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Total No. of Questions : 09] [Total No. of Pages : 03

J-328[6037 A]

[2126]

B.Tech (Semester - 4th)

LINEAR CONTROL SYSTEM (IC - 204)

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 open loop control system with suitable example.

b) Differentiate between time variant and time invariant systems.

c) Explain the continuous and sampled data control systems.

d) Define node, branch, path and loop in a signal flow graph.

e) Define the damping ratio and explain how it affects the response of a system.

f) Define Rise time and steady state error in relation to step response of a second order system.

g) Give the time response of a control system if it has:- Single root in negative half of s plane, Double pair of roots on jω axis.

h) Give the centroid and directions of asymptotes for root locus of a system whose open loop transfer function is K/s(s+1)(s+5).

i) Define phase margin and gain margin in a bode plot.

j) Define lead compensator with the help of its transfer function.

Section - B

(4 × 5 = 20)

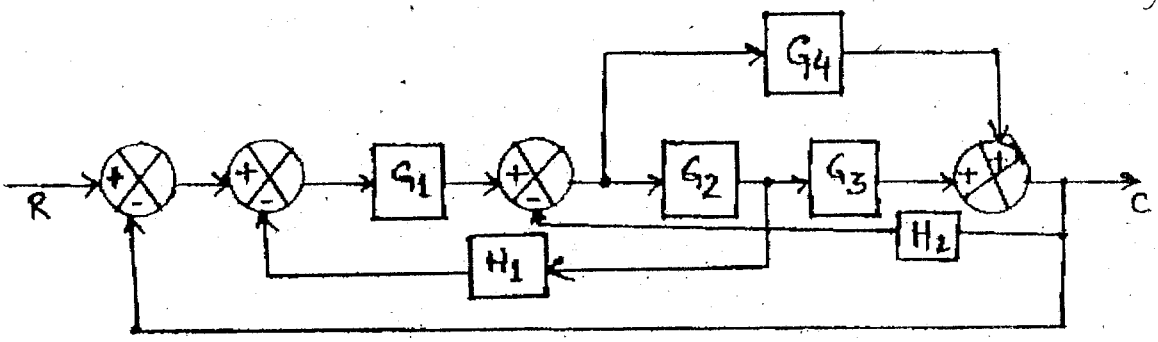
Q2) Explain the use of servomotor in control system with the help of neat diagram.

P.T.O.

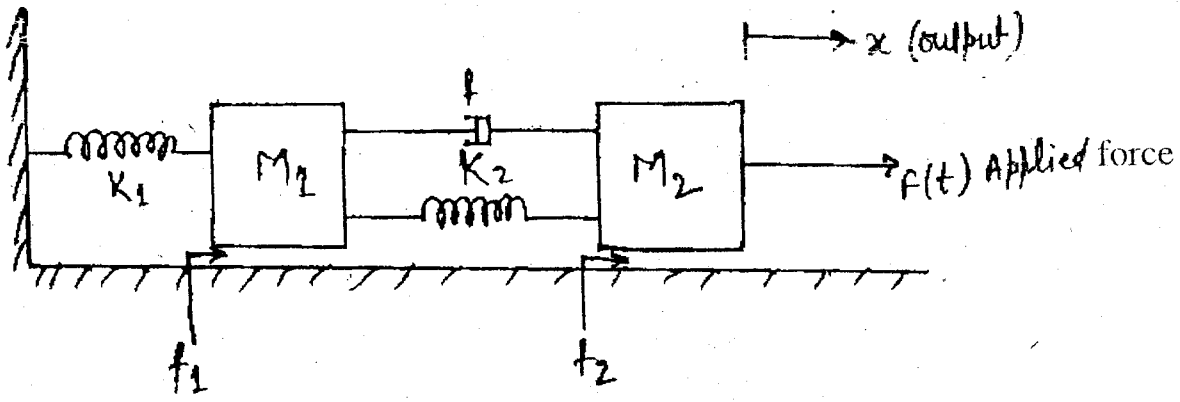
Q3) Explain the Nyquist criteria for determining the stability of a system.

Q4) Discuss the Routh - Hurwitz criteria for determining the stability of a control system and calculate the range of K for stable operation of following characteristic equation. $S^3 + 3KS^2 + (K + 2)S + 4 = 0$

Q5) Draw the signal flow graph for the following system and calculate the transfer function using Mason's gain formula.



Q6) Draw the mathematical model of the following system and obtain the transfer function.



Section - C

(2 × 10 = 20)

Q7) Draw a complete root locus plot for a system having open loop transfer function G(s) = K/S (S + 2) (S + 4) and calculate the values of following:

- Location of poles and zeroes;
- Centroid and angle of asymptotes;
- Angle of departures from poles;
- Angle of arrivals at zeroes;
- Break away points.
- Values of K and the frequency at which root locus crosses the jω axis.

28) A unit feedback system has an open loop transfer function $G(s) = K/S\,(S + 1)\,(0.2S - 1)$. It is desired to obtain a phase margin of 40° and $K_v = 8$ of the system. Select a suitable compensator and calculate its transfer function to meet the desired specifications. Sketch the asymptotic bode plot of compensated and un-compensated systems.

29) Sketch the Nyquist plot for the system with the open loop transfer function $G(s) = K/(S + 1)\,(S + 1.5)\,(S + 2)$ and determine the range of K for which the system is stable.