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

Question Paper Code: 41062

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2015.

Fourth Semester

Instrumentation and Control Engineering

01UIC403 - LINEAR CONTROL SYSTEMS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. What are the basic elements of control system?
2. State Mason's Gain Formula.
3. Give the expression for peak time and rise time of a second order system for under damped case with unit step response.
4. Define peak overshoot
5. Mention the advantages of Bode Plot.
6. The damping ratio and natural frequency of oscillation of a second order system is 0.5 and 8 *rad/sec* respectively. Calculate the resonant peak and resonant frequency
7. What is centroid and how it is being calculated?
8. State Nyquist stability criterion.
9. When Lag compensation is employed?
10. What are the merits of Lag-Lead network?

PART - B (5 x 16 = 80 Marks)

11. (a) Find C(S) / R(S) for the system shown in Fig. 1. using Mason’s Gain formula.

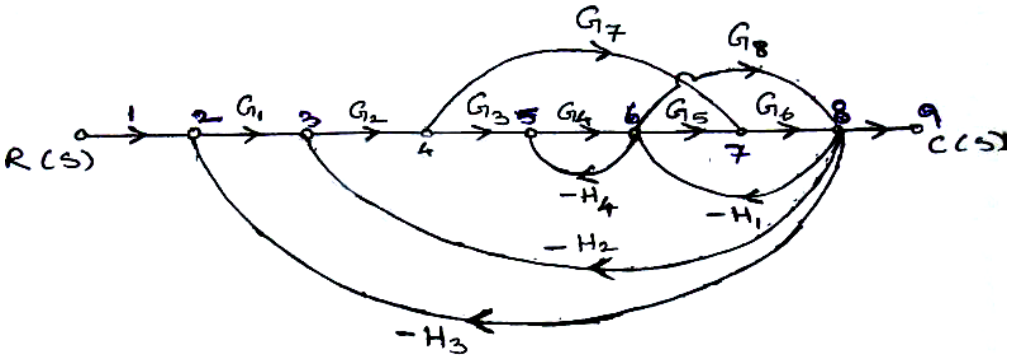

Fig. 1

Or

(b) Using Block diagram reduction technique evaluate the transfer function of the system whose block diagram is shown in Fig. 2. (16)

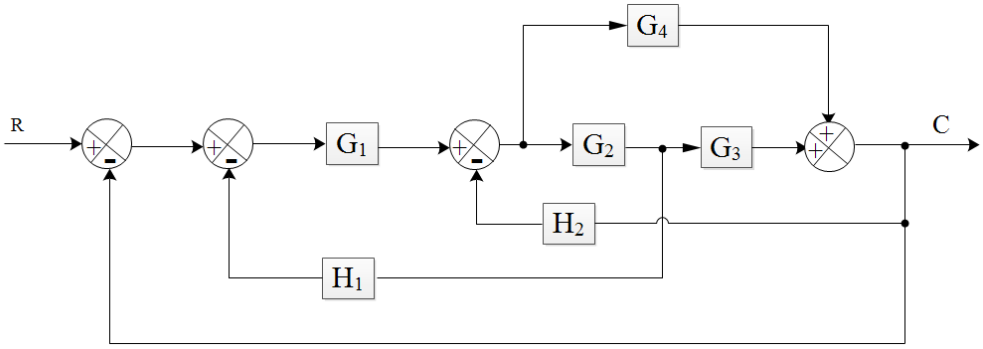

Fig. 2

12. (a) (i) Obtain the unit step response of unity feedback system whose open loop transfer function is G(S)= 4/ [s (5+s)]. (6)

(ii) A unity feedback control system has an open loop transfer function $G(S) = \frac{10}{s(s+2)}$

Find the rise time, percentage overshoot, peak time and settling time for a step input of 12 units. (10)

Or

(b) (i) Closed loop transfer function of a system with unity feedback is given by C(s)/ R(s) = (Ks + b) / (s^2+as+b). Find the open loop transfer function G(s) and also show that the Steady state error with unit ramp input is given by (a-k) / b. (8)

(ii) Derive the expression for peak time for a second order system which is in under damped condition. (8)

13. (a) Draw the bode plot for the system given as $G(S) = \frac{Ke^{-2s}}{[s(1+0.2s)(1+0.125s)]}$

Find its gain margin and phase margin. Also find *K* so that the system is stable with phase margin equal to -20°. (16)

Or

(b) The open loop transfer function of a system with unity feedback is given by $G(s) = \frac{1}{s(1+s)^2}$. Find the gain margin and phase margin of the system using polar plot. (16)

14. (a) Sketch the complete root locus for the system having $G(S)H(S) = \frac{K(s+7)}{(s+2)(s+6)}$ (16)

Or

(b) A unity feedback system with open loop transfer function is given by

$$G(S) = \frac{Ke^{-2s}}{s(s+1)(s+2)}$$

(i) If the system is operated at lower frequencies determine the K values for stability.

(ii) Also determine the frequency at which sustained oscillations are produced. (16)

15. (a) Write down the steps to design a lag compensator using Root Locus and also draw pole zero plot of Lag compensator in s - Plane. (16)

Or

(b) Realize a lead compensator using electrical network and also explain its frequency response. (16)