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

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.

PART – B (5×13=65 Marks)

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

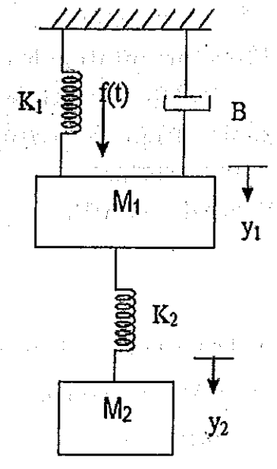

Fig. 11 a

(OR)

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

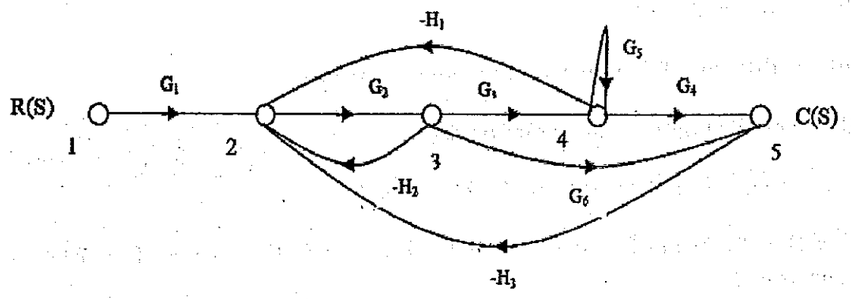

Fig. 11 b

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). H (s) = 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) = 400/s (s+ 2) (s + 10).

14. a) A unity feedback control system has an open loop transfer function G (s) = 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). H (s) = (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) = K / s (s + 1) (s + 2), design a suitable lag-lead compensator to give, velocity error constant = 10 sec-1, phase margin = 50°, gain margin ≥ 10 dB.

(OR)

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