Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: EE303

Course Name: LINEAR CONTROL SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks.

Marks

1 Define transfer function and derive the transfer function of an RC network. (5)

2 With the help of a neat diagram, explain the various time domain specifications. (5)

3 The open loop transfer function of a unity feedback system is $\frac{9}{(s+1)}$ Using dynamic error coefficients, find an expression for an error if the input r (t) = 1 + 2t +1.5 t^2. (5)

4 The open loop transfer function of a unity feedback system is $\frac{K}{s-4}$. (5)

Find the closed loop poles when k = 0, 1, 2, 3…..10 and mark it on the s- plane. Hence draw the root locus of the system.

5 Explain Gain margin and Phase margin with the help of bode plot. Mark gain crosses over frequency and phase cross over frequency. (5)

6 With the help of suitable figure explain frequency domain specifications? (5)

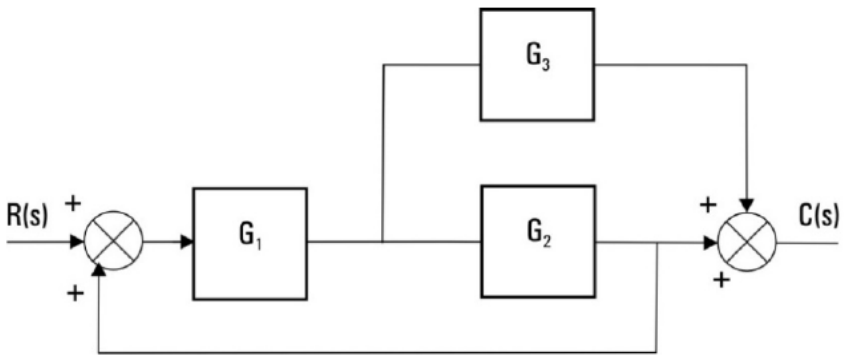
7 Give two examples of non-minimum phase transfer function. Explain why they are called non-minimum phase system? (5)

8 Give a physical example of transportation lag. How can it be represented? (5)

PART B

Answer any two full questions, each carries10 marks.

9 a) Consider the block diagram given in figure below. Draw the signal flow graph corresponding to the block diagram. Find the overall transfer function using Masons Gain Formula. (6)



b) Verify your answer using Block diagram reduction techniques. (4)

10 a) Explain the constructional features and principle of operation of a synchro? (5)

b) What are the advantages of stepper motor? List two applications of the stepper motor? (5)

11 a) Find the step response of a system with transfer function (6)

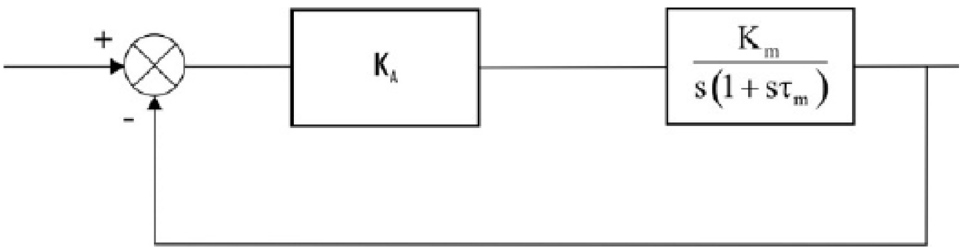
$\frac{4}{s(s+b)+4}$ If b=4 and b =5. Also find the effect of b on damping ratio?

b) With the help of a circuit diagram explain Force – Voltage and Force – Current analogy? (4)

PART C

Answer any two full questions, each carries10 marks.

12 a) Consider the system given in figure below. Given K_m = 2 and T_m = 1. If K_A =1 find steady state error to step, ramp and acceleration input. (7)



b) What will happen to steady state errors if K_A is increased to 10? (3)

13 a) Explain the significance of angle and magnitude criterion in root locus? (5)

b) Consider a system with characteristic equation $a_0s^3 + a_1 s^2 + a_2s + a_3 = 0$; given all coefficients are positive. Derive a sufficient condition for stability. (5)

14 a) The open loop transfer function of a unity feedback system is (2)

$$\frac{10K}{s(s^2+2s+2)}$$

Find the open loop poles?

b) Draw the root locus. Find the range of values of K for which the system is stable. Find all the closed loop poles corresponding to a damping ratio of 0.7 (8)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Sketch the bode plot and find the gain crossover frequency for given (6)

$$G(s)H(s) = \frac{10}{s(s+5)}$$

b) Given (4)

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

Find $\angle G(j\omega)$ at ω = 0

16 The open loop transfer function of a unity feedback system is (6)

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

Draw the Bode plot and find Gain margin and phase margin?

(4)

17 The open loop transfer function of a unity feedback system is (10)

$$\frac{2K}{s(s+1)(s+2)}$$

Investigate the stability of the system if K =1 using Nyquist stability criteria. Find the range of values of K for which the system is stable

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