A

06000MR301122003

Pages: 3

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree (S, FE) Examination January 2023 (2015 Scheme)

Course Code: MR301

Course Name: LINEAR CONTROL SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

1 Define open loop and closed loop system? Derive the transfer function of closed loop system. (5)

2 Write the differential equations of basic elements used in a mechanical translational system? (5)

3 The closed loop transfer function of second order system is (5)

$$\frac{C(s)}{R(s)} = \frac{10}{s^2 + 6s + 10}$$

What is the type of damping in the system?

4 Discuss about the advantages and limitations of Routh's criterion? (5)

5 What is Bode plot? Write down the advantages of Bode plot? (5)

6 Define gain margin and phase margin. (5)

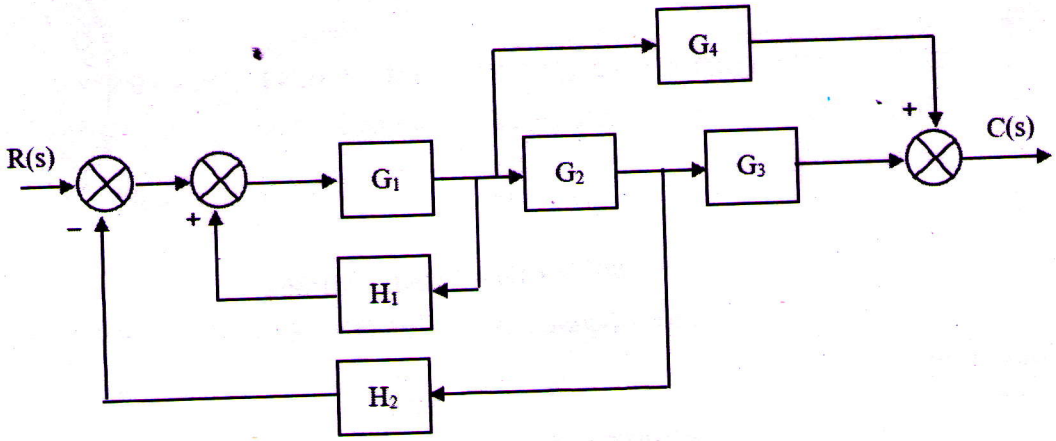
7 Draw the pole-zero plot of a lead-lag compensator? Mention the advantages of a lead-lag compensator (5)

8 What is a controller? Why controllers are important in control system. (5)

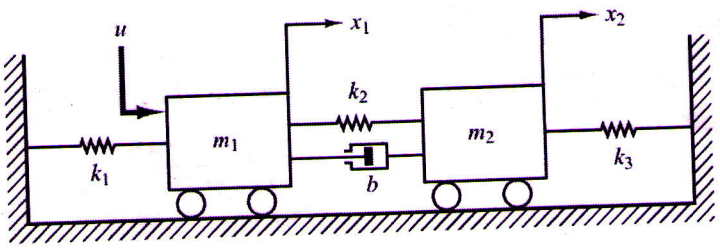
PART B

Answer any three questions, each carries 10 marks.

9 Find the closed-loop transfer function of the following system through block-diagram simplification (10)



10 Obtain the transfer functions $\frac{X_1(s)}{U(s)}$ and $\frac{X_2(s)}{U(s)}$ of the mechanical system shown in figure (10)



11 Derive the expression for time response of a underdamped second order system (10)

12 The characteristic equation of a system is given as follows. (10)

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$$

Comment on the stability of the system

13 A unity feedback system has an open loop transfer function (10)

$$\frac{K(s + 1.5)}{s(s + 1)(s + 5)}$$

Sketch the root locus

PART C

Answer any two questions, each carries 15 marks.

14 Sketch Bode diagram and obtain the gain and phase cross over frequency for the following transfer function. (15)

$$\frac{100(s+10)}{s(s+2)(s+5)}$$

15 Sketch the polar plot of a unity feedback system whose open loop transfer function is given below. (15)

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

Determine the phase margin and gain margin.

16 Explain in detail about PD,PI, PID controllers (15)

17 a) Discuss about the Lead , Lag Compensators (10)

b) Explain the automatic traffic light control with necessary sketch. (5)

****