Total No. of Questions : 6]

SEAT No. :

P73

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OCT. -16/BE/Insem. - 127

B.E. (Electrical)

CONTROL SYSTEM - II

(2012 Course) (403145) (SEMESTER - I)

Time : 1Hour] *[Max. Marks :30*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume Suitable data if necessary.*

Q1) The Open loop transfer function of the system is given as: **[10]**

$$G(s)=\frac{1}{s(s+1)};H(s)=1$$

Design a Cascade Lead Compensator so that the Phase Margin (PM) is at least 45° & steady state error for a unit ramp input is ≤ 0.1

OR

Q2) The Open loop transfer function of the system is given as: **[10]**

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

Design a Cascade Lag Compensator so that the Phase Margin (PM) is at least 50° & steady state error for a unit step input is ≤ 0.1

Q3) a) Define: **[5]**

i) state,

ii) state variable

iii) state vector

iv) state space

v) state model

P.T.O.

b) Obtain the state model of the electric network shown in Figure 1, selecting Vc and i_2 as state variables and current through inductor as the output. **[5]**

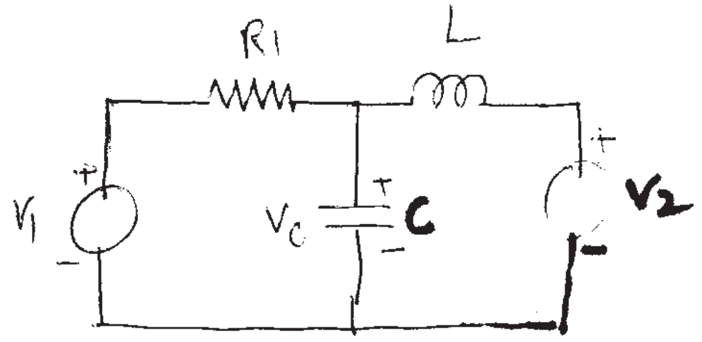

Figure 1

OR

Q4) a) Derive for the solution of homogeneous state equation $\dot{x} = Ax$. **[5]**

b) Compute: **[5]**

i) Resolvent matrix Φ (s)

ii) state transition matrix Φ (t) using LT method for the system matrix.

$$A=\begin{bmatrix} 0 & -1 \\ -2 & -3 \end{bmatrix}$$

Q5) Consider the system $\dot{x} = Ax + Bu; y = Cx$ where

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -5 & -6 \end{bmatrix}; B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}; C = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$$

Determine the state feedback gain matrix K such that the desired closed loop poles are located at $s = -2 \pm j4$ & $s = -10$. Use state feedback $u = -Kx$. **[10]**

OR

Q6) Discuss the conditions for complete state controllability & observability as per Kalman & Gilbert. **[10]**

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