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B067413(067)

B. Tech. (Fourth Semester) Examination
April-May 2021

(AICTE Scheme)

MODERN CONTROL SYSTEMS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

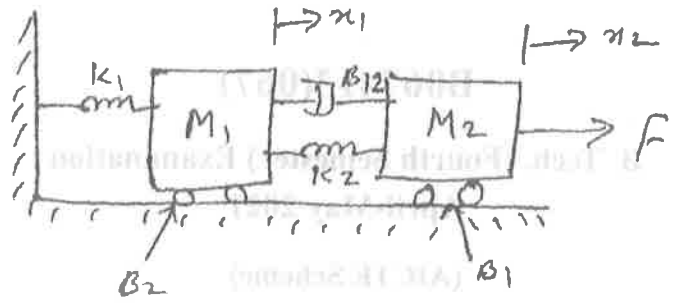
Note : *Attempt all questions. Part (a) of each question is compulsory and carries 4 marks each. Attempt any* ***two*** *from parts from (b), (c) and (d) and carries 8 marks each.*

Unit-I

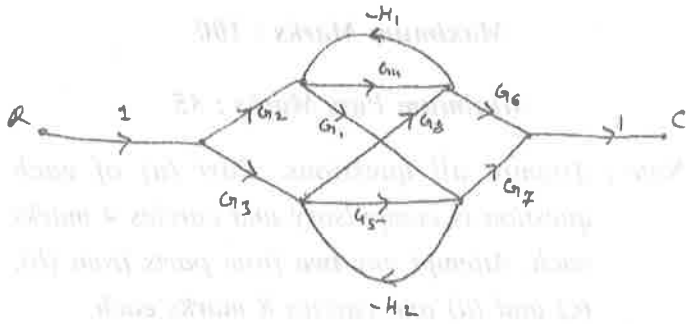
1. (a) Define transfer function. 4

(b) Comparison between open loop and closed loop system. 8

(c) Draw the analogous electrical circuit of the system show in figure. Use force-voltage analog. 8



(d) Obtain the transfer function C/R from the signal flow group show in figure. 8



Unit-II

2. (a) Define transient repsonse. 4

(b) A feedback system is described by the following transfer function

$$G(s) = \frac{1^2}{s^2 + 4s + 16}, \quad H(s) = KS$$

The damping factor of the system is 0·8./ Determine the overshoot of the system, and the value of K. 8

(c) For a unity feedback control system the forward path transfer function is

$$G(s) = \frac{20}{s(s+2)(s^2 + 2s + 20)}$$

Determine the steady state error of the system. When the inputs are

(i) 5

(ii) $5t$

(iii) $\frac{3t^2}{2}$ 8

(d) The characteristics equation of feedback control system is $s^4 + 20s^3 + 15s^2 + 2s + k = 0$.

(i) Determine the range of K for the system to be stable

(ii) Can the system be marginally stable? If so, find the required value of K and the frequency of sustained oscillation. 8

Unit-III

3. (a) Define all pass and minimum phase system. 4

(b) Consider a unity feedback control system with the following feedback transfer function

$$G(s) = \frac{K}{s\left(s^2 + 4S + 8\right)}$$

plot the root locii for the system. 8

(c) Sketch the polar plot of

$$G(s) = \frac{K}{(1+5T_1)(1+5T_2)} \cdot$$ 8

(d) Draw the Bode plot for the transfer function

$$G(s) = \frac{50}{s\,(1+0\cdot 25\,s)\,(1+0\cdot 1\,s)}$$

from the graph determine

(i) Gain crossover frequency

(ii) Phase crossover frequency

(iii) G. M. & P. M.

(iv) Stability of the system 8

Unit-IV

4. (a) Define stability. 4

(b) Using Nquist criterion investigate the stability of a closed long control system where open loop transfer function is given below

$$G(s)\cdot H(s) = \frac{K}{S\,(1+5T_1)(1+5T_2)}$$ 8

(c) Write short notes on different type of compensations. 8

(d) Write short notes on load-log compensation. 8

Unit-V

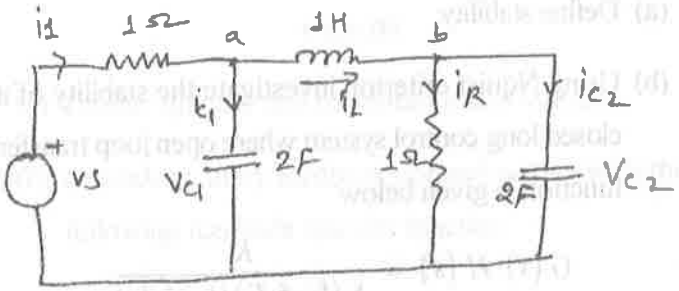
5. (a) Define state equation with Mathematical. 4

(b) A single input single output system is given as

$$\dot{x}\,|\,t\,| = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 & 2 \end{bmatrix} x(t).$$ 8

(c) Write the state equation for the circuit shown in figure 8



(d) Construct the state model of a system characteristics by the differential equation.

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\,dy/dt + 6\,y = u$$

Give the block diagram representation of the state mode. 8