6TH SEM./ ELECTRICAL(INST. & CTRL)/ 2022(S)

EET-604 Control System Engineering

Full Marks: 80 Time- 3 Hrs

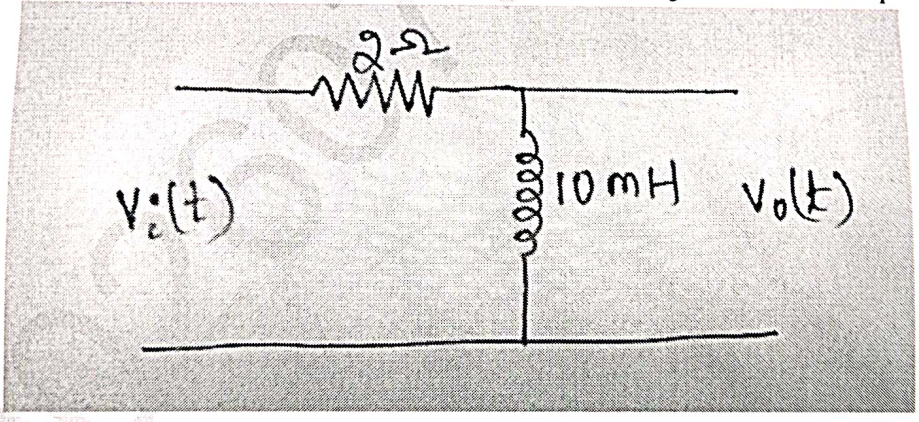
Answer any **Five** Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. Write Mason's gain formula.
b. Define order and type of control system.
c. What do you mean by steady state error?
d. What is the effect of adding poles and zeros on the root locus?
e. What is Bode plot?
f. State the correlation between time response and frequency response.
g. What is phase and gain cross-over frequency?
h. Define all pass and minimum phase system.
i. What do you mean by principle of argument?
j. What is Nicholas chart?

2. Answer **Any Six** Questions 6 x 5

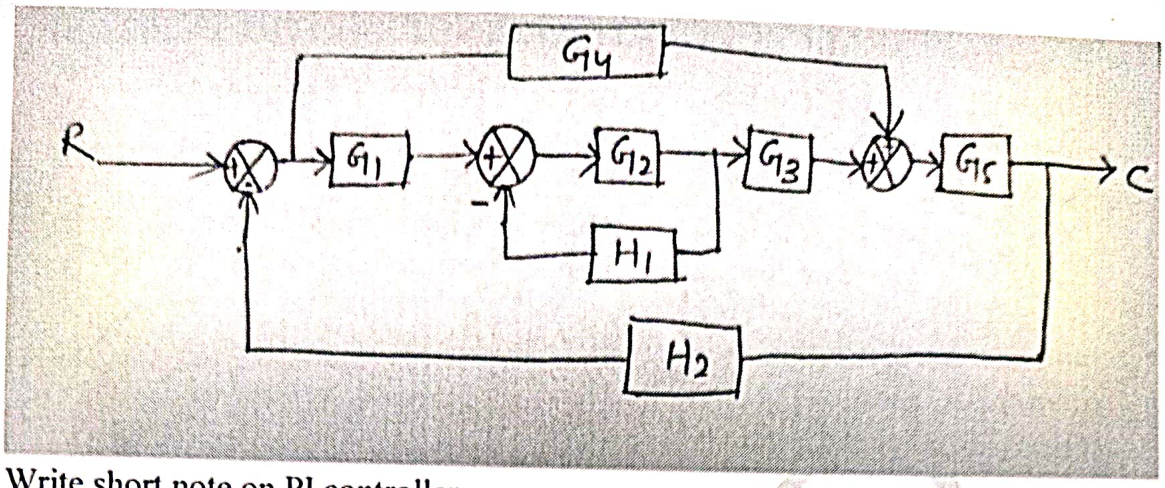
a. Find the time response of system shown below subjected to unit step signal.



b. The forward path transfer function of a unity feedback control system is $\frac{5(s^2+2s+100)}{s^2(s+5)(s^2+3s+10)}$. Find the type of the system and static error co-efficients.

c. The forward path transfer function of a unity feedback control system is $G(s)=\frac{100}{s(s+6.54)}$. Determine the response peak, resonant frequency and bandwidth of the system.

d. Determine transfer function of the system having below block diagram



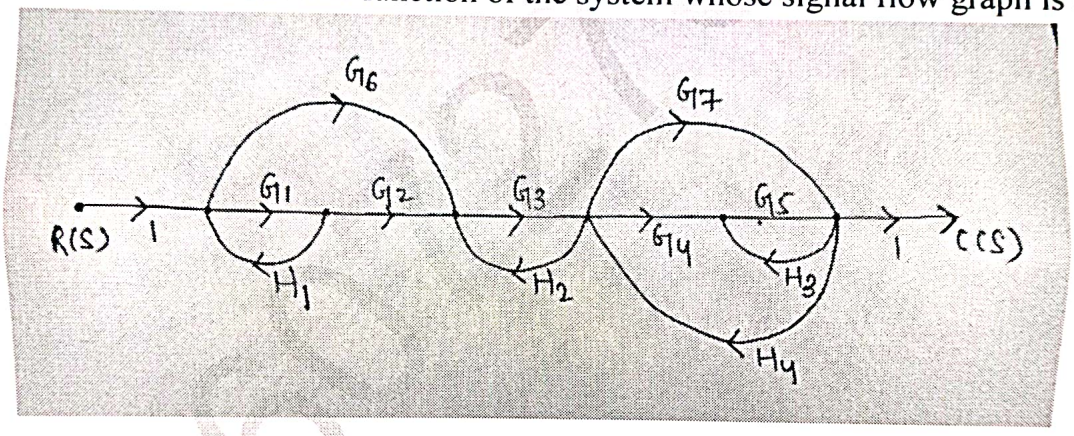
e. Write short note on PI controller.

f. State and explain Nyquist stability criteria.

g Derive time response of a first order system with unit step input. Also find the steady state error.

3 a. Differentiate between block diagram and signal flow graph. 04

b. Find the transfer function of the system whose signal flow graph is given below 06



4 The forward path transfer function of a unity feedback control system is $\frac{25}{s(s+25)}$. *10*

Determine Natural frequency, damping ratio, damped frequency, rise time, percentage overshoot, 4% settling time.

5 Sketch the root locus for the system having transfer function *10*

$G(s)H(s)=\frac{k(s+4)}{s(s^2+4s+20)}$ and state condition for system stability.

6 a. Define polar plot. State the procedure to draw the polar plot. 05

b. Sketch the polar plot of a system with 05

$$G(s)H(s)=\frac{10}{s(s+1)(s+2)}$$

7 Write short notes on the followings. 5×2

a. Constant M and N circle

b. Nicholas chart

6TH SEM./ELECTRICAL / 2024(S)

Th-3 Control System Engineering

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2

Figures in the right hand margin indicates marks & Use Calculator

1. Answer **All** questions 2 x 10

   a. How do you define Transfer Function?

   b. Define Signal Flow Graph (SFG) & write two properties of SFG.

   c. Write the effect of Negative feedback in control system.

   d. How do you mean by **Order** and **Type** of a system?

   e. State the Mason's gain formula.

   f. What is the main objective of Root-Locus analysis Technique?

   g. How do you define relative stability?

   h. Write the effect of adding poles to closed loop control system.

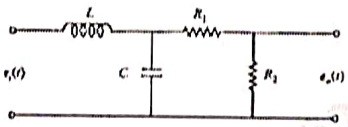
   i. Give two disadvantages of closed loop control over open loop control system.

   j. Define Peak Time and settling time.

2. Answer **Any Six** Questions 6 x 5

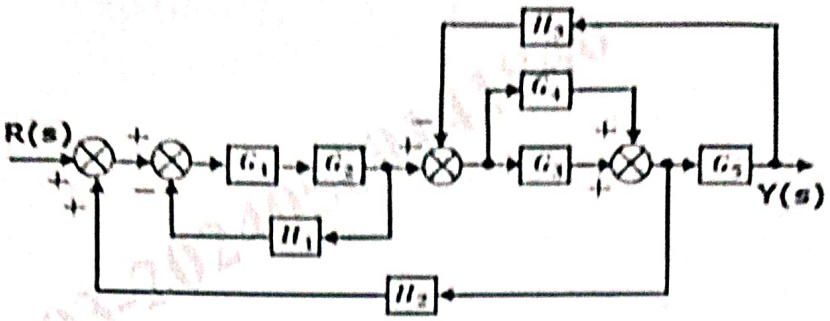
   a. Derive the expression for peak time and setting time for the under damped second order system with unit step input.

   b. Obtain the Transfer Function for the given electrical system



   c. Explain details of PD controller used in control system.

   d. Obtain the Transfer Function of a given system using Block Diagram Reduction Technique.



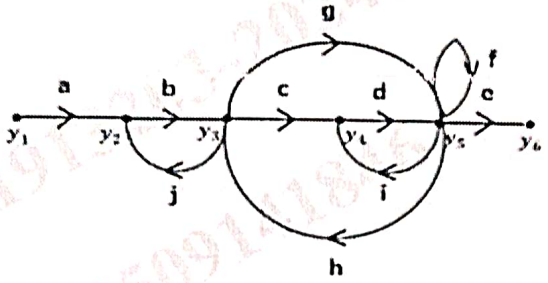
e. Explain details of Nicholas Chart used in control system.

f. State difference between open loop and closed loop control system.

g Write short note on Constant M and N circle in brief.

3 Describe construction and working principle of Synchros. Also explain how it is used in servo application. 10

4 Obtain the closed loop transfer function of the system C(S)/R(S) using Masson's gain formula 10



5 Sketch the Root-Locus of the system whose transfer function is given by 10

$$G(s)H(s) = \frac{K}{s(s+3)(s+5)}$$

6 Describe with neat block diagram the working of armature controlled DC motor as a control system. 10

7 The open loop transfer function of the plant is 10

$$G(s)H(s) = \frac{10(s+2)}{s^2(s+10)}$$

Use Bode Plot, Find the Gain Margin and Phase Margin.

6TH SEM./ ELECTRICAL/2022(S)

TH-3 Control System Engineering

Full Marks: 80 Time- 3 Hrs

Answer any FIVEQuestions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. What is signal flow graph?
b. Define phase margin. Is it positive or negative for stable feedback systems?
c. What do you mean by velocity error constant?
d. Define(i)Gain cross over frequency (ii) Resonant frequency, in frequency domain analysis.
e. What is the time response to unit ramp input in first order system?
f. What is corner frequency in Bode plot?
g. Define (i) Impulsesignal (ii) Transfer function.
h. What are the open loop poles of G(s).H(s) = $\frac{12(s+1)}{s(s+4)(s+5)}$?
i. What do you mean by all pass system?
j. What are the advantages of polar plot?

2. Answer **Any Six** Questions 6 x 5

a. Explain the effects of feedback in a closed loop control system.
b. What are the basic properties of signal flow graph?
c. Derive the damped natural frequency from the time responseof second-order system to the unit step signal.
d. Describe about the PI controller using Block Diagram briefly.
e. Write a brief note on Constant-M circles with the help of polar plot.
f. An unity feedback control system has an open loop transfer function: G(s)= $\frac{K}{s(s^2+4s+13)}$.Find the (i) Centroid of asymptotes(ii) Breakaway point.
g Explain the effect of addition of poles and zeros to G(S).H(S) on the shape of Nyquist plot.

3 Explain all the rules for reduction of Block diagram, used in control systems in details. 10

4 Explain about the Nicholas Chart used in frequency response analysis briefly. 10

5 Describe about the construction and working ofAC servomotors in details with the help of a neat diagram. 10

6 Describe the properties, advantages, disadvantages of transfer function in details. 10

7 Derive the expression for rise time, peak time, peak overshoot for second order systems 10