PAPER ID-310475

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

BTECH
(SEM V) THEORY EXAMINATION 2024-25
CONTROL SYSTEM

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

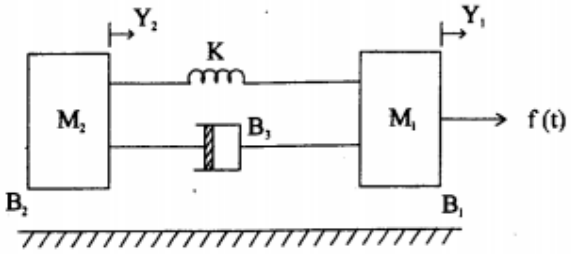
SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	CO	Level
a.	Define transfer function. Give an example for it.	1	K1
b.	What is Mason's gain formula?	1	K2
c.	What are the standard test signals used in control system.	2	K2
d.	What do you mean by Settling Time, write expression for 2nd order system?	2	K3
e.	What are the main advantages of Root Locus plot?	3	K2
f.	What are the main advantages of Root Locus plot?	3	K2
g.	Define gain and phase margins.	4	K1
h.	Write advantages of Bode Plot.	4	K2
i.	What is the compensator? What are the different types of compensator?	5	K3
j.	What is the properties of state transition matrix?	5	K2

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a.	Write down the differential equation governing the mechanical translation system and find the transfer function 	1	K5
b.	The unity feedback system is characterized by an open loop transfer function is G(S) = K/s(s+20). Determine the gain K, so that the system will have a damping ratio of 0.6. For this value of K, determine unit step response, time domain specifications: settling time (2% criterion), Peak overshoot, Rise time, Peak time, Delay time for a unit-step input.	2	K4
c.	Sketch the root locus of the system whose open loop transfer function is $$G(s) = \frac{K}{s(s+2)(s+5)}$$ Find the value of K so that system is marginal stable , find out damped frequency of oscillation, also find K when the damping ratio of the closed loop system is 0.5	3	K5

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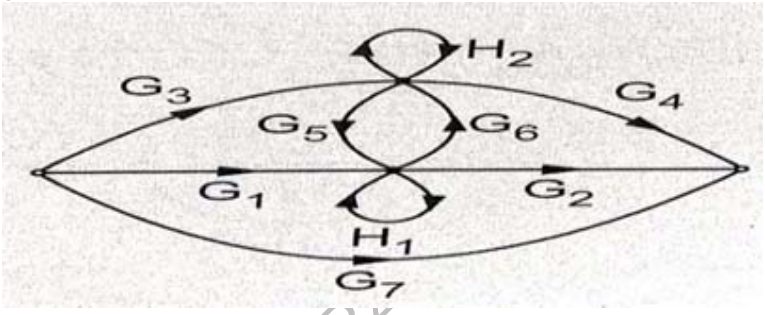
d.	Demonstrate the significance of gain margin and phase margin on a polar plot. Also, draw and properly label the polar plot for stable and unstable system.	4	K3
e.	State properties of State Transition Matrix (STM), find out State Transition Matrix for $$A = \begin{bmatrix} 0 & 1 \\ -8 & -6 \end{bmatrix}$$	5	K3

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

a.	Describe Mason's gain formula and obtain the transfer function of the SFG given below 	1	K5
b.	Explain open loop and closed loop control system with a suitable example in each case.	1	K4

4. Attempt any *one* part of the following: **10 x 1 = 10**

a.	Derive the expression for steady state error and explain Kp,Kv and Ka.	2	K3
b.	Derive the time response of a second order control system for unit step input	2	K3

5. Attempt any *one* part of the following: **10 x 1 = 10**

a.	Determine the value of K such that the roots of the characteristics equation given below lie to the left of line s = -1. $S^3 + 10S^2 + 20S + K = 0$	3	K4
b.	Explain the effect of addition of pole & zero on Root Locus & time domain specifications.	3	K3

6. Attempt any *one* part of the following: **10 x 1 = 10**

a.	Draw the complete Nyquist plot for a unity feedback system having the open loop Function, from this plot obtain all the information regarding stability. $$G(s)\,H(s) = \frac{K}{s(s+3)(s+5)}$$	4	K5

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b.	Write down the procedure for designing Lag-Lead compensator .	4	K2

7. Attempt any *one* part of the following: 10 x 1 = 10

a.	What are the characteristics of servomotors? Compare the AC and Dc servomotors?	5	K3
b.	Obtain the state space representation for the following differential equation $\ddot{y}+5\dot{y}+7y=114$, where 'y' is the output and 'u' is the input.	5	K4