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

Question Paper Code: 31541

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fourth Semester

Electronics and Instrumentation Engineering

01UEI401 – CONTROL ENGINEERING

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

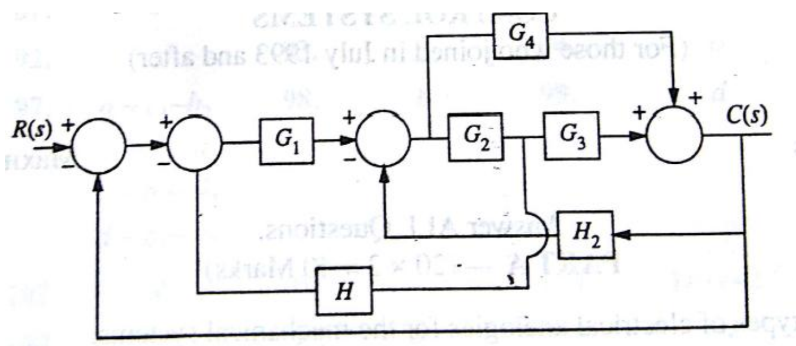
Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Name two types electrical analogies for the mechanical systems.
2. State the rule for shifting the summing point ahead of a block.
3. Compare step response of first order and second order systems.
4. What is positional error coefficient? Explain.
5. What are the frequency domain specifications.
6. Draw the circuit of lead compensator and draw its pole-zero diagram.
7. How are locations of roots of the characteristics equation related to stability.
8. Define centroid.
9. Define sampling theorem.
10. Write the properties of state transition marix.

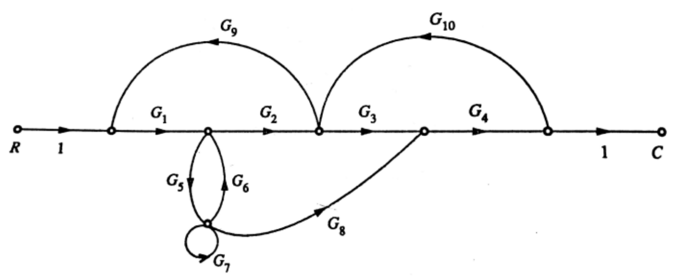
PART - B (5 x 16 = 80 Marks)

11. (a) Obtain the closed loop transfer function C(s)/R(s) for the system shown in figure. (16)



Or

(b) Using Mason's gain formula, find C/R of the signal flow graph shown in figure. (16)



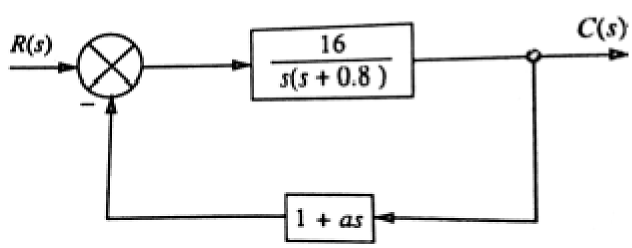
12. (a) The open loop transfer of a feedback control system with unity feedback given by

$$G(s) = \frac{40}{s(1 + 0.5s)}$$

Find the error constants for the system. Also obtain the steady state error when the input is $r(t) = 1 + 5t + 10t^2$. (16)

Or

(b) For the system shown in figure, find the value of "a" such that the damping ratio is 0.5. Determine the rise time, peak time, maximum overshoot and settling time in the unit step response. (16)



13. (a) The open loop transfer function of unity feedback system is given by $G(s) = \frac{10(s+2)}{s(s+1)(s+3)}$. Sketch the polar plot and determine the gain margin and phase margin. (16)

Or

(b) The open loop transfer function of certain unity feedback control system is given by $G(s) = \frac{12}{s(s+2)}$. Design a lead compensation such that the closed loop system satisfies the following specifications. (a) Static Velocity error constant = 24 sec^{-1}, Phase margin = 55 deg and Gain margin ≥ 13 db. (16)

14. (a) Sketch the root locus for the unity feedback system whose open loop transfer function is given by $G(s) = \frac{K}{s(s^2+6s+10)}$. Determine the range of 'K' for which the system to be stable. (16)

Or

(b) A certain unity negative feedback control system has the following open loop transfer function, $G(s)H(s) = \frac{K}{s(s+2)(s^2+2s+5)}$. Find the break-away points and draw the root locus for $0 \le \omega \le \infty$. (16)

15. (a) A LTI system is characterized by the state equation

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Where 'u' is a unit step function. Compute the solution of these equation assuming initial condition $x_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ (16)

Or

(b) (i) Obtain the state transition matrix for the state model whose system matrix A is given by A= $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ (8)

(ii) Compute the transfer function of a linear time-invariant system is represented by the state equation $\dot{X} = \begin{bmatrix} 0 & 3 \\ 0 & -2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 1 \end{bmatrix} U$ and $Y = \begin{bmatrix} 2 & 1 \end{bmatrix} X$. (8)
