Code No: 115AD

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, May - 2018

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) One of the best example of closed loop control system is a person driving a motor cycle. Justify. [2]

b) Write the differential equations for the mechanical system shown in Figure 1. [3]

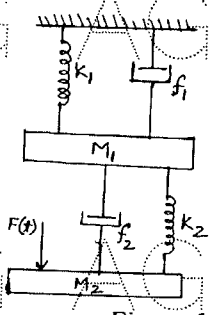

Figure 1

c) How is AC servomotor different from normal induction motor? [2]

d) Give the Mason's gain formula. [3]

e) What are static error coefficients? How are they related to the steady state error? [2]

f) Explain the effect of PD controller on the performance of control system. Why is the derivative controller alone not used in the control system? [3]

g) Compare absolute stability and relative stability. [2]

h) What is break away and break in points? What is the procedure to determine them? [3]

i) State the advantages of frequency domain approach. [2]

j) What is the procedure to obtain gain margin and phase margin from Bode plot? [3]

PART - B

(50 Marks)

2.a) What are effects of negative feedback on the system performance?

b) Derive the transfer function of the system shown in figure 2. [4+6]

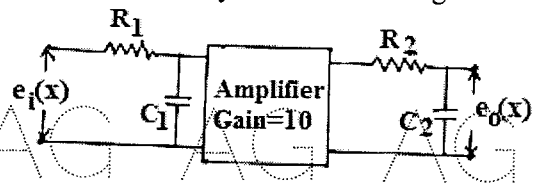

Figure 2

OR

3.a) Describe a control system to fill a tank with water after it is emptied through an output at the bottom. This system automatically stops the inflow of water when the tank is filled. Draw the block diagram of the system.

b) What are the limitations of open loop control systems? Explain the methods available to overcome them? [6+4]

4. Find out the input-output relationship of the control system represented by the block diagram shown in figure 3. [10]

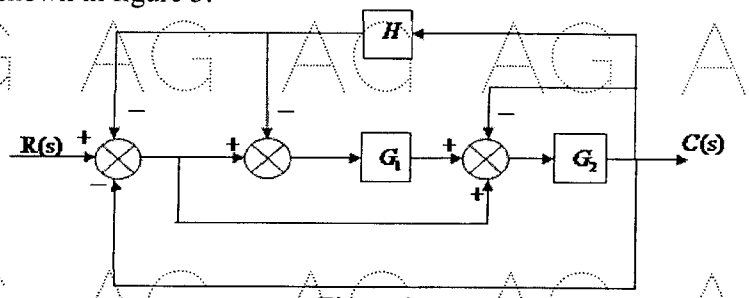

Figure 3

OR

5. With the help of neat sketches, explain the construction and working principle of Synchro transmitter and receiver. [10]

6. The open loop transfer function of a unity feedback system is given by $G(s) = K/(s(1+sT))$, where K and T are constants having positive values. By what factor the gain K be reduced so that (a) the peak overshoot of unit step response is reduced from 80% to 20%. (b) the damping ratio increases from 0.1 to 0.5. [10]

OR

7. The open loop transfer function of a unity feedback system is given by $G(s) = 300/(1+0.1s)$. Evaluate the generalized error coefficients. Determine the steady state error of the system when the input is (a) $t^2/2$ (b) $1+5t+t^2$ [10]

8.a) With suitable physical examples, explain the terms: absolute stable system, marginal stable system and unstable system.

b) A unity feed back control system has the forward path transfer function, $G(s) = K(s+1)/(s^3+\beta s^2+4s+1)$. Determine the value of K and β so that the closed loop system oscillates at a frequency of 3 rad/sec. [5+5]

OR

9. The open loop transfer function of a control system is given by $G(s)H(s) = \frac{K}{s(s+8)(s^2+2s+5)}$. Sketch the root locus plot and determine, (a) the break away points, (b) the angle of departure from complex poles and (c) condition for stability. [10]

10.a) Explain various frequency domain specifications.

b) Determine the open-loop transfer function of a system whose approximate plot is shown in figure 4. [4+6]

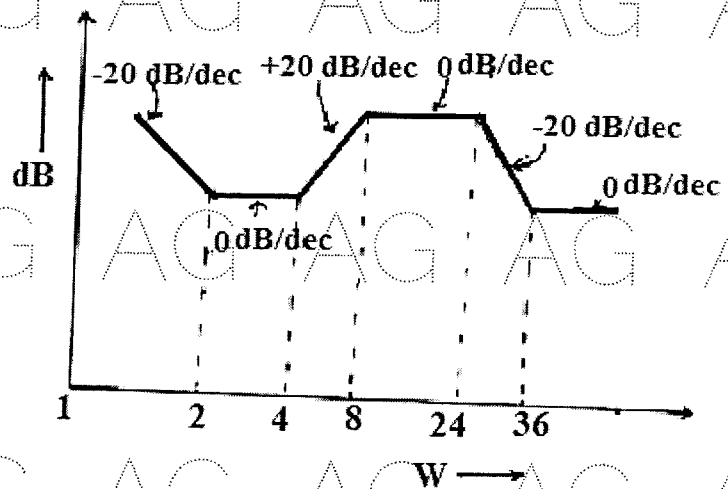

Figure 4

OR

11. A feedback control system is given by $G(s) = \dfrac{10}{s(1+0.2s)(1+0.01s)}$; $H(s) = 1$

Draw the Bode plot of the system. Determine

a) Gain crossover and phase crossover frequencies

b) Gain margin and phase margin

c) Stability of the closed loop system. [10]

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