Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EC409

Course Name: CONTROL SYSTEMS

Max. Marks: 100 Duration: 3 Hours

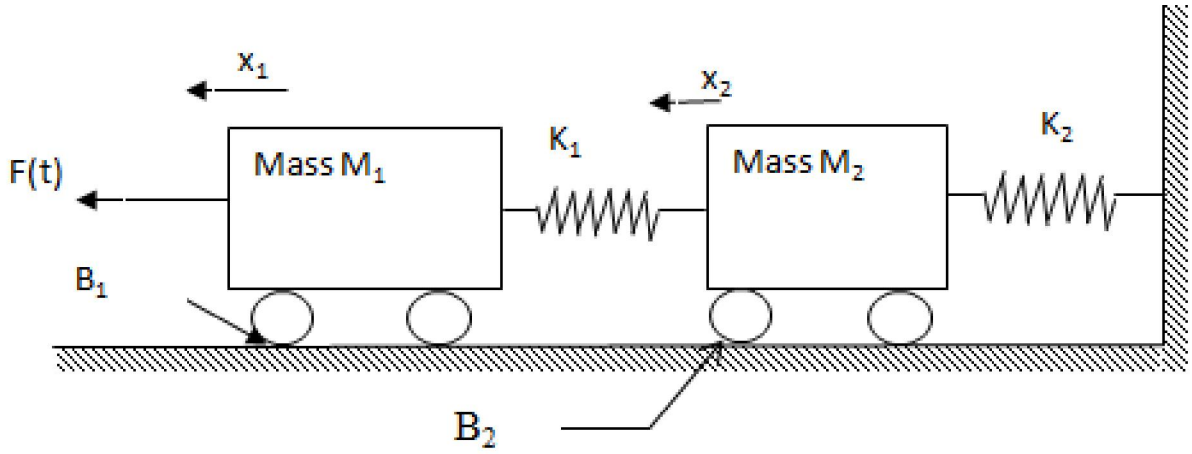
PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Draw the signal flow graph for the following sets of algebraic equations. (5)

$x_1 = ax_0+bx_1+cx_2$, $x_2 = dx_1+ex_3$, $x_3= fx_0+gx_2$, $x_4 = hx_3$

b) Find the transfer function $\frac{X2(S)}{F(S)}$.Also draw the force voltage analogy of the given system (10)

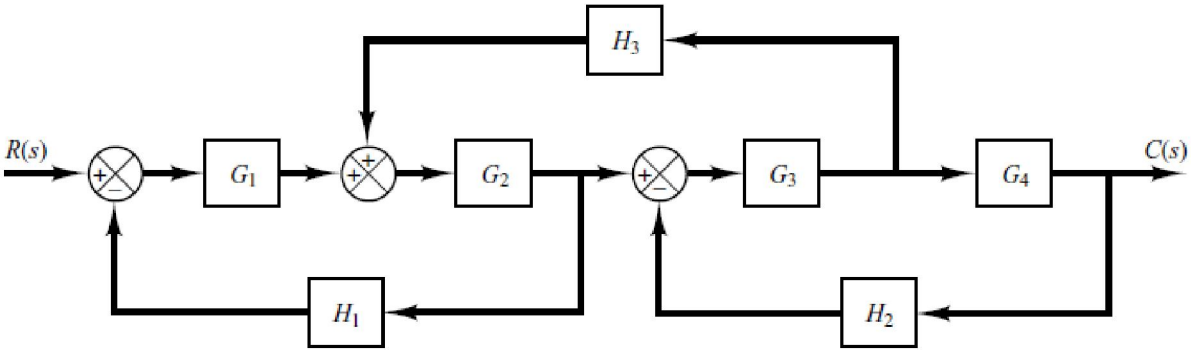


2 a) Explain how the overall transfer function of a system can be found by using Mason's gain formula. (5)

b) Derive an expression for peak time of a second order system. (5)

c) Derive an expression for time response of a second order under damped system to step input. (5)

3 a) Find the transfer function of the given system using block reduction technique. Verify the result using Mason's gain equation (10)



b) Determine the step, ramp and parabolic error constants for the unity feedback control system. (5)
$G(S) = \frac{10(S+2)}{(S+1)s^2}$

PART B
Answer any two full questions, each carries 15 marks.

4 a) Using Routh Hurwitz criterion, determine the number of roots in the right half of S-plane (5)
$S^4+2S^3+10S^2+20S+5=0$

b) Sketch the root locus for $G(s)H(s) = \frac{K}{s(s+6)(s^2+4s+13)}$ (10)

5 a) Compare PI,PD and PID controllers. (5)

b) Plot the Bode diagram for the following transfer function and find the Gain margin and Phase margin. (10)

$$G(S) = 10/ S(1+0.4S) (1+0.1S)$$

6 a) Draw the Nyquist plot for the system whose open loop transfer function is (8)
$G(s)H(s) = \frac{K}{s(s+2)(s+10)}$. Determine the range of K for which the closed loop system is stable.

b) Describe the design procedure of a lead compensator. (7)

PART C
Answer any two full questions, each carries 20 marks.

7 a) A dynamic system s represented by the state equation. (5)

$$X=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & -2 & -3\end{bmatrix} \quad X + \begin{bmatrix}0\\0\\1\end{bmatrix} r$$

Check whether the system is completely controllable.

b) What is transfer matrix of a control system? Derive the equation for transfer matrix. (7)

c) Obtain the state model for the given transfer function (8)

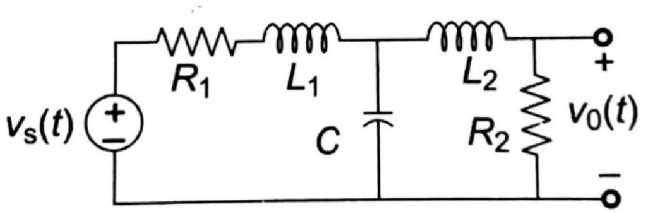
$$\frac{Y(s)}{U(s)} = \frac{1}{s^2+s+1}$$

8 a) State initial and final value theorem for Z transform (5)

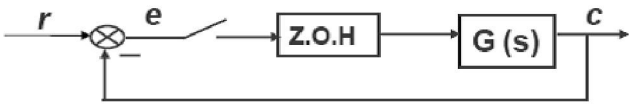
b) Derive the expression for pulse transfer function of a zero order hold system (7)

c) Determine the state transition matrix of $A=\begin{bmatrix}0 & 1\\ 0 & -2\end{bmatrix}$ (8)

9 a) Represent the electrical network shown in fig a in state model in physical variable form (10)



b) For the sampled data control system shown if Fig, find the response to unit step input where (10)



$G(s)=\frac{1}{(s+1)}$ T-1 sec

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