Code No: R1922024 **R19** SET - 1

II B. Tech II Semester Regular Examinations, August/September - 2021
CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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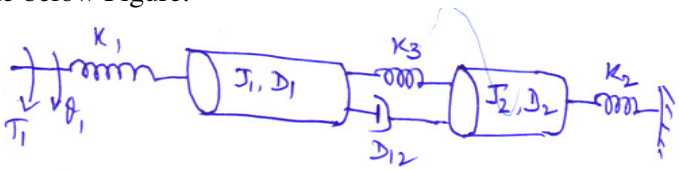
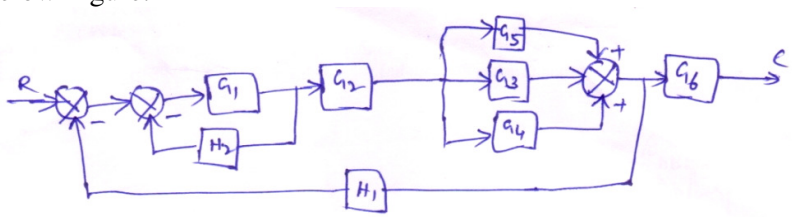
1	a)	Explain the importance of electrical analog systems		7M
	b)	Find the transfer function $\frac{\theta_1(s)}{T_1(s)}$ for the given rotational mechanical system shown in the below Figure.		8M



Or

2	a)	Describe the AC servo motor and draw its torque –speed characteristics		7M
	b)	Using method of reduction determine the ratio $\frac{C(s)}{R(s)}$ in the block diagram shown in below Figure.		8M



3	a)	Define the the following terms (i) absolute stability (ii) marginal stability (iii) conditional stability		6M
	b)	By means of RH criterion determine the stability of the system representedby the characteristic equation $S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$		9M

Or

4	a)	What is the nature of response of a second order system with different types of damping.		5M
	b)	Sketch the root locus for the characteristic equation is $s(s+1)(s+2) + k(s + 1.5) = 0$		10M
5	a)	Sketch the Bode plot for the following transfer function and determine the system gain K for the gain crossover frequency ω_g to be 10 rad/s. $G(s)H(s) = \frac{Ks^2}{(1+0.25s)(1+0.025s)}$		9M
	b)	What are the advantages of the Nyquist plot		6M

Or

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6 Sketch Bode plots for the systems whose open-loop transfer functions are: 15M

(a) $G(s) = s(s+1)$

(b) $G(s) = \frac{(s+1)(s+6)}{(s+2)(s+3)}$

(c) $G(s) = \frac{s+10}{s^2(s+1)(s+100)}$

7 a) Explain the procedure for designing the lead compensator 7M

b) Compare Lead, Lag and Lead-Lag compensators with suitable example 8M

Or

8 For the given open loop transfer function, $G(s) = \frac{K}{s(s+4)(s+6)}$. 15M

Design suitable lead compensation so that phase margin is $\geq 40^o$ and velocity error constant, $K_v \geq 20$

9 a) Obtain the state variable model in Jordan canonical form, for the system with transfer function 7M

$$\frac{Y(s)}{U(s)} = \frac{2s^2+6s+5}{(s+1)(s+1)(s+2)}$$

b) A state variable system described by 8M

$$A = \begin{bmatrix} 0 & -2 \\ 1 & -3 \end{bmatrix}; \quad B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}; \quad C = [0 \quad 1]$$

Find the observability.

Or

10 a) Consider the state-space problem model: 8M

$$\dot{\underline{x}}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \underline{x}(t) + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = [1 \quad 2]\underline{x}(t)$$

Show that the system is completely state controllable and completely state observable

b) A second order linear system is described by 7M

$$\dot{x}_1 = -3x_1 + x_2 + u$$

$$\dot{x}_2 = -x_1 - x_2 + u$$

and $y = x_1 + x_2$.

Determine the transfer function and also calculate the zero input response of $x_{1(0)} = 1$ and $x_{2(0)} = -1$.