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

# Question Paper Code: 34501

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Fourth Semester

Electronics and Instrumentation Engineering

01UEI401 – CONTROL ENGINEERING

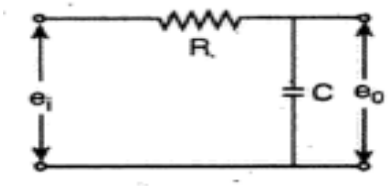
(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

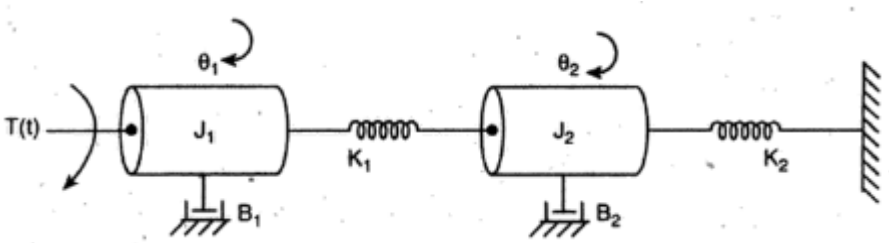
1. Compare open loop and closed loop control system.
2. Find the transfer function of the given electric network.



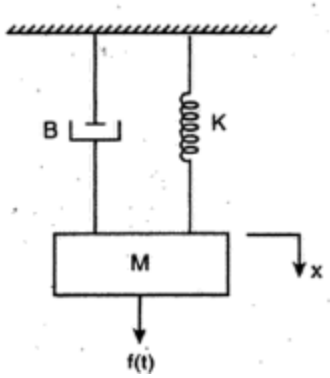

3. Define Type and order of a system.
4. Distinguish between static and dynamic error coefficients.
5. List out the frequency domain specifications.
6. What is compensator?
7. Relate the roots of the characteristic equation with stability.
8. Define centroid.
9. Define sampling theorem.
10. Write the solution of homogeneous state equations.

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)

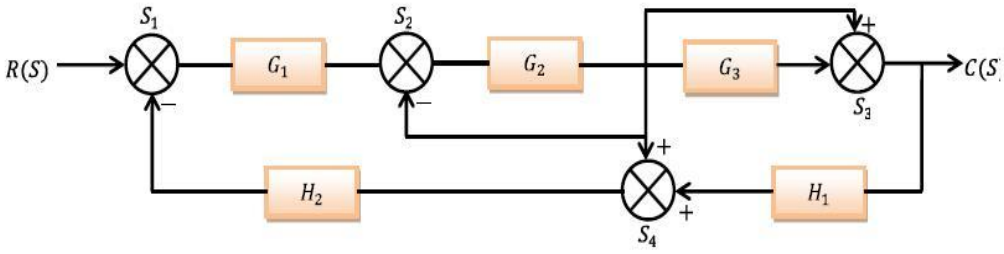



(ii) Draw the force-voltage and force-current analogous circuits for the given mechanical system. (8)




Or

(b) Draw the signal flow graph and find *C(S) / R(S)* using Mason's gain formula for the system 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) 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 Steady state error with unit ramp input is given by $(a-k) / b$. (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) Design a suitable compensator for a system with open-loop transfer function is $G(S) = \frac{1}{S(S+1)(0.5S+1)}$, so that the static velocity error constant $K_v$ is 5 $sec^{-1}$, the phase margin is at least 40°, and the gain margin is at least 10 *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) Sketch the root locus of the system whose open loop transfer function is $G(s) = \frac{K}{s(s+4)(s+2)}$ Identify the value of '$K$' so that the damping ratio of the closed loop system is 0.5. (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 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)