Reg. No : | | | | | | | | | |

Question Paper Code : 19EE5A

B.E / B.Tech DEGREE EXAMINATION, NOV / DEC 2021

Fifth Semester

EE19505 - CONTROL SYSTEMS

Electrical and Electronics Engineering

(Regulations 2019)

Time : Three Hours Maximum : 100 Marks

Answer ALL Questions

PART A (10 x 2 = 20 Marks)

1. What are the properties of signal flow graphs?
2. Define Transfer function.
3. Distinguish between Type and Order of the system.
4. List the advantages of generalized error constants over static error constants.
5. Name the parameters which constitute frequency domain specifications.
6. Define gain margin and phase margin.
7. State Nyquist stability criterion.
8. Write the Routh Hurwitz criterion.
9. What is the need of a compensator to be introduced in a system?
10. What is lead compensation?

PART B (5 x 13 = 65 Marks)

11. a. Write the differential equations governing mechanical system shown in figure. Draw the force voltage electrical analogous circuits and verify by writing mesh and node equations.

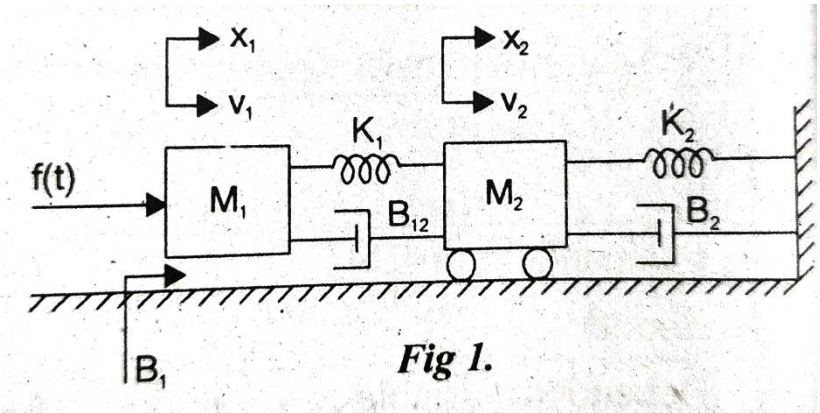
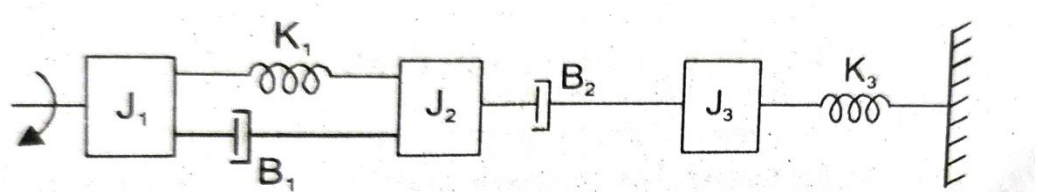


Fig 1.

(OR)

b. Write the differential equation governing the mechanical rotational system shown in fig. Draw the Torque Voltage & Torque Current analogous circuits and verify by writing Mesh and Node Equations.



12. a. The open loop transfer function of a unity feedback control system is given by G(s) = $\frac{K}{s(sT+1)}$. Where K and T are positive constant. By what factor should the amplifier gain K be reduced, so that the peak overshoot of unit step response of the system is reduced from 75% to 25 %.

(OR)

b. Discuss the following controllers a) PD controller b) PI controller.

13. a. Apply bode plot procedure for the transfer function given below to obtain the gain and phase crossover frequencies. G(s) = $\frac{10}{S\,(1+0.4S)\,(1+0.1S)}$.

(OR)

b. The open loop transfer function of a unity feedback system is given by G(S) = $\frac{1}{s\,(1+s)\,(1+2s)}$ Sketch the polar plot and find the gain margin and phase margin. (B)

14. a. A unity feedback control system has an open loop transfer function, G(s) = $\frac{K}{s(s^2+4s+13)}$ Sketch the root locus for the system.

(OR)

b. A unity feedback system is characterized by the open loop transfer function

G(s) = $\frac{K}{(s+2)(s+4)(s^2+6s+25)}$

. Using routh stability criterion, calculates the range of K for the system to be stable. Determine the value of K, which will cause sustained oscillation in the closed loop system. Also determine the frequency of sustained oscillation.

15. a. Design a lag compensator unity feedback system has an open loop transfer function,

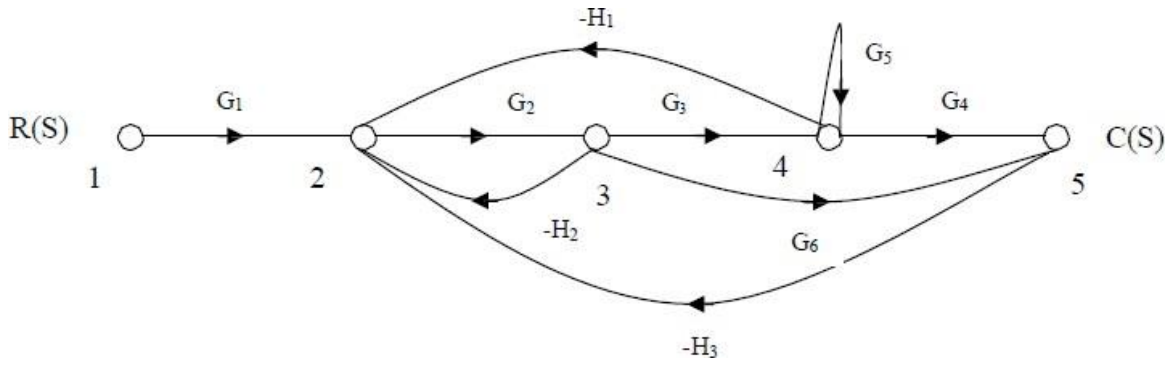
G(s) = $\frac{K}{s(s+4)(s+80)}$ to meet the following specification phase margin to be at least 33^0 and velocity error constant Kv = 30 sec^{-1}

(OR)

b. Derive the expression for M & N circle and draw the family of M & N Circles.

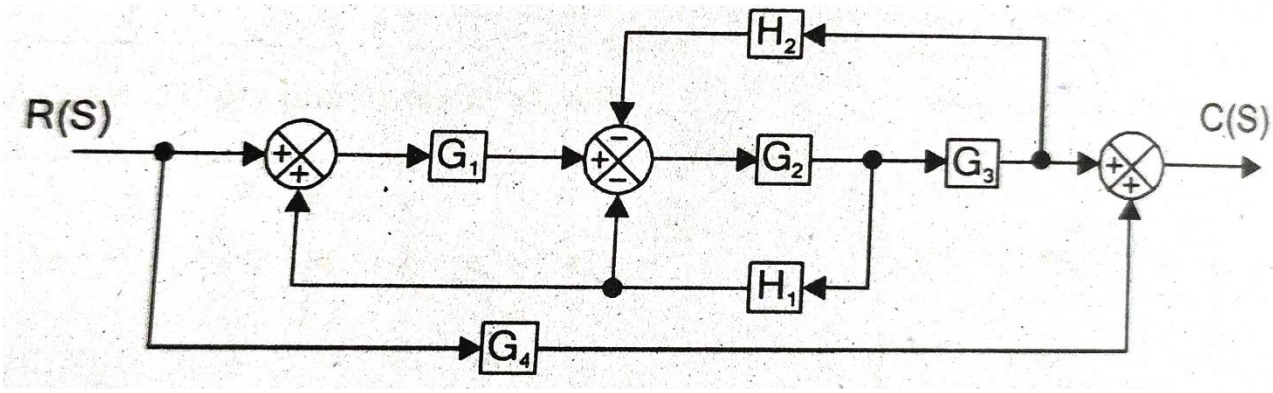
PART C (1x15=15 Marks)

16. a. Find the overall gain C(s) / R(s) for the signal flow graph shown below.



(OR)

b. Obtain the closed loop transfer function C(S)/R(S) of the system whose block diagram is shown in fig.



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