Sanjay Ghodawat University, Kolhapur 2019-20

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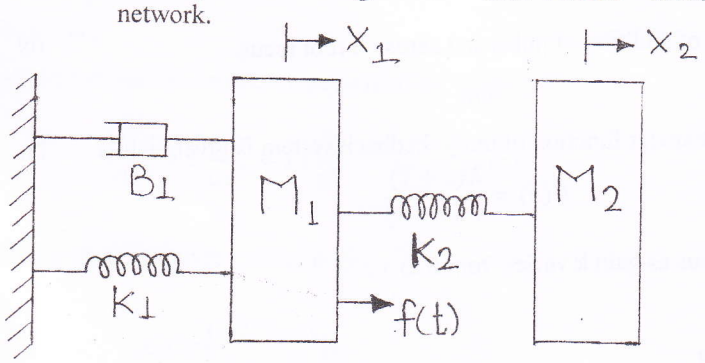
Year and Program:2019-20 Electrical & Electronics Engineering | **School of Technology** | **Department of Electrical Engineering**

Course Code: EET301 | **Course Title: Control System End Semester Examination (ESE)** | **Examination: T.Y. B. Tech Sem.-V**

Day and Date: Tuesday 19/11/19 | **Time:** 3hrs **Max Marks: 100** | 10.30am to 1.30pm.

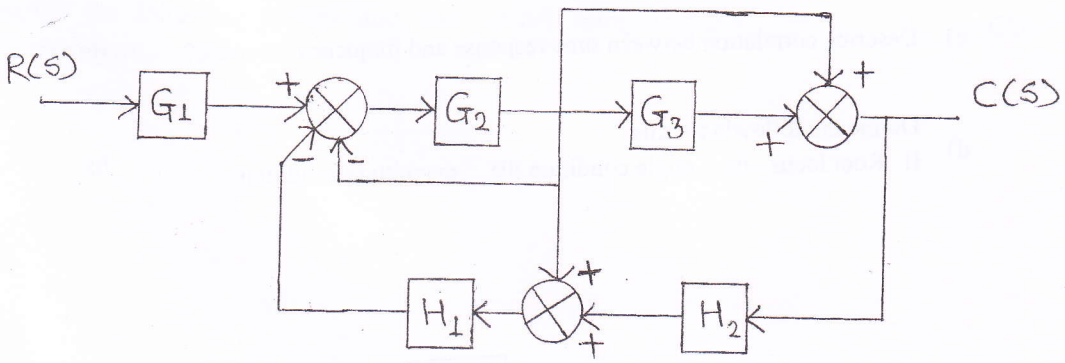
Instructions:
1) All questions are compulsory.
2)Assumesuitable data wherever necessary.
3)Figures to the right indicate full marks.

Q.1	**Solve the following**	Marks	Bloom's Level	CO
a)	For the system given figure below i) Develop mechanical network. ii) Write differential equation of performance. iii) Develop force-voltage and force-current analogous network.	07	L_3	CO1



OR

a)	Calculate the transfer function by using block diagram reduction method.	07	L_4	CO1



	b)	The unity feedback system controlled by PID controller having open loop transfer function $$G(s) = \frac{1}{s(s+1)(s+5)}$$ Estimate value of K_p, T_i and T_d by applying Ziegler Nichols method.	08	L_5	CO2
		OR			
	b)	Explain Proportional, Integral & Derivative control Modes.	08	L_2	CO2
Q.2		**Solve any following**			
	a)	Determine the stability of following system by Routh's & Hurwitz's criteria $$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$$	07	L_3	CO3
		OR			
	a)	EvaluateRise time, Settling Time, Peak Time, % Maximum Peak Overshoot, Delay Time of unit step response of closed loop system given below $$\frac{C(s)}{R(s)} = \frac{16}{s^2 + 2s + 16}$$	07	L_5	CO3
	b)	Explain effect of addition of poles and zeros on root locus.	08	L_2	CO4
		OR			
	b)	Forward path transfer function of unity feedback system is given below $$G(s) = \frac{k(s+1)}{s^2(s+9)}$$ Sketch root locus as gain k varies from 0 to ∞.	08	L_3	CO4
Q.3		**Solve any Two**			
	a)	Compare Block diagram reduction & Signal flow graph method.	08	L_2	CO1
	b)	List the different effects of PI controller on second order system?	08	L_1	CO2
	c)	Describe correlation between time response and frequency response?	08	L_2	CO3
	d)	Define the following terms i) Root locus ii) angle condition iii) magnitude condition.	08	L_1	CO4

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Q.4 **Solve any Two**

a) For unity feedback system — 09 — L_3 — CO5

$$G(s) = \frac{10}{s(s+1)(s+5)}$$

Sketch the bode plot. Determine Gain margin and Phase margin also determine stability of closed loop system.

b) Sketch the bode plot of following system. — 09 — L_3 — CO5

$$GH(s) = \frac{170(\frac{s}{10}+1)}{s(\frac{s}{1.75}+1)(\frac{s}{60}+1)}$$

Determine Gain margin and Phase margin.

c) Decide stability using Nyquist path. — 09 — L_3 — CO5

$$GH(s) = \frac{1}{s(s+1)}$$

Q.5 **Solve any Two**

a) Develop state model of a system represented by — 09 — L_3 — CO6

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 10y = 3u(t)$$

b) Consider the system having state model — 09 — L_2 — CO6

$$\dot{x}(t) = \begin{bmatrix} -2 & -3 \\ 4 & 2 \end{bmatrix} x(t) + \begin{bmatrix} 3 \\ 5 \end{bmatrix} u(t)$$

$$y = [1 \quad 1]x(t) + [0]\,u(t)$$

Convert the given state model into transfer function.

c) Convert the following system into state model using Jordan's canonical form. — 09 — L_2 — CO6

$$\frac{C(s)}{R(s)} = \frac{1}{(s+2)^2(s+1)}$$

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Q.6 **Solve any Three**

a) Sketch polar plot of following transfer function — 06 — L_3 — CO5

$$G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}$$

b) Explain the stability criteria by using Bode Plot. — 06 — L_2 — CO5

c) Consider the system with state equation, — 06 — L_2 — CO6

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

Estimate the state controllability.

d) Define the stability of following system by using Eigen values. — 06 — L_1 — CO6

i) $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$

ii) $A = \begin{bmatrix} -3 & 1 \\ 1 & -3 \end{bmatrix}$

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