M.Sc. Second Semester (Applied Electronics) (New) (CBS)

15022 : Elective-I : Control System : 2 AE 5

P. Pages : 3

Time : Three Hours

* 0 1 3 0 *

AV - 3302

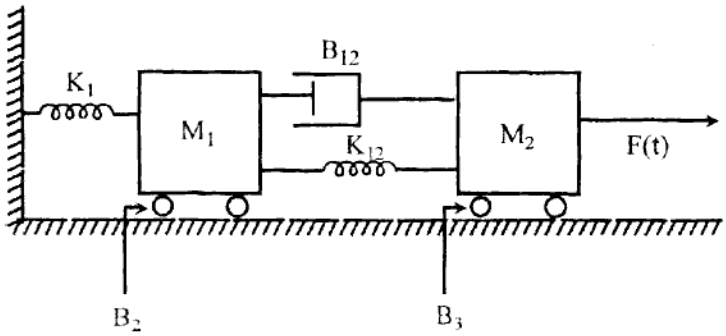
Max. Marks : 80

Notes : 1. Assume suitable data wherever necessary.
2. Illustrate your answer necessary with the help of neat sketches.
3. Use of pen Blue/Black ink/refill only for writing the answer book.

1. a) Distinguish between the following. **6**

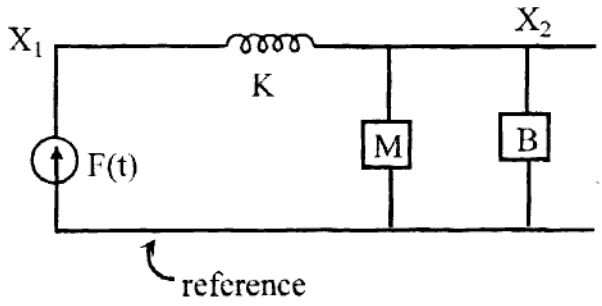
a) Linear and non-linear control system.
b) Feedback and feed forward control system.
c) Open loop and close loop control system.

b) Write the differential equations for the mechanical system shown in fig. Also obtain an analogous electrical circuit based on force-voltage analogy. **8**

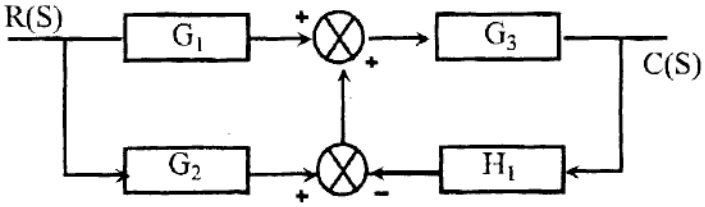


OR

2. a) Derive the transfer function if x_2 is the output and f(t) is input. **7**



b) From the Block diagram shown in fig. below, draw the corresponding signal flow graph and evaluate close-loop transfer function using Mason's gain formula. **7**

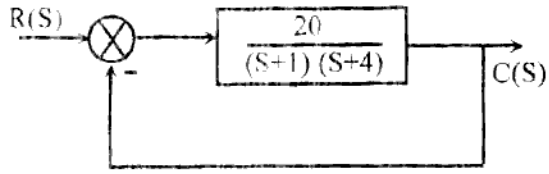


3. a) For the system having $T.F = \frac{64}{s^2+5s+64}$, for unity step input determine. 5

i) w_n ii) ξ

iii) wd iv) Time for peak overshoot T_p.

b) For the system shown in figure obtain close loop transfer function, damping ratio natural frequency and output response if subjected to unit step input. 8



OR

4. a) For system $s^4+22s^3+10s^2+s+K=0$ find K(mar) and ω at K(mar). 7

b) For a system with characteristics equation 6

$f(s)=s^6+3s^5+4s^4+6s^3+5s^2+3s+2=0$

examine stability.

5. a) Sketch the root locus for following having 13

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

OR

6. a) Find the value of K for $\xi=.707$ from root locus of system having 13

$$G(s)\cdot H(s)=\frac{k}{s(s+2)(s-8)}$$

7. a) For unit feed back system 14

$$G(s)=\frac{800(s+2)}{s^2(s+10)(s+40)}$$

Sketch the bode plot. asymptotic in nature. Comment on stability.

OR

8. a) Give the steps to solve problems by Nyquist Criterion. Also state advantages of Nyquist plot. 7

b) State the advantages and limitations of frequency response method. 7

9. a) Find the state transition Matrix of state equation. 7

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 1\end{bmatrix}U$$

b) Obtain state space model of the system with transfer function. 6

$$\frac{y(s)}{u(s)}=\frac{6}{s^3+6s^2+11S+6}$$

OR

10. a) Explain the following terms. **6**

i) State ii) State variables

iii) State equations iv) State transition matrix

b) Examine the observability of system given below. **7**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

11. a) Explain following properties of Z-transform. **6**

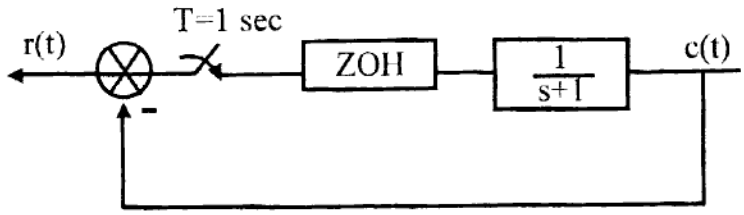
i) Linearity ii) Shifting

b) Find the inverse Z-transform of: **7**

i) $\dfrac{z-0.4}{z^2+z+2}$

OR

12. a) For sampled-data system, find the response to unit step input. **7**



b) Explain the working of sampled data control system. **6**

****