

R13

Code No: 115AD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, November - 2015

CONTROL SYSTEMS

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A (25 Marks)

- 1.a) Explain the effect of negative feedback in control systems [2]
- b) Find the TF of following system (figure 1). [3]

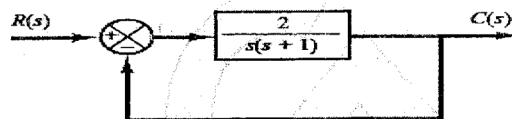


Figure 1

- c) Synchro acts as error detector? Justify? [2]
- d) Write the importance of SFG in control systems [3]
- e) Define the standard test signals in control systems [2]
- f) The damping ratio for the characteristic equation $s^2 + 2s + 1 = 0$ is [3]
- g) Define angle of departure and angle of arrival in root locus [2]
- h) Write the drawbacks of RH criteria [3]
- i) Explain the minimum phase system? [2]
- j) Magnitude in decibels of give transfer function $G(s) = \frac{1}{(s+2)}$ is [3]

PART - B (50 Marks)

- 2.a) Explain any two examples of closed loop control systems. [5+5]
- b) Discuss electrical analogous of mechanical rotational systems. [5+5]

OR

- 3.a) Discuss the characteristics of feedback in control systems.
- b) Write the differential equations to represent the following system in figure 2 below and draw its electrical equivalent circuit [5+5]

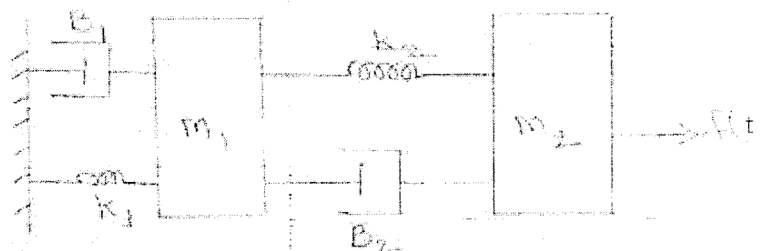


Figure 2

- 4.a) Explain how Synchro acts as an error detector and determine the transfer function.
b) Obtain the transfer function for the system represented by block diagram shown below figure 3 using the block diagram reduction technique. [5+5]

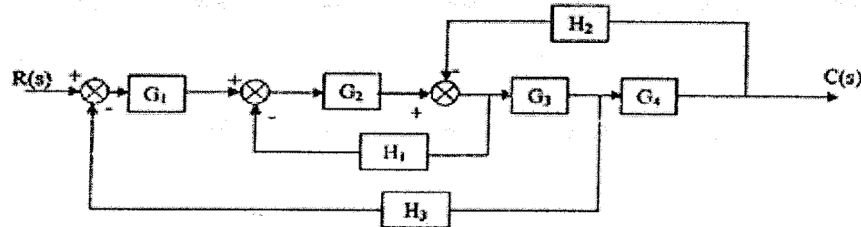


Figure 3

OR

- 5.a) Find the transfer function of series RLC circuit
b) Obtain the transfer function $Y(s)/R(s)$ from block diagram shown below figure 4 by using the signal flow graph method. [5+5]

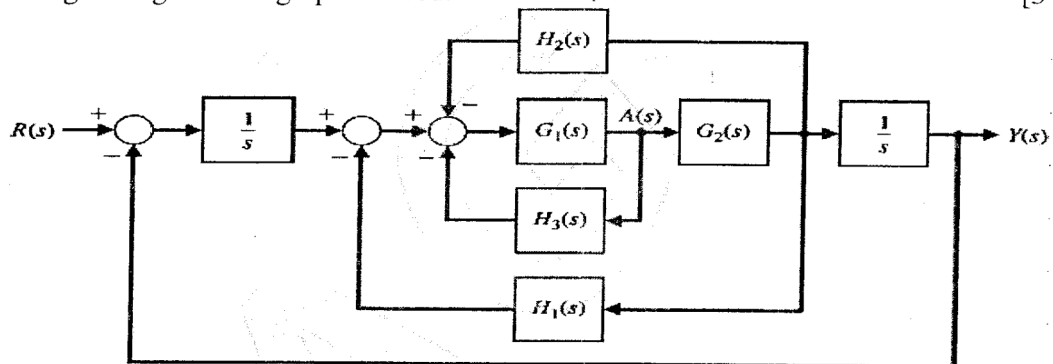


Figure 4

6. A unity feed-back control system has its open-loop transfer function given by

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

Determine an expression for the time response when the system is subjected to

- a) Unit impulse function
b) Unit step input function.

[10]

OR

- 7.a) A unity feedback system has $G(s) = \frac{1}{s(s+4)}$. The input to the system is described by $r(t) = 4+6t+2t^3$. Find the steady state error.
b) A unity feedback control system has an open loop transfer function $G(s) = 16/S(S+2)$. Determine the natural frequency, damping factor, percentage overshoot and time at which the maximum overshoot occurs [5+5]

- 8.a) Using Routh-Hurwitz criterion check whether systems represented by the following characteristics equations are stable or not. Comment on the location of roots. Determine the frequency of sustained oscillations if any $S^3 + 20S^2 + 9S + 100 = 0$

- b) Sketch the root locus of the system:

$$G(s) = \frac{K(S+3)}{S(S+6)(S^2+2S+2)}$$

- i) Find marginal value of K

- ii) Find the value of K for damping ratio of 0.5.

[5+5]

OR

- 9.a) The open loop transfer function of a unity feedback system is given by

$$G(s) = \frac{1}{S(1+0.4S)(1+0.25S)}$$

Find the restriction on K so that the closed loop system is absolutely stable.

- b) Explain the following control action with neat schematic diagram and derive its necessary equations.

- i) Proportional ii) Integral iii) Derivative iv) Proportional plus integral

[5+5]

10. Sketch the bode plot for the given system whose $H(s) = 1$, and

$$G(S) = \frac{1}{S(S+4)(S+0.2)}$$

- a) Find gain margin

- b) Find the phase margin for damping ratio of 0.5

[10]

OR

11. Using Bode plot or otherwise determine the gain margin and phase margin of the system with

Open loop transfer function

[10]

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

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