

Printed Pages : 4

EEE502

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 2112**

Roll No.

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**B. Tech****(SEMESTER-V) THEORY EXAMINATION, 2012-13****CONTROL SYSTEM****Time : 3 Hours ]****[ Total Marks : 100****Note :** Attempt **all** sections.**Section – A**1. Answer **all** parts :**2 × 10 = 20**

- (a) Define "CONTROL SYSTEM" & Classify.
- (b) What are the advantages and disadvantages of "OPEN LOOP CONTROL SYSTEM" ?
- (c) Enlist standard test signals used in time-response analysis.
- (d) What do you understand by "GAIN" and "PHASE" margin in polar plots ?
- (e) Explain the significances of M & N constant circles.
- (f) What are the merits and demerits of frequency domain analysis ?
- (g) Define the term "STATE" and "STATE VARIABLES" in state space representation.
- (h) What do you mean by "RELATIVE STABILITY" in control systems ? Also mention its significances.
- (i) What do you understand by "ABSOLUTE STABILITY" in control system ?
- (j) Enlist the performance indices used in time response analysis.

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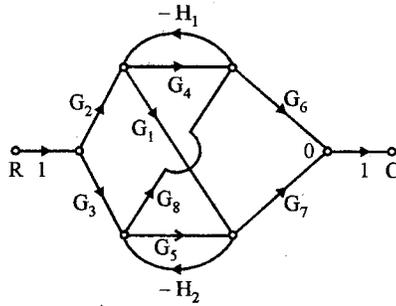
**P.T.O.**

**Section – B**

2. Answer any **three** parts or questions of the following :

**3 × 10 = 30**

(a) A control system represented by the following signal flow graph as shown in fig.1



**Fig. 1 signal flow graph of control system**

Find the transfer function  $\frac{C(s)}{R(s)}$  by Mason's Gain formula.

(b) What do you mean by "POSITIVE" and "NEGATIVE" feedback in control systems ? Discuss their advantages and disadvantages. Also mention their physical examples. Define Disturbance signal in a control systems.

(c) Explain the following :

- (i) RISE TIME ( $t_r$ )
- (ii) PEAK TIME ( $t_p$ )
- (iii) SETTLING TIME ( $t_s$ )
- (iv) DELAY TIME ( $t_d$ )
- (v) First Peak over shoot ( $m_p$ )
- (vi) Steady-state errors ( $e_{ss}$ )

Also mention their significances in second order control systems.

(d) Measurement conduct on servomechanism shows the system response to be

$$C(t) = 1 + 0.2 e^{-60t} - 1.2 e^{-10 t}$$

When it is subjected to unit step input, obtain the closed loop transfer function.

- (e) Draw the root locus for the system

$$G(s)H(s) = \frac{K}{s(s+3)(s+6)}$$

Obtain value of K when  $\zeta = 0.6$  from root locus.

**Section - C**

Answer **all** questions :

**5 × 10 = 50**

3. Sketch the Nyquist plot for a system with

$$G(s)H(s) = \frac{10(s+1)}{(1+2s)(1+0.1s)(1+0.02s)}$$

Also find stability (condition for stable)

**OR**

Given  $G(s) = \frac{40(s+5)}{s(s+10)(s+2)}$ . Draw the Bode Plot. Find gain and phase margin.

4. What do you mean by "LAG" and "LEAD" network in control systems? Also mention its significances limitations in control systems.

**OR**

What do you understand by "CONTROLLABILITY" and "OBSERVABILITY" of a given control systems? Also mention its importances and limitations.

5. What do you mean by "POLAR" and "INVERSE POLAR" plot in control systems? Also mention their significances and drawbacks. How to find relative stability from polar plots.

**OR**

Determine if the largest time constant is less than 1 sec.

$$s^3 + 4s^2 + 6s + 4 = 0$$

consider the block diagram as shown in fig. 2.

6.

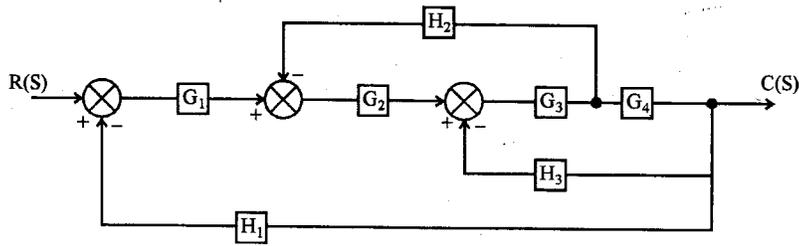


Fig. 2 Block Diagram

Find  $\frac{C(s)}{R(s)}$  by block diagram reduction techniques.

OR

What are the block diagram reduction technique rules in control systems ? Also mention its advantages and disadvantages.

7. Explain the following :

- (i) PI controllers
- (ii) PID controllers
- (iii) PD controllers

OR

Determine the polar plots of the following :

(i)  $G(j\omega) = \frac{j\omega}{1 + j\omega a}$

(ii)  $G(j\omega) = \frac{(j\omega)^2}{1 + j\omega a}$

Also obtain gain and phase margin from polar plots in (i) and (ii) parts.