COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra)
SHIVAJI NAGAR, PUNE - 411 005

End Semester Examination
IE(ILE) - 14001 Control Systems
Instrumentation and Control Engineering

Course: B.Tech
Semester: Sem VII
Year: 2014-2015
Time: 02.00 pm - 05.00 pm

Max. Marks: 60
Date: /11/2014
20 NOV 2014

Instructions:

MIS No. _____

1. **All questions carry equal marks.**
2. **Mobile phones and programmable calculators are strictly prohibited.**
3. **Writing anything on question paper is not allowed.**
4. **Exchange/Sharing of anything like stationery, calculator is not allowed.**
5. **Assume suitable data if necessary.**
6. **Write your MIS Number on Question Paper.**

1. (a) Sketch the root locus for the systems whose open loop transfer functions are given by

$$\frac{k(s-2)}{s(s+1)(s+4)}$$

Show the number branches, termination points, break-in (-away)points *(if any)*, $j\omega$ axis crossings *(if any)* and angles of departure (arrival)*(if any)*.

(b) Repeat part (a) if the zero at +2 is shifted to -2.

(c) What inference about the stability of the system can be made by just looking at the open loop transfer functions given above in part (a) and part (b)?

(d) Comment on parts (a) and (b).

2. Consider the system in Fig. 1 with

$$G(s) = \frac{1}{s^2(s+2)(s+5)}$$

Find the steady state errors to unit step and unit ramp inputs for

(a)

$$G_c(s) = k(1+2s),\ H(s) = 1$$

(b)

$$G_c(s) = k,\ H(s) = (1+2s)$$

Comment on your answers.

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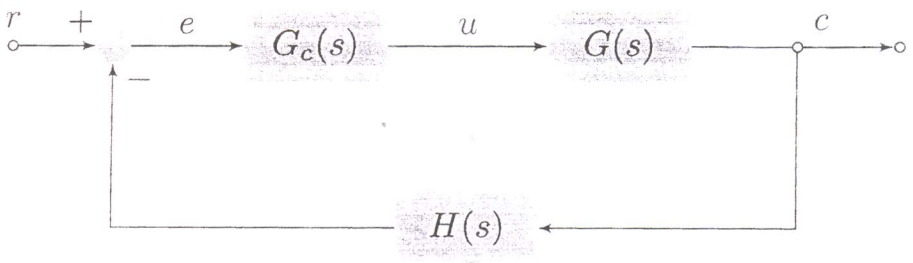

Figure 1: Question 2 and question 3

3. Define stability of an open loop and a closed loop system.

   Given the system shown in Fig. 1 with

$$G(s) = \frac{1}{s(s+1)(s+4)(s+5)}$$

   and

$$G_c(s) = k,\ H(s) = 1$$

   Find the range of k for stability. Repeat the problem with $G_c(s) = k(s+a)$ where a is a positive constant. Comment on your answers.

4. (a) What do you understand by the term frequency response?

   (b) Sketch the polar plot of in the frequency range of $-\infty < \omega < \infty$

$$G(s) = \frac{1}{s^2(s+4)(s+2)}$$

   (c) Sketch the polar plot of

$$G(s) = \frac{(s-1)}{(s^2+1)(s+4)}$$