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

Question Paper Code: 31541

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fourth Semester

Electronics and Instrumentation Engineering

01UEI401 – CONTROL ENGINEERING

(Regulation 2013)

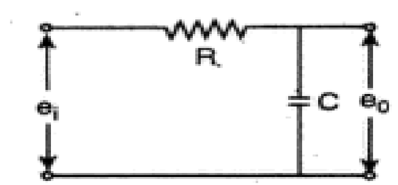
Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Compare open loop and closed loop control system.

2. Find the transfer function of the given electric network.



3. Define Type and order of a system.

4. Distinguish between static and dynamic error coefficients.

5. List out the frequency domain specifications.

6. Draw the circuit of lead compensator and draw its pole-zero diagram.

7. State Nyquist stability criterion.

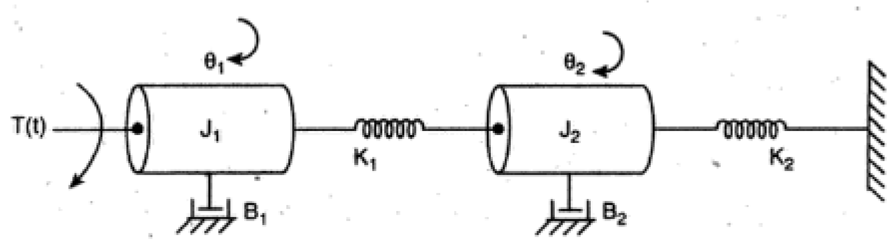
8. Give the expression for finding the ‘centroid’ in the construction of root locus.

9. Define sampling theorem.

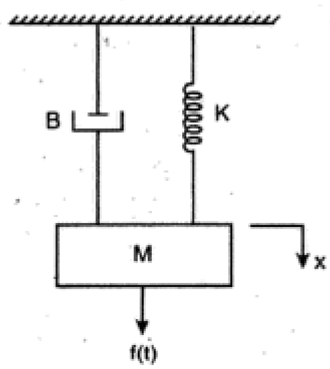
10. Mention the need of state variables.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) For the mechanical system shown in figure write the differential equations and hence find $\frac{\theta_2(s)}{T(s)}$. (8)

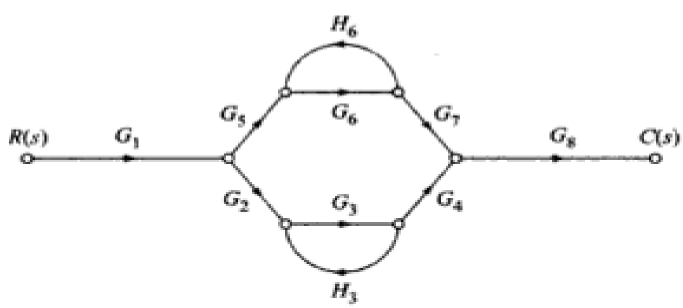


(ii) Draw the force-voltage and force-current analogous circuits for the given mechanical system. (8)



Or

(b) Find the transfer function C(s)/R(s) using SFG Mason's gain formula. (16)



12. (a) (i) Derive an expression for time response of a second order under damped unity feedback system when excited with an unit step input. (10)

(ii) Derive an expression of peak time and rise time for time response of a second order under damped unity feedback system. (6)

Or

(b) (i) A unity feedback system has $G(s) = \frac{1}{s(1+s)}$. The input to the system is described by $r(t) = 1 + 2t + 1.5t^2$. (10)

(ii) Determine the position, velocity and acceleration coefficients for the unity feedback systems having forward loop transfer function $G(s) = \frac{K(1+s)(1+2s)}{s^2(s^2+4s+20)}$. (6)

13. (a) The open loop transfer function of unity feedback system is given by $G(s) = \frac{1}{s^2(1+s)(1+2s)}$. 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) (i) For the characteristic equation F(s)=$s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4$. Find the number of roots falling in the right half and left half of the s-plane. (10)

(ii) The open loop transfer function of an unity feedback system is given by $G(s) = \frac{K(s+2)}{s(s+1)(s+3)(s+5)}$. Determine the range of K for which the system is just stable. (6)

15. (a) (i) Obtain the state model of the system described by the following transfer function $\frac{y(S)}{u(s)} = \frac{5}{s^2+6s+7}$. (8)

(ii) 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)

Or

(b) (i) Compute $x_1(t)$ and $x_2(t)$ of the system described by $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -3 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$, where the initial conditions are $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$. (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 $Y = [2 \quad 1] X$. (8)
