Paper id: 250782

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

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

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

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

SECTION A

1. Attempt *all* questions in brief. **02 x 7 = 14**

Q no.	Question	CO	Level
a.	Compare between open loop &closed loop system.	1	2
b.	Define transient response and steady state response of a system.	3	1
c.	Write short note on Kalman's test.	2	2
d.	The open loon transfer function of unity feedback system is given by $G(s) = \frac{50}{(1+0.1s)(s+10)}$. Determine the K_p&K_v.	3	3
e.	Check the stability of the system whose characteristic equation is given by $2s^4 + 2s^3 + s^2 + 3s + 2 = 0$	4	4
f.	Explain the term (i) asymptotes (ii) centroid.	4	2
g.	Define relative and absolute stability.	5	1

SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

a.	Draw the block diagram and derive the transfer function of armature controlled dc motor.	1	3
b.	A system is described by the matrices $A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & -2 & 3\end{bmatrix}$, $B=\begin{bmatrix}0\\0\\1\end{bmatrix}$, $C=[1 \quad 2 \quad 0]$ Determine the transfer function.	2	3
c.	Consider a unity feedback control system with the closed loop control function $\frac{C(s)}{R(s)} = \frac{Ks+b}{s^2+as+b}$ Determine the open loop transfer function. Show that the steady state error in the unit ramp input response is given by $e_{ss} = \frac{a-k}{b}$	3	4
d.	Explain concept of stability in detail and also explain the effect of location of poles on stability.	4	2,4
e.	Sketch the bode plot for the transfer function (on semi log paper) $G(s) = \frac{1000}{s(1+0.1s)(1+0.001s)}$	5	4

SECTION C

3. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Determine the ratio C(s)/R(s) for the system shown in figure:	1	3

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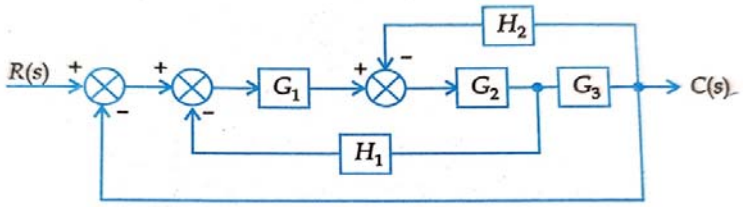
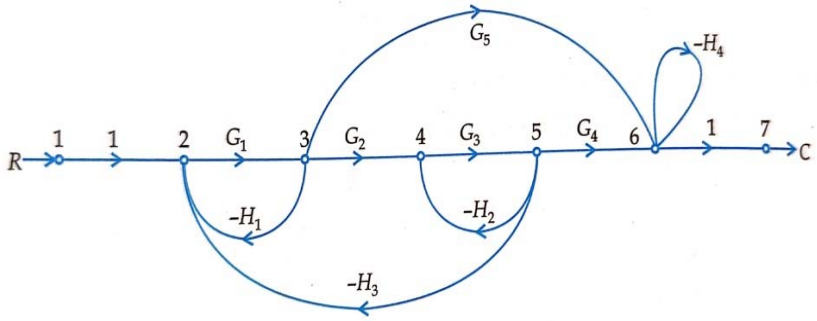
			
b.	For the given signal flow graph find the ratio C/R. 	1	3

4. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Consider the following system $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-0.5 & 0\\ 0 & -2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u(t)$ $y(t) = [0 \quad 1]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$ Test for controllability and observability.	2	4
b.	A system is described by the following transfer function $G(s) = \frac{20(10s+1)}{s^3+3s^2+2s+1}$ Find the state and output equation of the system.	2	3

5. Attempt any *one* part of the following: **07 x 1 = 07**

a.	The open loop transfer function of a servo system with unity feedback is given by $G(s) = \frac{10}{(s+2)(s+5)}$ Determine the characteristic equation of the system, damping ratio, undamped natural frequency of oscillation. What is the percentage overshoot of the response to a unit step input.	3	4,5
b.	Derive the expression for response of first order system with unit step input.	3	3

6. Attempt any *one* part of the following: **07 x 1 = 07**

a.	For a unity feedback system the open loop transfer function is given by $G(s) = \frac{k}{s(s+2)(s^2+6s+25)}$	4	4

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	Sketch the root locus. (on graph paper)		
b.	Explain Routh Hurwitz's stability criteria. For a system with characteristic equation $s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$, examine stability	4	4,5

7. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Sketch the polar plot of $$G(s) = \frac{10}{s(s+1)}$$	5	4
b.	With a suitable diagram define: (a) Phase crossover frequency (b) Gain crossover frequency (c) Phase Margin (d) Gain margin	5	3