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GANPAT UNIVERSITY
B.Tech. Sem-IV ELECTRONICS & COMMUNICATION ENGINEERING
CBCS Regular Examination May-June 2013
2EC 402:- Control Systems

TIME: 3 HOURS **TOTAL MARKS: 70**

INSTRUCTIONS:

1. Attempt all questions.
2. Answers to the two sections must be written in separate answer books.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

SECTION-I

1 (A) A unity feedback control system has an open-loop transfer function 8

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

Sketch the root locus of the system. Show all salient points on graph paper. Comment on stability.

(B) Define: Relative stability, Critical stability 4

OR

1 (A) Using Routh-Hurwitz criterion, determine the stability of following transfer functions. 8

(a) $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$

(b) $2s^4 + 4s^2 + 1 = 0$

(B) By Hurwitz criterion, find stability, State demerits of Hurwitz criterion. 4

$$s^4 + 8s^3 + 18s^2 + 16s + 4 = 0$$

2 (A) A unity feedback control system has an open-loop transfer function 6

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

Find the necessary conditions for the system to be stable using Routh's criterion of stability.

(B) Using Routh criterion determine stability of the system whose characteristics equation is $s^5 + 3s^4 + 2s^3 + 6s^2 + 6s + 9 = 0$ Find no. of poles in RHP and LHP of s-plane. 6

OR

2 (A) Draw the Nyquist plot for transfer function, Comment on the stability. 5

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

(B) Explain the concept of gain margin and phase margin. 4

(C) Define: Breakaway and Breakin points in root locus. 3

3 (A) Sketch the bode plot for transfer function 8

$$G(s)H(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

From the bode plot determine

(a) Phase crossover frequency (b) Gain crossover frequency (c) Gain Margin (d) Phase Margin (e)Stability of the system

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(B) Sketch the polar plot for transfer function

$$G(s)H(s) = \frac{1}{s(s-1)}$$

SECTION II

4 (A) Using the block diagram reduction techniques, find the closed loop transfer function of the system whose block diagram is given in below fig.1. 6

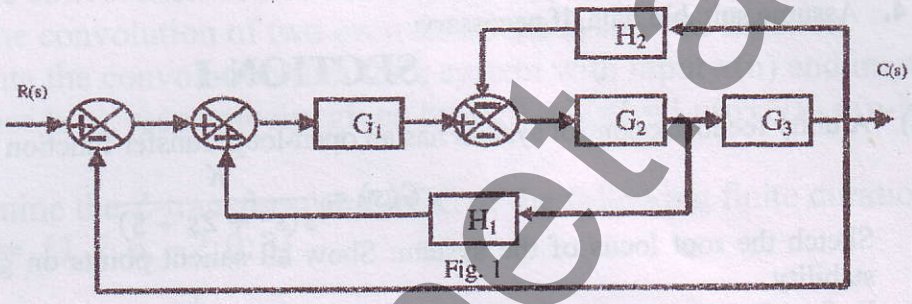


Fig. 1

(B) Obtain the transfer function of a field control DC Servomotor. 6

OR

4 (A) Write brief short notes on open loop control systems and closed loop control systems with the help of block diagrams. Explain role of each block. Give some suitable real life examples of both types of systems. 6

(B) Draw signal flow graph of the system shown in fig. 1. Obtain overall system transfer function using Mason's gain formula. 6

5 (A) What is analogous system? Explain Force-Current Analogy With suitable Example. 6

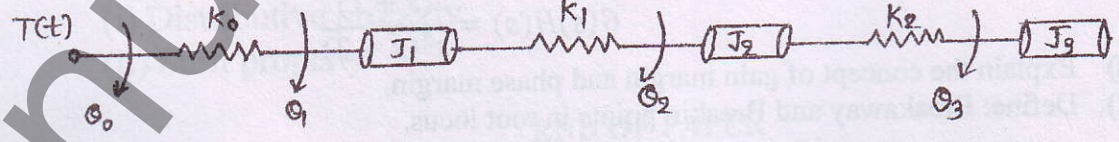
(B) What is transfer function? Explain poles and zeros of transfer function. 3

(C) What do you mean by the term 'FEEDBACK'? List out effects of feedback. 2

OR

5 (A) Explain Standard Test Signals and their Laplace transforms used in control system. 4

(B) Draw the mechanical network. Write differential equations of performance and also draw the analogous electrical circuit of the system shown below. 7



6 (A) Derive steady state error (Ess) and static error co-efficients. 6

(B) Define Following Terms 6

(1) Transfer Function (2) Source Node (3) Self Loop

(4) Peak Time (5) Rise Time (6) Settling Time

End of Paper