

Paper id: 250782

Printed Page: 1
Institute: (code: 245) JNTU

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 loop 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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Paper id: 250782

Printed Page: 2 of 3
Subject Code: BEC602

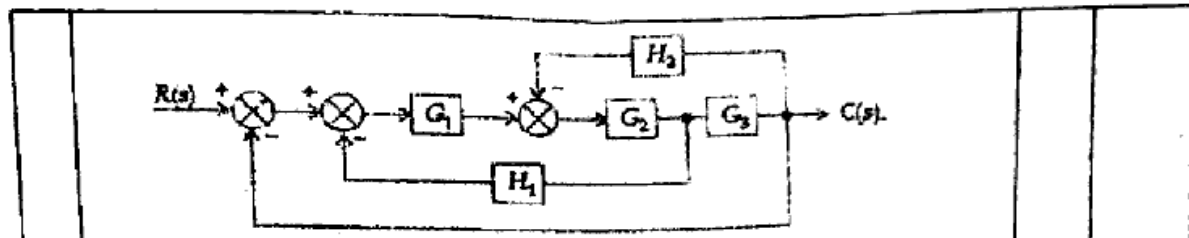
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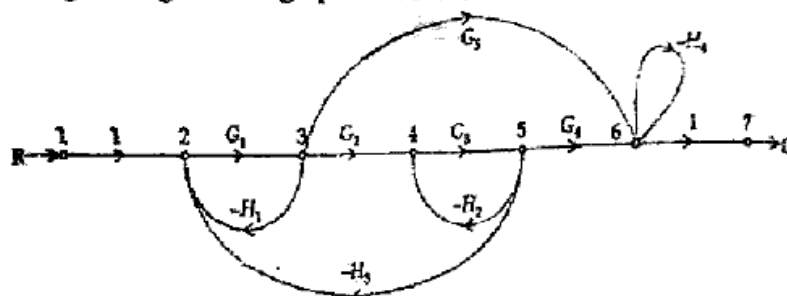
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- b. For the given signal flow graph find the ratio C/R.



4. Attempt any one part of the following:

07 x 1 = 07

- a. Consider the following system

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -0.5 & 1 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Test for controllability and observability.

- 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.

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, frequency of oscillation. What is the percentage overshoot of the response to a unit step input.

- b. Derive the expression for response of first order system with unit step input.

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

$$G(s) = \frac{k}{s(s+2)(s^2+6s+25)}$$

2 | Page



Paper Id: 250782

Printed Page: 3 of 3

Subject Code: BFC602

Roll No:

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BTECH

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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