

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 carries 5 marks.

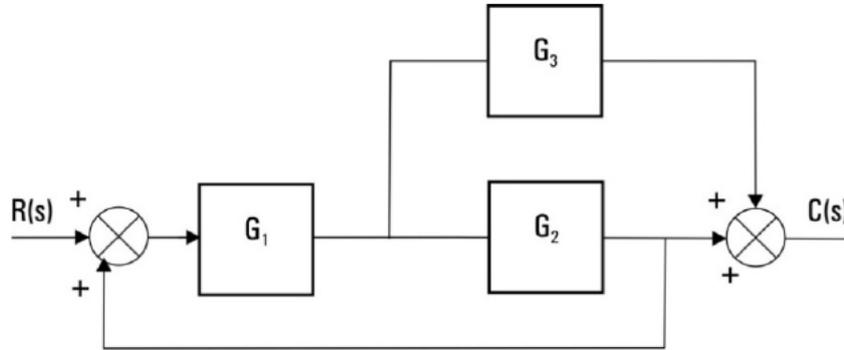
Marks

- | | | |
|---|---|-----|
| 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 $r(t) = 1 + 2t + 1.5t^2$. | (5) |
| 4 | The open loop transfer function of a unity feedback system is $\frac{K}{s-4}$. Find the closed loop poles when $k = 0, 1, 2, 3, \dots, 10$ and mark it on the s- plane. Hence draw the root locus of the system. | (5) |
| 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 carries 10 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)

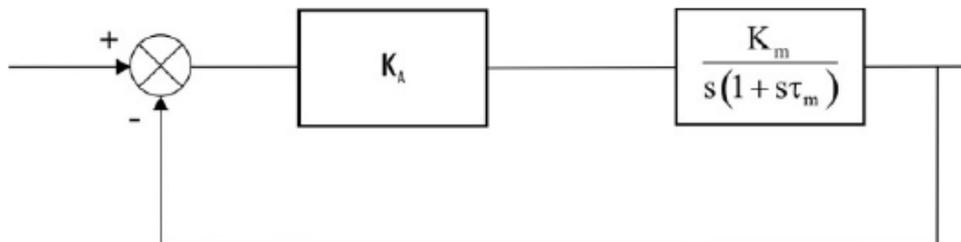


- b) Verify your answer using Block diagram reduction techniques. (4)
- 10 a) Explain the constructional features and principle of operation of a synchro? (5)
- b) What are the advantages of stepper motor? List two applications of the stepper motor? (5)
- 11 a) Find the step response of a system with transfer function $\frac{4}{s(s+b)+4}$ If $b=4$ and $b=5$. Also find the effect of b on damping ratio? (6)
- b) With the help of a circuit diagram explain Force – Voltage and Force – Current analogy? (4)

PART C

Answer any two full questions, each carries 10 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 $a_0s^3 + a_1s^2 + a_2s + a_3 = 0$; (5)
given all coefficients are positive. Derive a sufficient condition for stability.
- 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. (8)
Find all the closed loop poles corresponding to a damping ratio of 0.7

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 $\omega = 0$
- 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
