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B.E /B.Tech DEGREE END SEMESTER EXAMINATIONS MAY 2013

Branch Electronics and Communication Engineering

IV Semester

EC9254 Control Systems

Time: 3 hours **Max: 100**

Answer ALL questions

PART-A (10 x 2 =20 MARKS)

1. Draw the block diagram of a closed loop system and obtain its transfer function.

2. State Mason'S rule with an example.

3.Define the different steady state errors?

4. Define PI and PD controller.

5. What is the need for compensators? What are the different types of compensators?

6. What is the use of M & N circle and Nichol's chart?

7 What is the condition for a stable system? Mention few technique to verify the stability of a sysyem.

8. What is meant by dominant pole? What is its significance?

9. Define controllability and observability.

10. What is sampler & Hold circuit.

PART –B (5 X 16 = 80 marks)

11. i) Derive the step response of a second order system. **(4)**

ii) Discuss the response of a second order system for different pole location **(4)**

i ii) Obtain the expression for %overshoot, settling time, rise time and peak time for a second order system. **(8)**

12 a) Find the transfer function X3(s)/F(s) for the system shown in Figure 12 a

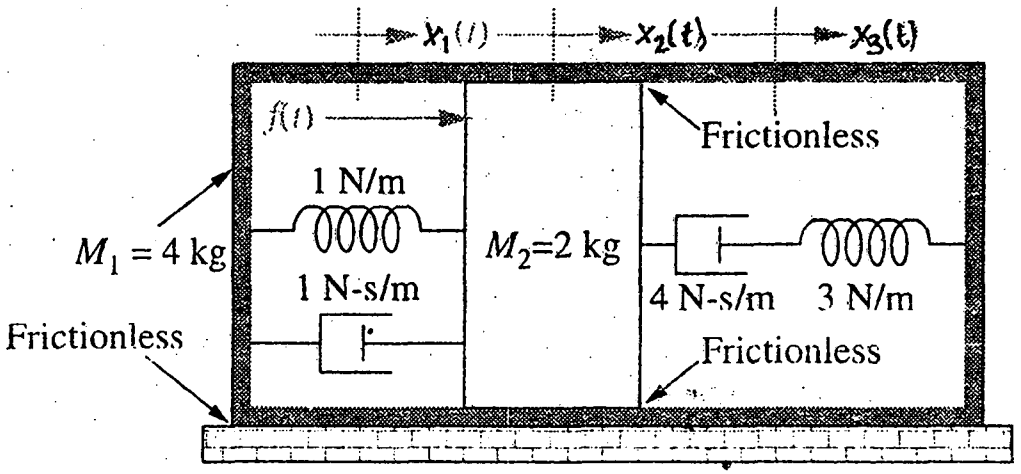
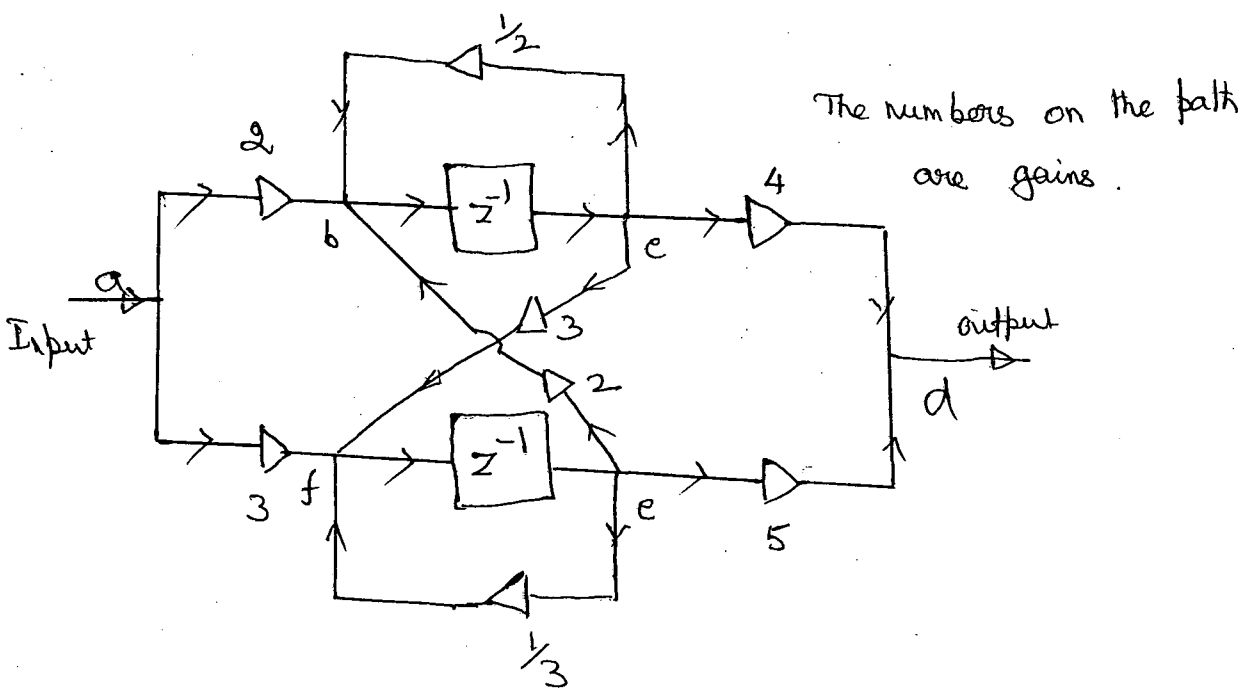


Fig 12 a

(OR)

12 b i) Find the transfer function for the signal flow graph using Mason's rule. **(6)**



The numbers on the path are gains.

Figure 12 b (i)

B ii) Derive the transfer function of an armature – controlled DC servo motor. **(10)**

13 a i) Find the transfer function for the amplitude Bode plot shown in figure 13 a i and determine the phase plot . **(10)**

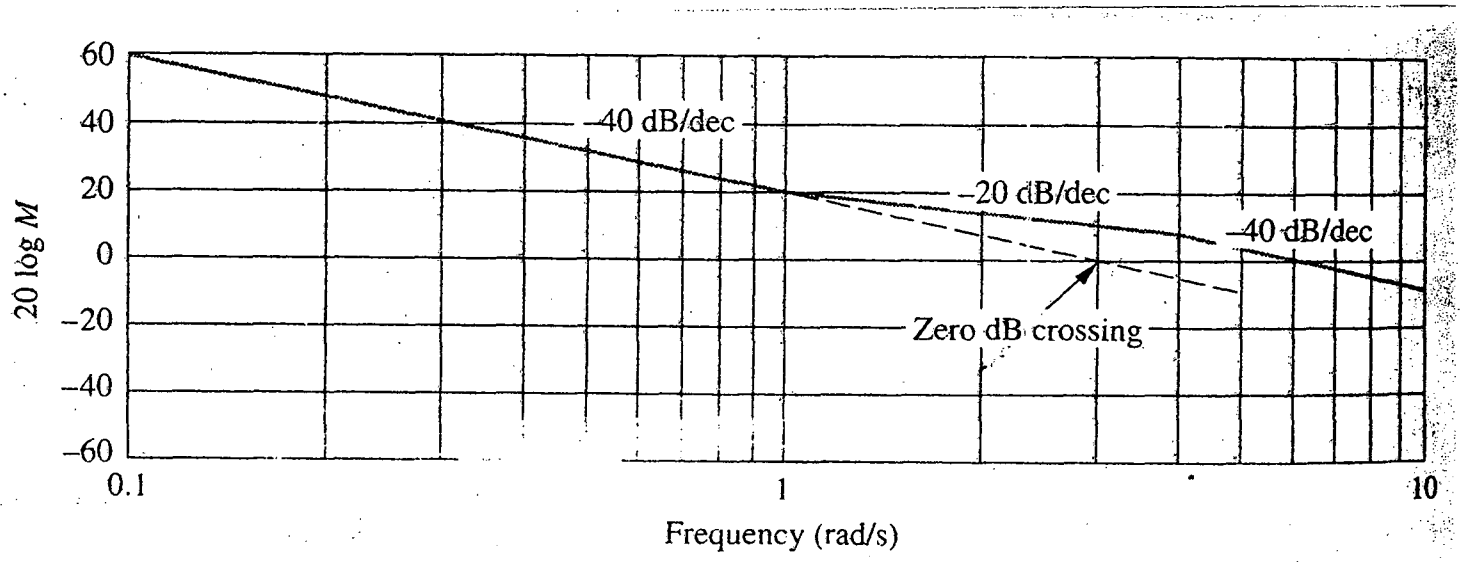


Figure 13 a (i)

ii) Derive the constant M and N circle **(6)**

(OR)

13 b i) The unity feedback system with open loop transfer function G(s) =K(s+ a)/s (s + b) is to be designed to meet the following requirements: The steady –state position error for a unit ramp input equal 1/10; the closed – loop poles will be located at -1 $\pm$ j 1. Find K, a, b in order to meet the specifications. (10)

B ii) How do you reduce the steady state error by 10% using suitable compensation technique. (6)

14 a Construct the root locus of a open loop transfer function $G(s) = \frac{K(s-3)(s-5)}{(s+1)(s+2)}$

And obtain the following. Breakaway point, the point to meet imaginary axis and corresponding gain

And the range of K for stability.

(OR)

14 b i) Find the stability of a open loop system with the transfer function G(s) = K/(s+2)(s+4)(s+6) using Nyquist criteria **(10)**

b ii) Determine the stability of the characteristic equation $2s^5+3s^4+2s^3+3s^2+2s+1$ using Routh- Hurwitz criteria. **(6)**

15 a i) Find the A,B,C,D matrices of the following transfer function TF(s) = (s+4)/(s+1)(s+2)(s+5) **(10)**

A ii) Verify the controllability of the above system. **(6)**

(OR)

15 b i) Given the the matrices

$$A=\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -3 & -2 \end{bmatrix} \quad B=\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad C=[\,0\ \ 5\ \ 1\,] \quad D=[\,0\,]$$

Determine the transfer function and its observability **(6+6)**

B ii) Determine the minimum sampling frequency and the bandwidth if the signal has the frequency range from 1000 hz to 4000 hz and the samples are represented by 8 bits/sample. **(4)**