MODEL QUESTION PAPER-1. with effect from 2019-20 (CBCS scheme) Page No 1/6

18EI/BM44.

USN | | | | | | | | | |

Fourth Semester BE Degree Examination

Subject Title: CONTROL SYSTEM

TIME: 03 Hours. Max Marks: 100

Note: (1) Answer any five full question choosing at least ONE full question from each Module.

Module-1

1(a) Obtain mathematical model for the following SMD system as shown in fig No-1(a) based on force-voltage analogy.

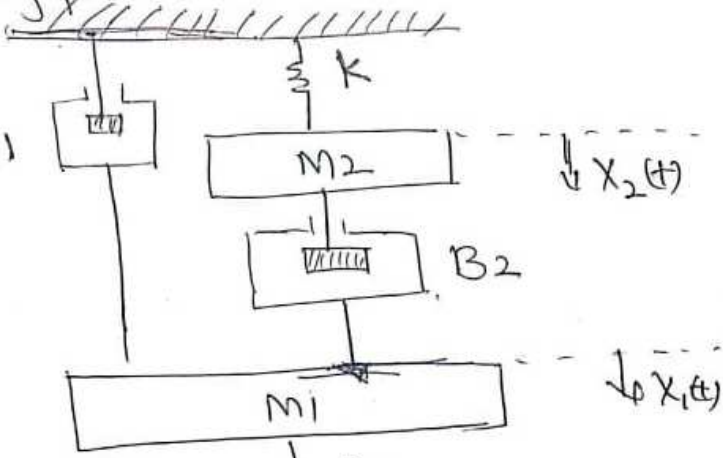

fig No-1(a)

-10-

1(b) Reduce the following block diagram as shown in fig No 1(b) using block diagram reduction techniques and hence obtain final system transfer function.

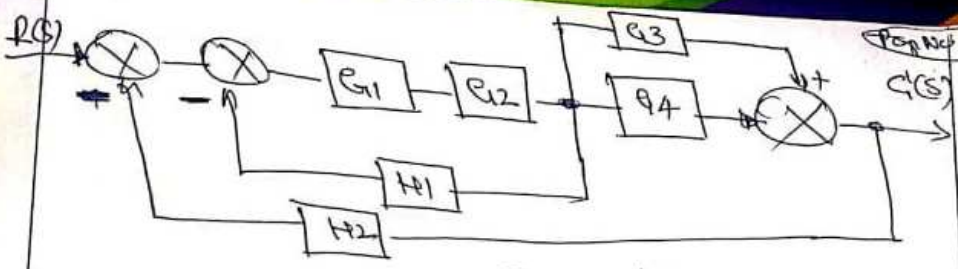

Fig No 1b

-10-

OR

2(a) obtain mathematical for the following SMD system as shown in fig No-2a based on force-current-analogy.

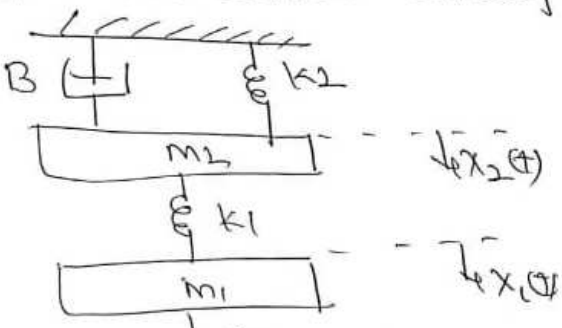

Fig No-2(a)

-10-

2(b) Reduce the following block diagram as shown in fig No 2(b) using block diagram reduction techniques and hence obtain final system transfer function.

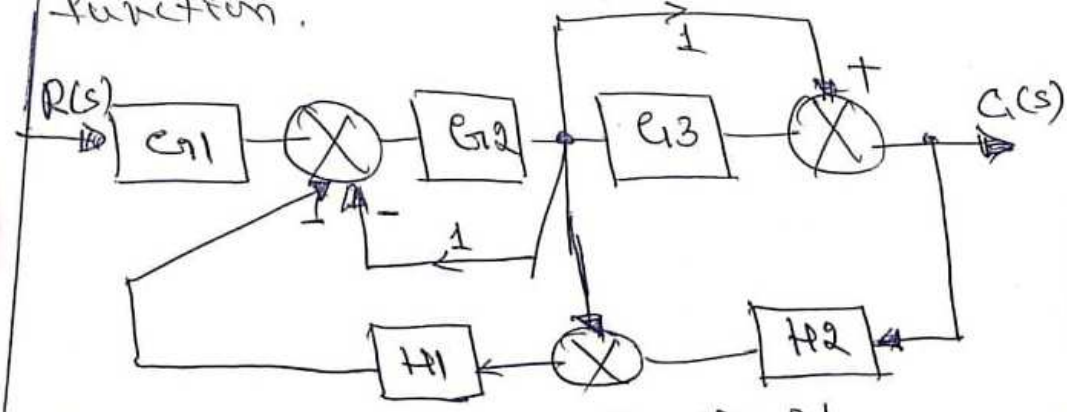

Fig No 2b.

-10-

MODULE - 2

3(a) Define Mason's gain formula. Using the same, obtain final System transfer function for the following signal flow graph as shown in fig No - 3(a)

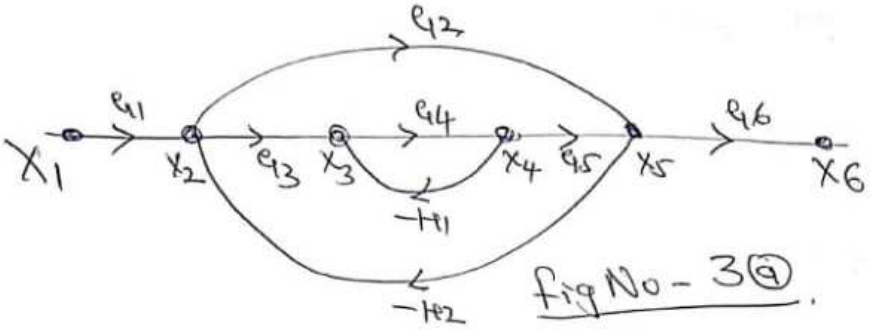

fig No - 3(a). -10-

3(b) Define steady state error and error constants. Derive an equation for position error constant, velocity error constant and acceleration error constants. -10-

OR

4(a) Draw the next waveform for the second order under damped system. Define all the time response specifications. Hence derive an equation for the rise time and peak time. -10-

4(b) Consider the following differential equation.

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 8x.$$

find all the time domain specifications for unit step input. -10-

MODULE-3

5 (a) What is the concept of stability? Examine the stability of the following characteristics equations using R-H criterion.

(i) $S^8 + 5S^6 + 2S^4 + 3S^2 + 1 = 0$

(ii) $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$ -10-

5 (b) For the following unity feedback system obtain the root locus and draw all the salient points.

$$G(S) = \frac{K}{S(S+2)(S+1)}$$ -10-

OR

6 (a) Find the range of value of 'K' so that the system with following characteristic equation will be stable.

$S(S^2+S+1)(S+4) + K = 0$ -06-

6 (b) Consider the following characteristic equation given by

$S^4 + 22S^3 + 10S^2 + S + K = 0$

find K margin and the frequency 'ω' at K margin. -08-

6@ Consider the following unity feedback system given by

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

Draw the root locus. obtain all the salient points on the root locus. -06-

MODULE-4

7@ Derive an equation to correlate between time and frequency response specifications in terms of (i) Resonant Peak (ii) Bandwidth. -10-

7@ Consider the following a second order system with unity feedback given by $G(s) = \frac{200}{s(s+8)}$

find (i) Resonant Peak (ii) Bandwidth -10-

OR

8@ What is a polar plot? Discuss how would you find stability for the given system using polar plot? -10-

8@ Define Nyquist ~~Plot~~ stability criterion. Describe general construction procedure for the Nyquist stability plot. -10-

9(a) Consider MIMO system. Hence define concept of state, state variable, state model and state diagrams. — 10

9(b) obtain the state model for system represented by

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 10y = 3u(t)$$

Also draw the state diagram — 10

OR

10(a) Consider a system having state model given by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & -3 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 3 \\ 5 \end{bmatrix} u$$

$$Y = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \quad D = [0].$$

obtain its transfer function. — 10

10(b) Enlist and explain all properties of state transition matrix — 10