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**Question Paper Code : 50714**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fifth Semester

Electronics and Instrumentation Engineering

IC6501 – CONTROL SYSTEMS

(Common to Electrical and Electronics Engineering/Instrumentation and Control Engineering)

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Codes / Tables / Charts to be permitted, if any may be indicated

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Define open loop and closed loop control system.
2. What are the basic elements used for modeling mechanical translational system ?
3. Distinguish between type and order of a system.
4. What is the effect on system performance when a proportional controller is introduced in a system ?
5. List out the different frequency domain specifications.
6. Give the need for lag/lag-lead compensation.
7. What are the necessary conditions for stability ?
8. What are the effects adding open loop poles and zero on the nature of the root locus and on system ?
9. Write the homogeneous and nonhomogeneous state equation.
10. Define state trajectory.

50714

-2-



PART - B

(5×13=65 Marks)

11. a) Find the transfer function  $\frac{y_2(s)}{f(s)}$ .

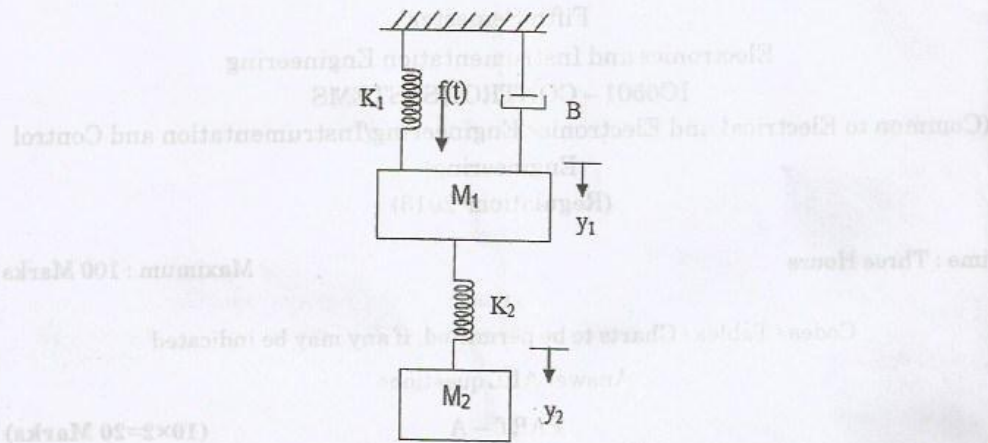


Fig. 11 a

(OR)

b) Find the overall gain  $C(S) / R(S)$  for the signal flow graph shown in Fig. 11 b.

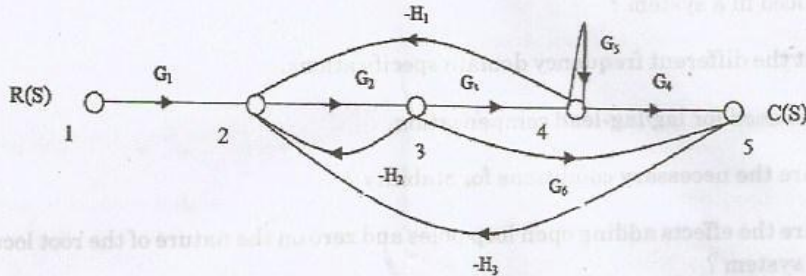


Fig. 11 b



12. a) Derive the expressions for second order system for under damped case and when the input is unit step.

(OR)

- b) Find the static error coefficients for a system whose transfer function is,  $G(s) = \frac{10}{s(1+s)(1+2s)}$ . And also find the steady state error for  $r(t) = 1 + t + t^2/2$ .

13. a) Sketch the Bode plot and hence find Gain cross over frequency, Phase cross over Frequency, Gain margin and Phase margin for the function

$$G(s) = \frac{10(s+3)}{s(s+2)(s^2+4s+100)}$$

(OR)

- b) Sketch the polar plot for the following transfer function and find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin for  $G(s) = \frac{400}{s(s+2)(s+10)}$ .

14. a) A unity feedback control system has an open loop transfer function  $G(s) = \frac{K(s+9)}{s(s^2+4s+11)}$ . Sketch the root locus.

(OR)

- b) Determine the stability of closed loop system by Nyquist stability criterion, whose open loop transfer function is given by,  $G(s) = \frac{(s+2)}{(s+1)(s-1)}$ .

15. a) Explain the concepts of controllability and observability.

(OR)

- b) Obtain the complete solution of nonhomogeneous state equation using time domain method.

PART - C

(1×15=15 Marks)

16. a) For the given system,  $G(s) = \frac{K}{s(s+1)(s+2)}$ , design a suitable lag-lead compensator to give, velocity error constant = 10 sec<sup>-1</sup>, phase margin = 50°, gain margin ≥ 10 dB.

(OR)

- b) Realize the basic compensators using electrical network and obtain the transfer function.