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B.Tech. (Sem. - 4th)

LINEAR CONTROL SYSTEM

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) Differentiate between linear and non linear systems.

b) Discuss the relative merits and demerits of closed loop systems with respect to open loop systems.

c) Define transfer function also discuss its importance in control system.

d) What is the significance of time constant in first order systems?

e) How Nyquist criterion is different from Routh-Hurwitz criterion?

f) Discuss the significance of gain and phase margin in control engineering.

g) How the difficulties faced in Routh-Hurwitz criterion are taken care? Explain.

h) Explain how servomotor is different from ordinary motor.

i) Write down (any four) the salient features of root locus plot.

j) Why compensation is required? Discuss.

Section - B

(4 × 5 = 20)

Q2) Determine the stability of the system whose characteristics equation is given by $s^5 + 11s^4 + 4s^3 + 2s^2 + 17s + 33 = 0$.

Q3) The closed loop transfer function of a unity feedback control system is given by

$$\frac{C(s)}{R(s)} = \frac{5s + 10}{s^2 + 6s + 10}$$

Determine the steady state error for unit ramp input.

Q4) Discuss the relation between time and frequency domain response for a second order systems.

Q5) Discuss the field control DC motor. Also find the transfer function relating angular velocity and the input voltage applied to the field winding.

Q6) Represent the following set of equations by a signal flow graph and determine the overall gain relating x_5 and x_1.

$$x_2 = ax_1 + fx_2$$
$$x_3 = bx_2 + ex_4$$
$$x_4 = cx_3 + hx_5$$
$$x_5 = dx_4 + gx_2$$

Section - C

(2 × 10 = 20)

Q7) A unity feedback control system has its open loop transfer function given by

$$G(s) = \frac{4s + 1}{4s^2}$$

Determine an expression for the time response when the system is subjected to

(a) Unit impulse input function.

(b) Unit step input function.

Q8) Sketch the root locus plot for the system when open loop transfer function is given by

$$G(s)\,H(s) = \frac{K}{s(s+6)\,(s^2+4s+13)}$$

Q9) Design a lead compensator such that the system having following open-loop transfer function will have a phase margin of about 40°.

$$G(s)\,H(s) = \frac{5}{(1+s)\,(1+0.5s)^2}$$

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