RGM COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)
04th April 2023
III B.Tech. I Sem. (R20) End Examinations (Supplementary)
CONTROL SYSTEMS ENGINEERING
ECE

Time: 3 Hrs **Total Marks: 70**

Note 1:Answer Question No.1 (Compulsory) and 4 from the remaining
2:All Questions Carry Equal Marks

1a Define the following terms w.r.t state variable approach
i. State transmission matrix
ii. State transition equation

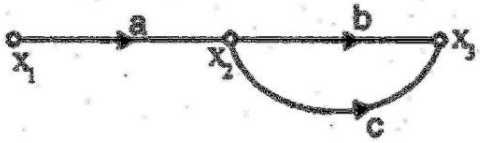
b To what classification of systems can the transfer function be best applied?

c Draw the approximate polar plot for $G(S)=\frac{1}{S(1+ST_1)(1+ST_2)}$

d Prove that the breakaway points of the root locus are the solutions of $\frac{dK}{dS}=0$. Where K is open loop gain of the system whose open loop transfer function is $G(S)$

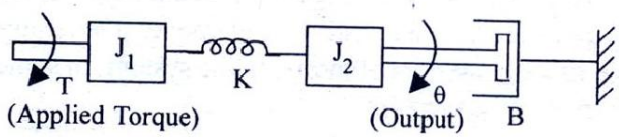
e The real part of the pole generates what part of a response?

f Eliminate the loop in a given signal flow graph by writing suitable equations and find the ratio of output to the input.



g When do you say that the system is completely state controllable?

2 a) Find the transfer function — for the following system as shown in the figure.(10)



b) Explain feedback characteristics of a closed loop systems. (4)

3 a) Define the terms which are associated with SFG. (4)
b) For a given Block diagram as shown in the Fig., draw the SFG, and find the transfer function. (10)

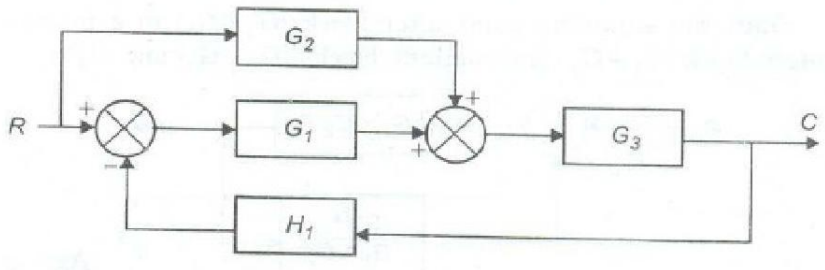


Fig.

4 For the given open loop transfer function G(S) = 1/ S(1+2S)(1+S), determine
   a) Gain cross over frequency and phase cross over frequency. (10)
   b) Gain margin and phase margin of the system. (4)

5 a) For the following response function, determine if pole-zero cancellation can be approximated. If it can, find percent overshoot, settling time, rise time, and peak time. $C(s) = \frac{(S+3)}{S(S+2)(S^2+3S+10)}$ (10)

b) Explain the various types of standard test signals. (4)

6 a) Obtain the derivation of transfer function from state model. (8)

b) Consider a system having state model (6)

$\begin{bmatrix} X1 \\ X2 \end{bmatrix} = \begin{bmatrix} -2 & -3 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} X1 \\ X2 \end{bmatrix} + \begin{bmatrix} 3 \\ 5 \end{bmatrix} U \quad Y = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} X1 \\ X2 \end{bmatrix}$ with D=0 obtain its transfer function.

7 a) System with unity feedback having open loop transfer function $G(S) = \frac{K(S+1)}{S^3 + aS^2 + 2S + 1}$ oscillates with frequency of 2 rad/sec. Find the values of K_{mar} and a . (10)

b) Define the terms Break-in point and Break-Away point. (4)

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