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Total No. of Questions : 09] [Total No. of Pages : 02

B.Tech. (Sem. - 4th)

LINEAR CONTROL SYSTEMS

SUBJECT CODE : IC - 204

Paper ID : [A0310]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

Q1) *(10 × 2 = 20)*

a) Define linear and nonlinear control systems.

b) Give requirements of good control system.

c) Write limitations of transfer function approach.

d) State Mason's Gain Formula.

e) What is meant by Critically damped system?

f) State limitations of Routh's method.

g) Differentiate between direct root locus and inverse root locus.

h) State limitations of frequency domain approach.

i) Give advantages of Bode plots.

j) Define Nyquist stability criterion.

Section - B

(4 × 5 = 20)

Q2) With the help of suitable example differentiate between :

(a) Time variant and invariant systems.

(b) Continuous and Discrete data systems.

Q3) Derive the transfer function of simple liquid level system.

Q4) How steady state error of a control system is determined? How it can be reduced?

Q5) Find the range of K for stability of
$S^4 + 2S^3 + 2S^2 + (3 + K)S + K = 0$, for $K > 0$.

Q6) Define bandwidth. State the advantages and limitations of frequency domain approach.

Section - C

(2 × 10 = 20)

Q7) State the advantage of Bode plot. Draw the Bode diagram for

$$G(s) = \frac{100(0.02S + 1)}{(S + 1)(1 + 0.1S)(1 + 0.01S)^2}$$

Mark the following on the Bode diagram, recording the numerical values
(a) gain crossover frequency.
(b) phase margin.
(c) phase crossover frequency.
(d) gain margin.

Q8) How is it possible to make assessment of Relative stability using Nyquist criterion? Construct Nyquist plot for the system whose open loop transfer function is $G(s)H(s) = \frac{K(1+S)^2}{S^3}$

Find the range of K for stability.

Q9) Design a suitable lead compensator for a system with unity feedback and having open loop transfer function

$G(s) = \frac{4}{S(S+1)(S+4)}$ to meet the specifications

(a) Damping ratio = 0.5.
(b) Undamped natural frequency = 2 rad/sec.

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