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TEE-502

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

PAPER ID : 2056

Roll No.

B. Tech.

(SEM. V) EXAMINATION, 2007-08

CONTROL SYSTEM

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

- 1 Attempt any two of the following : $2 \times 10 = 20$
- (a) What do you understand by "disturbance"? What are various types of disturbances? Explain. Give an example of time-varying control system.
- (b) Obtain C/R ratio of a system whose signal flow graph is given below in figure 1.

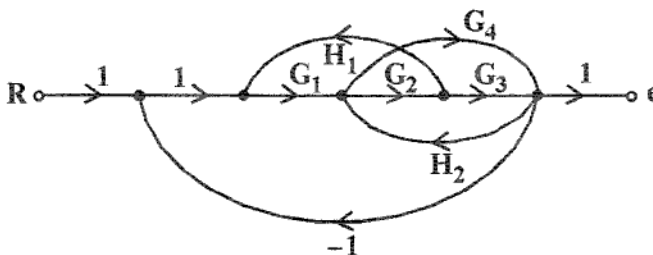


Figure - 1 : Signal Flowgraph

- (c) Explain basic rules of block diagram reduction. Define blocks, summing point and branch point in context of block diagram representation of physical systems. Compare block diagram approach and signal flow graph approach.



2 Attempt any two of the following : 10×2=20

(a) A unity feedback control system has open-loop

$$\text{transfer function as } G(s) = \frac{K(s+2)}{s^3 + \beta s^2 + 4s + 1}$$

Determine the value of K and β , so that the closed loop unit step response has $r = 0.2$ and $w_n = 3$ rad/sec.

- (b) Define ramp-error constant for a control system. Derive the values of ramp error constants and steady state error due to ramp-input for type 0,1,2 and 3 control systems.
- (c) Compare the effects on the time response of a second order control system due to derivative feedback control and error derivative control actions.

3 Attempt any two of the following : 10×2=20

- (a) What is the difference from constructional point of view between the rotors of synchro transmitter and synchro-receiver. Explain the reasons behind it. Also explain that why synchro-transmitters are designed to have high impedance ?
- (b) With the help of an example, explain how Routh-Hurwitz criterion can be used in designing a linear control system. What are the situations under which Routh-Hurwitz criterion cannot be used to determine stability.
- (c) Explain how to determine gain margin and phase margin of a closed loop control system from its root-loci. Illustrate with the help of an example.



- 4 Attempt any two of the following : $2 \times 10 = 20$
- (a) What do you understand by frequency response? What are its various methods? Discuss their relative advantages, disadvantages and limitations.
 - (b) Can an exact correlation between the transient response specifications and frequency response specifications of an higher order control system be established? If yes how and if no then why?
 - (c) Explain what do you understand by "Inverse Nyquist Plot." Can the closed loop stability of a unity feedback control system be assessed using inverse Nyquist plot? Illustrate with the help of an example.
- 5 Attempt any two of the following : $10 \times 2 = 20$
- (a) Prove that the eigen values of a matrix remain unchanged under linear transformation. Illustrate this fact with the help of an example.
 - (b) What are controllability and observability of a control system? Give the methods of their testing. What is the important of controllability and observability in the design of control systems ?
 - (c) Make a technical comparison between cascade lead and cascade lag compensation used for linear control systems. Support with suitable examples.
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