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

PAPER ID : 2112 Roll No. | | | | | | | | | | |

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 : $2 \times 10 = 20$

(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.

Section – B

2. Answer any **three** parts or questions of the following : $3 \times 10 = 30$

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

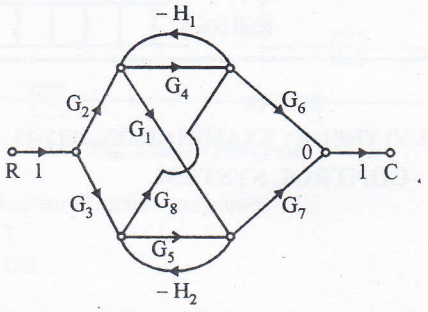

Fig. 1 signal flow graph of control system

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 r = 0.6 from root locus.

Section – C

Answer **all** questions : **5 × 10 = 50**

3. Sketch the Nyquest 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.

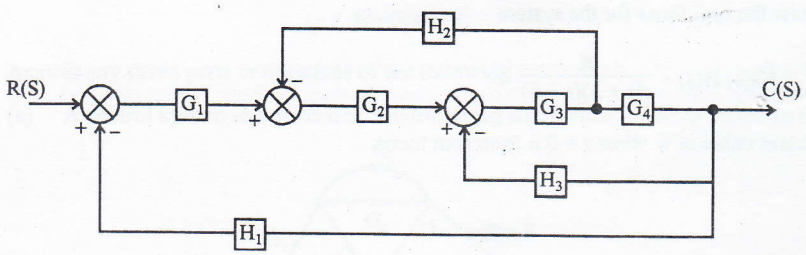

Fig. 2 Block Diagram

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) $G(jw) = \frac{jw}{1 + jw\,a}$

(ii) $G(jw) = \frac{(jw)^2}{1 + jwa}$

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