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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: EE484

Course Name: Control Systems

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1 Define transfer function of a system. What are the disadvantages of transfer function analysis. (5)

2 Explain the working of dc tachometer (5)

3 Draw the typical step response of a second order under damped system with all time domain specifications. Define rise time, settling time and maximum overshoot. (5)

4 Explain the effect of addition of poles and zeros to a system. (5)

5 The open loop transfer function of a unity feedback system is given by $G(s) = \frac{k}{s(2s+1)(s+1)}$. Find the gain margin of the system. (5)

6 What is meant by frequency response of a system? What are the different frequency domain specifications? (5)

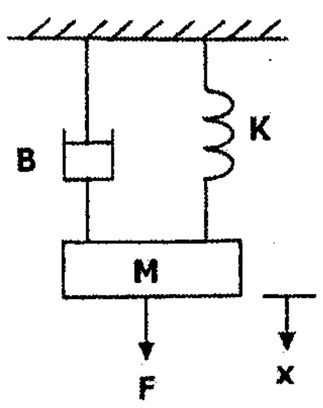
7 Define state and state variable. What is a state diagram ? (5)

8 Determine the state space representation of the system represented by the differential equation $\frac{d^3y}{dt^3} + \frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 8y = 10\,u(t)$ (5)

PART B

Answer any two full questions, each carries 10 marks.

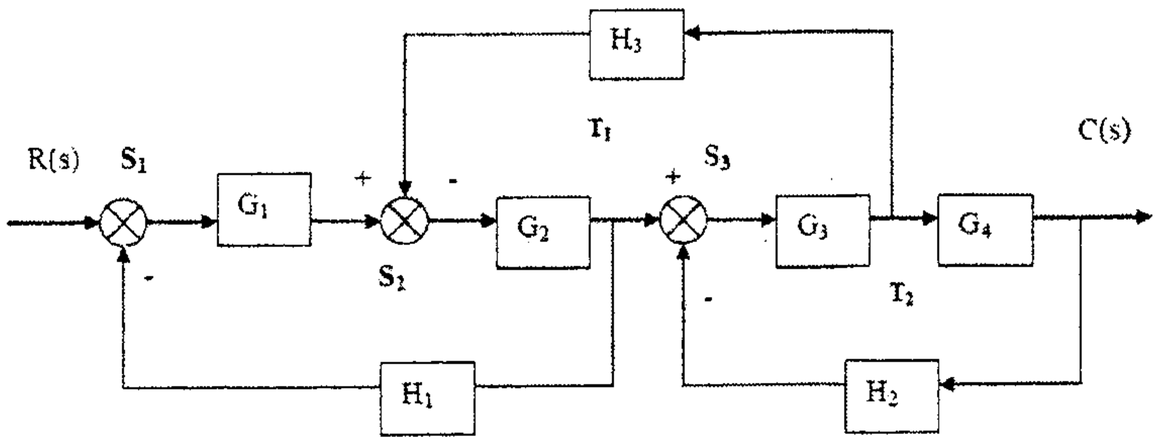
9 a) Write the differential equations governing the mechanical system shown in figure (5)



Draw the analogous electrical network based on Force - Current Analogy

b) Explain the principle of operation of Gyroscope (5)

10 Find the overall transfer function C(s)/R(s) of the given figure using Mason's gain formula (10)



11 Explain the constructional details and working of a field controlled DC servo motor. (10)

PART C

Answer any two full questions, each carries 10 marks.

12 a) Derive the expression for the unit step response of first order system. . How time constant affects the speed of response of the system. (5)

b) Explain the concept of stability in control systems. (5)

13 a) For a unity feedback control system the open loop transfer function $G(S) = \frac{10(s+2)}{s^2(s+1)}$ (5)

Find the steady state error ,when the input $R(s) = \frac{3}{s} - \frac{2}{s^2}$

b) By Routh stability criterion determine the stability of the system represented by the characteristic equation $10s^3-s^2-9s-10 = 0$. (5)

14 Sketch the Root locus of a unity feedback system with open loop transfer function is $G(s)H(s) = \frac{K}{s(s+1)(s+3)}$ (10)

Find the value of K so that the damping ratio of the closed loop system is 0.7.

PART D

Answer any two full questions, each carries 10 marks.

15 The open loop transfer function of a unity feedback system is given by $G(s) = \frac{1}{s(1+s)(1+2s)}$. Sketch the polar plot and determine the gain margin and phase margin. (10)

16 a) Define phase margin and gain margin, with the help of bode plot. (4)

b) A feedback system has a closed loop transfer function $T(s) = \frac{10(s+4)}{s(s+1)(s+3)}$ (6)

Obtain the state space representation of the system .

17 a) Derive the expression for transfer function of a system from state space representation. (4)

b) Consider a single input single output system whose state variable description is given by (6)

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -12 & -8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [8 \quad 1] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Obtain the Eigen values and Eigen vectors of the system.

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