

Roll No:

BTECH
(SEM. VI) THEORY EXAMINATION 2025-26
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.	What type of feedback is preferred in control system and why?	1	K4
b.	State the Kalman's test for controllability.	2	K2
c.	For the transfer function $G(s) = \frac{1(s^2 + 4)(1 + 2.5s)}{2(s^2 + 2)(1 + 0.5s)}$ Plot the poles and zeros in s-plane.	3	K3
d.	Define Routh Hurwitz's stability criterion.	4	K2
e.	Comment on the effect of addition of poles and zeros on the stability of the system.	3	K4
f.	Define gain margin and phase margin.	5	K2
g.	Find the transfer function of the system described by $\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 3y = 5$	1	K3

SECTION B

2. Attempt any three of the following:

07 x 3 = 21

Q no.	Question	CO	Level
a.	Draw the block diagram and derive the transfer function of armature controlled dc motor.	1	K2
b.	Evaluate the observability of the system with $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, C = [3 \quad 4 \quad 1]$	2	K3
c.	The overall transfer function of a system is given by $\frac{C(s)}{R(s)} = \frac{20}{s^2 + 6s + 25}$ Determine the characteristic equation of the system, ω_n , ξ , ω_d , t_p and M_p .	3	K3
d.	Explain root locus technique for stability. Enumerate the various steps for construction of root loci with suitable example.	4	K2
e.	Explain Nyquist stability criterion with suitable example.	5	K2

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SECTION C

3. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Solve by block diagram reduction technique	1	K3
b.	Obtain the signal flow graph representation for a system whose block diagram is given below. Find the corresponding $C(s)/R(s)$ ratio using the Masons Gain formula	1	K3

4. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Obtain the transfer function model for the following state space system. $A = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, C = [1 \quad 0], D = [0]$	2	K3
b.	Derive the expression for the state transition matrix using Laplace transform method.	2	K2

5. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Determine K to limit the error of a system for input $1 + 8t + \frac{18}{2}t^2$ to 0.8 having $G(s)H(s) = \frac{k}{s^2(s+1)(s+4)}$.	3	K4
b.	With a neat sketch explain all the time domain specifications.	3	K2

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6. Attempt any *one* part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Determine the stability of a system having following characteristic equation: $s^5 + 2s^4 + 24s^3 + 48s^2 - 25s - 50 = 0$	4	K4
b.	Define the following terms (i) stable system (ii) Unstable system (iii) conditionally stable system (iv) Relative stability	4	K1

7. Attempt any *one* part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	For the following transfer function draw the bode plot , find the gain and phase margin $G(s)H(s) = \frac{5}{s(10 + s)(20 + s)}$	5	K4
b.	Derive the expressions for resonant peak and resonant frequency for a standard second order system.	5	K4