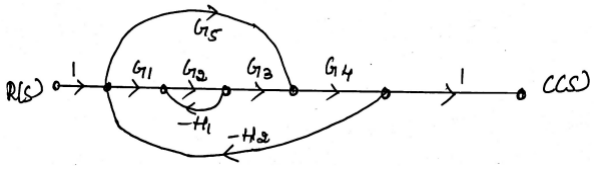


OR

2.	**a.**	Explain the Closed loop control system with real time application.	**07**	2.1.2
	b.	Determine the transfer function of the system shown in figure using block diagram reduction technique	**06**	3.1.3



	c.	Find transfer function for signal flow graph using Mason's gain formula	**07**	3.1.3



Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI – Programme Outcome)

Module-2

3.	**a.**	Explain the following with respect to time response of control systems. i)Transient Response ii) Steady State Response iii) Steady State error	**06**	2.2.2
	b.	Derive the unit step response of a second order for underdamped control system.	**08**	3.2.2
	c.	Determine the impulse response of second order system for a unity negative feedback system with $G(S) = \frac{1}{S(S+1)}$ using Simulink.	**06**	3.2.5

OR

4.	**a.**	Explain the following with respect to Transient Response Specifications. i)Delay Time ii) Rise Time iii) Peak Time iv) Peak Overshoot v) Settling Time	**06**	2.2.3
	b.	Derive the expression of steady state error e_{ss}. Also find e_{ss} for test inputs step and ramp and parabolic.	**08**	3.2.3
	c.	Find K_p, K_v, K_a and steady state error for a system where $r(t) = 3 + t + t^2$ whose open loop transfer function is $G(S)H(S) = \frac{10(S+2)(S+3)}{S(S+1)(S+5)(S+6)}$	**06**	3.2.3

Module-3

5.	**a.**	Define stability analysis and explain the concept of stability analysis with respect to s plane.	**10**	2.3.2
	b.	Find the stability of system having characteristic equation $S^6 + 4S^5 + 3S^4 - 16S^2 - 64S - 48 = 0$ using Routh's Criteria also find the positive real, zero real, negative real roots.	**10**	3.3.2

OR

6.	**a.**	Explain the applications of Routh's criteria i) Range of K ii) Marginal K iii) Frequency of sustain oscillations.	**10**	2.3.2
	b.	For the unity feedback systems, $G(S) = \frac{k}{S(1+0.5S)(1+0.25S)}$.Find the range of K, Marginal Value of K and frequency of sustain oscillations.	**10**	3.3.2

Module-4

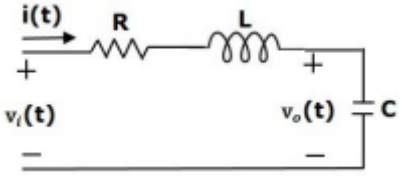
7.	**a.**	Explain the construction rules of root locus.	**10**	2.3.3
	b.	Sketch the root locus diagram for open loop transfer function $G(S) = \frac{k}{S(S+2)(S+5)}$	**10**	3.3.3

OR

8.	**a.**	Explain different general conditions to find existence of Break Away Point (BAP).	**10**	2.3.3
	b.	Sketch the Bode plot for the system having $G(S) = \frac{20}{S(1+0.1S)}$	**10**	3.3.3

Module-5

9.	**a.**	Explain the advantages of state variable approach.	**06**	2.2.2
	b.	Obtain state model of the given electrical system	**07**	3.2.3



	c.	Find the transfer function of the state model if $A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -6 & -11 & -6\end{bmatrix}$ $B=\begin{bmatrix}0\\0\\1\end{bmatrix}$ $C=\begin{bmatrix}1\\0\end{bmatrix}$ $D=[0]$	**07**	3.2.3

OR

10	**a.**	Mention the properties of state transition Matrix.	**06**	2.2.2
	b.	Find the state transition matrix for $A=\begin{bmatrix}0 & -1\\ 2 & -3\end{bmatrix}$	**07**	3.2.3
	c.	Find the transfer function for the system having state model as shown below $\dot{x}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}x+\begin{bmatrix}1\\0\end{bmatrix}u \;;\; y=[1 \quad 0]x$	**07**	3.2.3

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