R13

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]
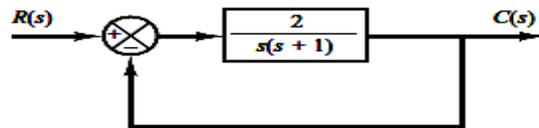 b) Find the TF of following system (figure 1).   [3]

Figure 1

  c) Syncro 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 $G(s) = \dfrac{1}{(s+2)}$ is [3]

PART - B (50 Marks)

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

OR

3.a) Discus 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]
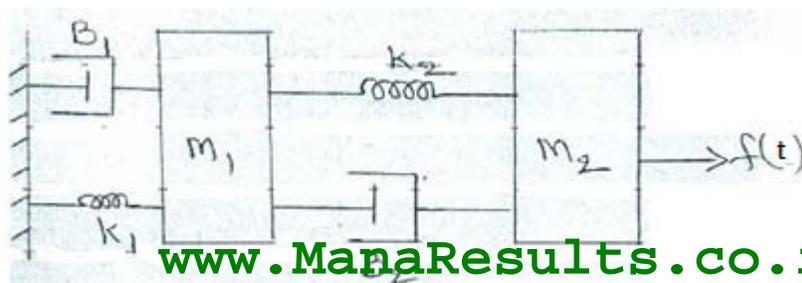
Figure 2

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]
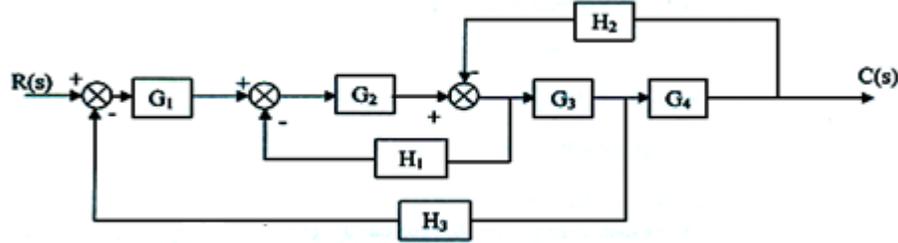

Figure 3

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]
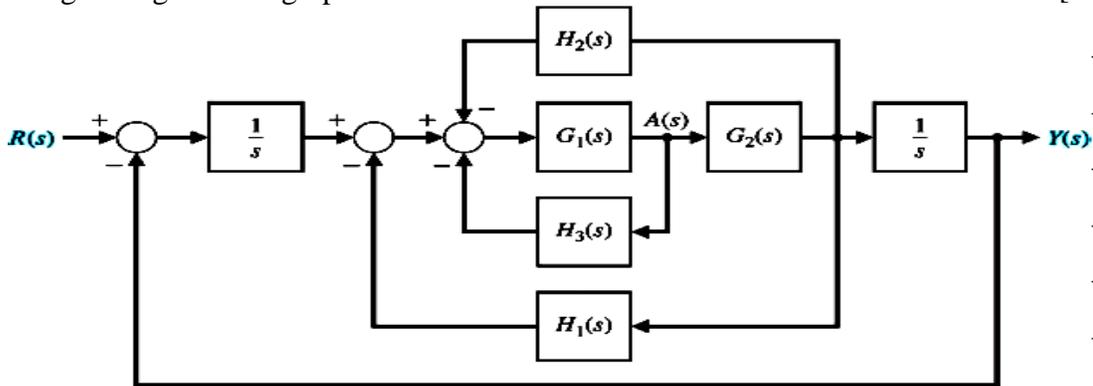

Figure 4

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}P 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]

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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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