

B.E. (CST) Part-III 5th Semester Examination, 2007

Automatic Control System (EE-511)

Time : 3 hours

Full Marks : 100

Use separate answerscript for each half.

Answer SIX questions, taking THREE from each half.

Two marks are reserved for neatness in each half.

FIRST HALF

- What do you mean by stability of a linear control system? State and explain Routh stability criterion in this context.
 - Consider the closed-loop system shown in Fig-1. Determine the range of K for stability. [Assume $K > 0$].

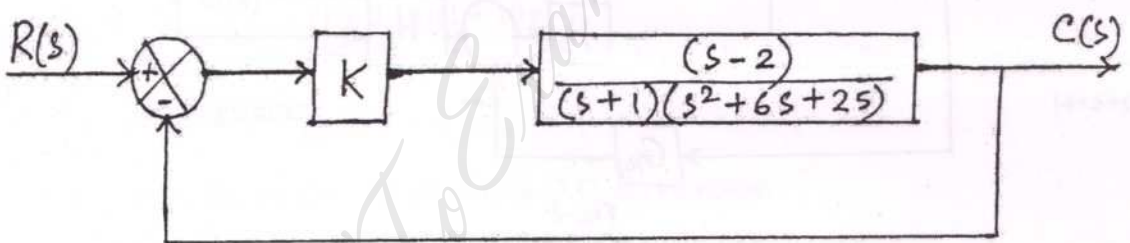


Fig.1 (Closed Loop System)

- The input voltage $e_i(t)$ is connected with a series LCR network. The output $e_o(t)$ is to be measured across capacitor C. Find out the transfer function of the above system. [3+8+5]
- Consider a feedback control system, whose characteristic equation is given below

$$1 + \frac{k(s^2 + 1)}{s(s + 2)} = 0$$
 Draw the root locus plot for the range of k as $0 < k < \infty$. [16]
 - The block diagram of a feedback control system is shown in the Fig.-2. The output Y(s) is

$$Y(s) = M(s) R(s) + Mw(s) W(s)$$
 Find the transfer functions M(s) and Mw(s)

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5. Write short notes (any two) : [8+8]
- a) Transfer function of a standard thermal system
 - b) Application of rules applied for Root locus plot
 - c) Classification of control system and relevant examples.

SECOND HALF

6. a) For a standard second order system deduce the expression of peak overshoot to a unit step input.
- b) Draw the block-diagram of an A.C. position control system.
- c) State the salient constructional features and find the transfer function of an A.C. servomotor. [6+5+5]

7. a) Define static error constants. What is “type” of a system?
- b) Determine the step error constant for
- $$G(s) = \frac{1000}{(1 + 0.1s)(1 + 10s)}$$
- c) Compare PI & PD controllers drawing block diagrams of the respective closed loop systems. [4+6+6]

8. a) Find the transfer function of a D.C. servomotor.
- b) State Nyquist Stability Criterion.
- c) Using Nyquist Stability Criterion, find closed loop stability of a unity feedback system with $G(s) = \frac{1}{s(s-1)}$. [4+4+8]

9. a) Draw the Bode Plots of :
- $$G(s) = \frac{300}{s(s+10)(s+40)}$$
- b) Find the Gain Margin and Phase Margin from the plots in 9(a).
- c) What is the use of a Synchro? [8+4+4]

10. a) Design a PID controller based on Zeigler-Nichols tuning for :
- $$G(s) = \frac{1}{s(s+3)(s^2+2s+2)}$$
- b) Define rise time and bandwidth of a system.
- c) What is a linear system? When is a system time invariant? [8+4+4]