PAPER ID-310717

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM V) THEORY EXAMINATION 2023-24
CONTROL SYSTEM

TIME: 3 HRS **M.MARKS: 70**

Note: 1. Attempt all Sections. If require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a.	Define the type & order of system.
b.	State self loop and dummy node in terms of signal flow graph.
c.	Discuss the effect of PD and PI controllers on 2ndorder control system performance.
d.	Write the formula of the following : **i)** Rise time **ii)** Peak Time **iii)** Peak Overshoot **iv)** Settling time
e.	Outline the special case of Routh-Hurwitz criterion.
f.	Explain the gain crossover frequency and phase crossover frequency in terms of Bode Plot.
g.	List the properties of state transition matrix.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a.	Describe the closed loop control system and explain any one example with suitable block diagram.
b.	Explain the time domain specifications and mark them on the response of 2nd order system when subjected to unit step input. Derive the formula of Peak overshoot.
c.	Determine the value of K such that the roots of the characteristics equation given below lie to the left of line s = -1. $s^3 + 13s^2 + 18s + K = 0$
d.	Demonstrate the significance of gain margin and phase margin on a polar plot. Also, draw and properly label the polar plot for stable and unstable system.
e.	Calculate state transition matrix for $A = \begin{bmatrix} 0 & -1 \\ 2 & -5 \end{bmatrix}$

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

a.	Discuss the root locus and sketch the loci of the roots of a unity feedback open loop transfer function $G(s)H(s) = \dfrac{K}{s(s+1)(s+3)(s+4)}$
b.	The open loop T.F. of certain unity feedback system is $G(s)H(s) = \dfrac{K(s+10)(s+20)}{s^2(s+6)}$ Compute (i) Range of K for stability (ii) Marginal value of K (iii) Location of roots for marginal stability

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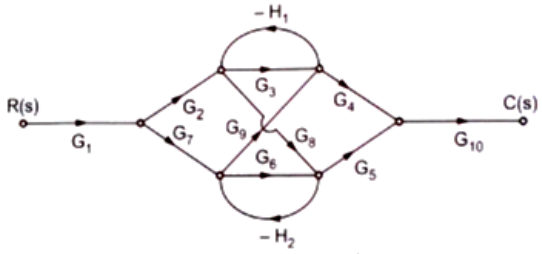
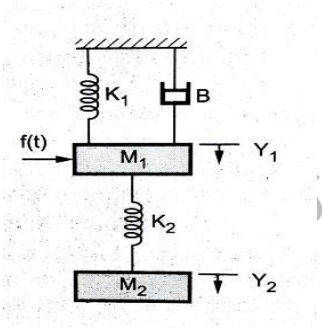
4. Attempt any *one* part of the following: 7 x 1 = 7

a.	Describe Kp, Kv , and Ka and steady state error for a system with open loop transfer function as : $G(s)H(s)=\dfrac{12(s+2)(s+3)}{s(s+1)(s+5)(s+4)}$ Where the input is $r(t)=4+t+t^2$
b.	Derive the generalized error coefficients and corresponding steady state error.

5. Attempt any *one* part of the following: 7 x 1 = 7

a.	Using Mason's gain formula obtain the transfer function of the SFG diagram given below- 
b.	For mechanical system shown in Fig, draw mechanical network, write differential equation of performance and also draw force-current and force-voltage analogous network. 

6. Attempt any *one* part of the following: 7 x 1 = 7

a.	Compute the phase crossover frequency and gain margin with open loop transfer function given below by sketching the polar plot. Also compute on stability of the system. $G(s)H(s)=\dfrac{1}{s(s+1)(3s+1)}$
b.	Explain the mapping theorem and Nyquist stability criterion with one example.

7. Attempt any *one* part of the following: 7 x 1 = 7

a.	Demonstrate the construction and working principle of AC servomotor. Draw its torque speed characteristics and mention its various applications.
b.	Judge the controllability and observability of a system with $A=\begin{bmatrix}0 & 1 & 0\\ 1 & 0 & 1\\ -6 & -11 & -9\end{bmatrix}$, $B=\begin{bmatrix}1\\0\\2\end{bmatrix}$, $C=\begin{bmatrix}10 & 5 & 1\end{bmatrix}$