Exam.Code:0930
Sub. Code: 6607

2023

B.E. (Electronics and Communication Engineering)

Sixth Semester

EC-624: Control System

Time allowed: 3 Hours Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part. Use of scientific calculator is allowed.

x-x-x

I. **(a)** What is the electrical analogue of force and rotational damping in torque-voltage analogy? **(2)**

(b) What may be the damping ratio when the percentage of overshoot of the system is 100%. **(2)**

(c) What is polar plot. **(2)**

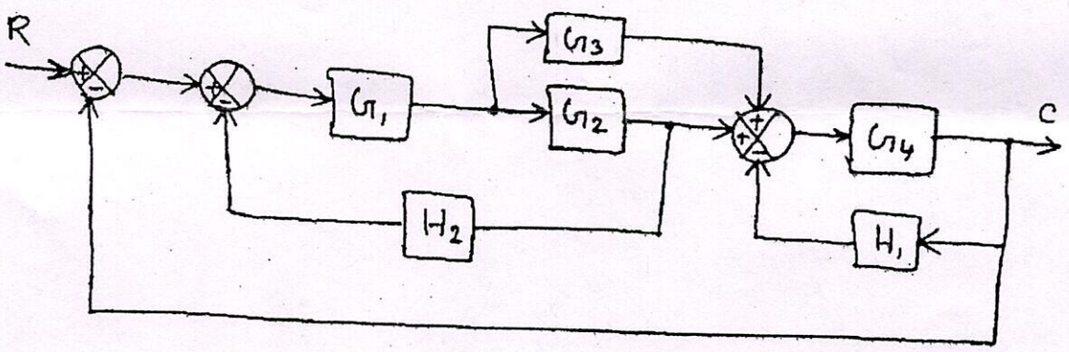
(d) Write any two advantages of stepper motor. **(2)**

(e) Draw the bode plot of a typical lead compensator. **(2)**

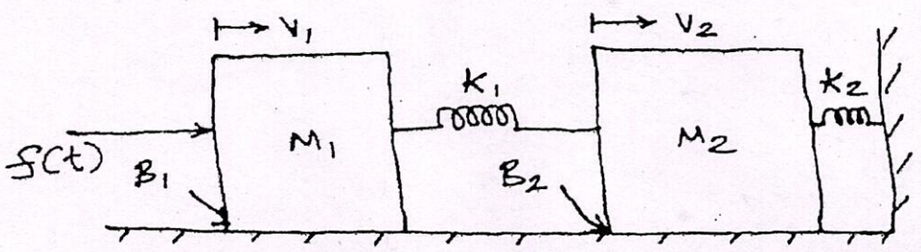
Part- A

II. **(a)** What are the characteristics of servomotors. **(5)**

(b) Using block diagram reduction rules, find transfer function of following block diagram. **(5)**



III. **(a)** Draw voltage and current analogs for the following mechanical system. **(5)**



(b) For unity feedback control system the open loop transfer function, $G(s) = \frac{10(s+2)}{s^2(s+4)}$. Find the e_{ss} when the input is $r(t) = 3 - 2t + 3t^2$ find Kp, Kv and Ka. **(5)**

IV **(a)** Sketch the root locus of the system having **(5)**

$$G(s)H(s) = \frac{K(S+15)}{(S)(S+1)(S+5)}$$

For positive values of K.

(b) Derive the expression for a) rise time b) Peak overshoot for the underdamped response of a second order system for unit step input. **(5)**

P.T.O.

Part-B

V. Draw the bode plot of the system $G(s)H(s) = \frac{K}{(S)(1+S)(1+0.1S)(0.02S+1)}$.

Find the value of K for gain margin = 10dB. **(10)**

VI. Consider the system whose open loop transfer is $G(s) = \frac{K}{(S)(S+1)(S+4)}$ The system is to be compensated to meet the following specifications. Damping ratio = 0.4, settling time = 10 sec. Velocity error constant $K_v = 5\ sec^{-1}$. Convert the given specifications to suitable frequency domain and then use bode plot to design the compensator/ **(10)**

VII. (a) Define: i) State ii) State variables iii) State space representation. **(3)**

(b) Find the state transition matrix for the following matrix, $A = \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$. **(3)**

(c) Obtain the state space representation for the following differential equation

$\ddot{y} + 5\dot{y} + 7y = 114u$

Where 'y' is the output and 'u' is the input. **(4)**

x-x-x