

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EE303

Course Name: LINEAR CONTROL SYSTEMS (EE)

Max. Marks: 100

Duration: 3 Hours

Graph sheet and semi-log sheets will be supplied. Assume any missing data.

PART A

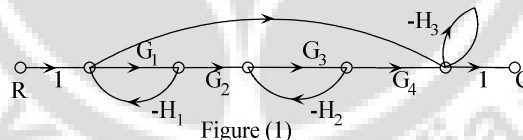
Answer all questions, each carries 5 marks.

- 1 Distinguish between open loop system and closed loop system. (5)
- 2 Obtain the transfer function of an AC tachogenerator. (5)
- 3 A unity feedback system has a open loop transfer function of $G(s) = \frac{10}{(s+1)(s+2)}$. Determine the steady state error for unit step input. (5)
- 4 What is angle criterion referred to root locus? (5)
- 5 Define gain margin and phase margin of a system. (5)
- 6 Determine the phase cross over frequency of a system with open loop transfer function $G(s) = \frac{1}{s(1+2s)(1+s)}$. (5)
- 7 Write a short note on Nichols chart. (5)
- 8 Explain the Nyquist stability criterion. (5)

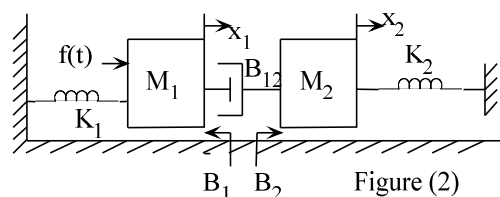
PART B

Answer any two full questions, each carries 10 marks.

- 9 a) Obtain the force voltage analogy of a general mechanical translation system. (5)
- b) Find the overall transfer function of the signal flow graph shown in Figure (1) using Mason's gain formula. (5)



- 10 a) Obtain the transfer function of an armature controlled DC motor. (5)
- b) The forward path transfer function of a unity feedback control system is given by $G(s) = \frac{2}{s(s+3)}$. Obtain an expression for unit step response of the system. (5)
- 11 a) Explain the effect of time constant on the speed of time response of a control system. (4)
- b) Obtain the electrical analogous of the mechanical system shown in Figure (2). Use force-voltage analogy. (6)



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PART C*Answer any two full questions, each carries 10 marks.*

- 12 a) For a unity feedback control system with the open loop transfer function (5)

$$G(s) = \frac{10(s+5)}{s^2(s+1)}$$

Find the position, velocity and acceleration error coefficients.

- b) Using Routh-Hurwitz criterion determine the relation between K and T so that unity feedback control system whose open loop transfer function given below is stable. (5)

$$G(s) = \frac{K}{s[s(s+20)+T]}$$

- 13 a) Explain the effect of addition of poles and zeros on the nature of root locus. (4)
 b) Sketch the root locus for the open loop transfer function of a unity feedback system given below, (6)

$$G(s) = \frac{K}{s(s+1)(s+3)}$$

- 14 a) Determine the stability of the system whose overall transfer function is given below (5)

$$G(s) = \frac{2s+5}{s^5+1.5s^4+2s^3+4s^2+5s+10}$$

- b) Explain the nature of time response of a second order system according to the location of roots of the characteristic equations. (5)

PART D*Answer any two full questions, each carries 10 marks.*

- 15 a) Explain any three frequency domain specifications of a control system. (3)

- b) The open loop transfer function of system is given by

$$G(s) = \frac{10}{s(0.4s+1)(0.1s+1)}$$

Draw the bode plot and obtain the gain and phase cross over frequencies. (7)

- 16 a) Explain the steps involved in obtaining the polar plot. (3)

- b) The open loop transfer function of a unity feedback system is given by (7)

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

Sketch the polar plot and determine the gain margin and phase margin.

- 17 a) Define the phase cross over frequency and gain cross over frequency of a system. (5)

- b) Differentiate between minimum phase and non-minimum phase system with suitable examples. (5)
