Code No: 155AR

R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, March - 2021

CONTROL SYSTEMS

(Common to ECE, EIE)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

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1.a) List the differences between open loop and closed loop systems with suitable examples.

b) Obtain the transfer function $\frac{\theta(s)}{V_a(s)}$ for armature controlled dc servomotor. [8+7]

2.a) What is meant by time response? Explain about (i) Steady- state response (ii) Transient response.

b) Find the steady-state error for unit step, unit ramp and unit acceleration inputs for the following systems.

i) $10/s(0.1s+1)(0.5s+1)$

ii) $1000/s^2(s+1)(s+20)$ [8+7]

3.a) List the properties of root locus and sketch the root locus of the unity feedback system with

$$G(s)=\frac{K}{s(s+2)(s^2+2s+4)}$$

b) A unity feed-back system is characterized by an open loop T.F $G(s) = K/s(s+10)$ Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K, determine Ts, Tp and Mp for a unit step input. [8+7]

4.a) Explain clearly the steps involved in the construction of Bode plots of a system with loop transfer function consisting of

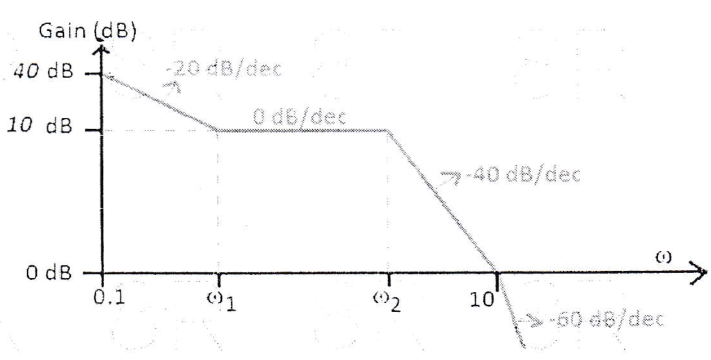
i) An open loop gain K

ii) One pole at origin

iii) One quadratic factor.

b) State and explain Nyquist Stability Criterion. [8+7]

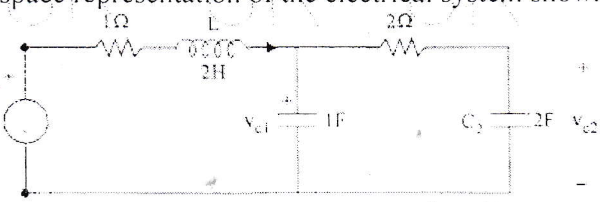
5. What is Phase Margin and gain margin? Determine the transfer function whose Bode diagram is given by [15]



6. Discuss the procedural steps of lag compensation design in frequency domain. [15]

7.a) Define the terms: i) State variable ii) State transition matrix.

b) Obtain the state space representation of the electrical system shown below.



Take $x_1 = i_L$, $x_2 = v_{C1}$, $x_3 = v_{C2}$ $v = u$ and $y = v_{C2}$ [6+9]

8.a) An LTI system is characterized by the homogeneous state equation:

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

Compute the solution of the homogeneous equation assuming the initial state vector $X_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$

b) The system is represented by the differential equation $\ddot{y} + 5\dot{y} + 6y = u$. Find the transfer from state variable representation. [8+7]

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