Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EE303

Course Name: LINEAR CONTROL SYSTEMS

Max. Marks: 100 Duration: 3 Hours

(Graph sheets and semi-log graph sheets will be provided)

PART A

Answer all questions, each carries 5 marks Marks

1 Give a comparison between open loop and closed loop control systems. Give an example for each. (5)

2 Explain the working of an AC Tachogenerator with a schematic diagram. (5)

3 For a closed loop system with G(s) = 1/(s+5) and H(s) = 5, calculate the generalized error coefficients. (5)

4 What is a root locus? What are the information obtained from a root locus? (5)

5 Derive an expression for resonant frequency and resonant peak of a second order system. (5)

6 Explain Gain margin and Phase margin. (5)

7 State and explain Nyquist stability criterion. (5)

8 Write notes on the following: (5)
i) Non-minimum phase systems ii) Transportation lag.

PART B

Answer any two full questions, each carries 10 marks

9 Derive the transfer function of an armature-controlled dc motor driving a load consisting of inertia and friction. Also draw the block diagram. (10)

10 a) Sketch the unit step response of an under damped second order system and mark various time domain specifications. (3)

b) Obtain the closed loop transfer function C(s)/R(s) using Mason's gain formula for a system whose signal flow graph is shown in Fig.1. (7)

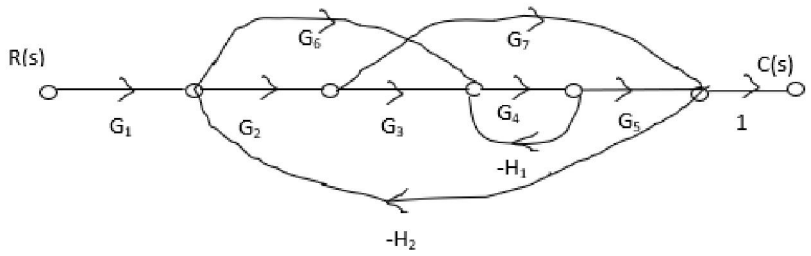

Fig.1

11 a) Derive an expression for peak time and settling time of an under damped second order system. (7)

b) A unity feedback control system is characterized by an open loop transfer function (3)

$G(s) = \frac{K}{s(s+10)}$ .Determine the gain K so that the system will have a damping ratio of 0.5

PART C

Answer any two full questions, each carries 10 marks

12 a) For the system shown in Fig.2, find the static error coefficients. Also find the steady state error for an input of 2u(t). (7)

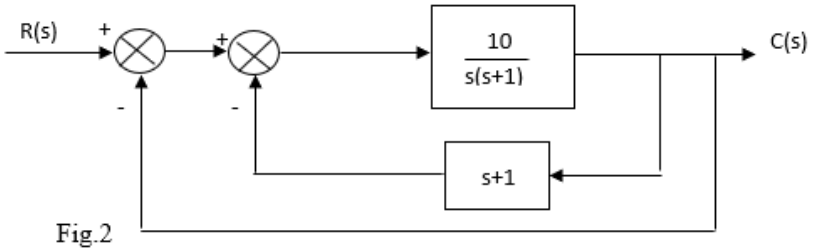

Fig.2

b) Explain the effect of adding a pole to a system on time response. (3)

13 Ascertain stability of the system whose characteristic equation is (10)

$s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$

Also find the number of roots lying on the left half, right half and imaginary axis of the s-plane.

14 Sketch root locus for a system with (10)

$$G(s)H(s) = \frac{K}{s(S+2)(s^2+2s+2)}$$

Hence determine the range of K for the system stability.

PART D

Answer any two full questions, each carries 10 marks

15 Construct bode plot for the system whose open loop transfer function is (10)

$$G(s)H(s) = \frac{4}{s(1+0.5s)(1+0.08s)}$$

Determine the following:

i) Gain margin ii) Phase margin iii) Closed loop stability

16 Sketch the polar plot of a unity feedback control system having an open loop transfer function (10)

$$G(s) = \frac{K}{s(1+0.5s)(1+4s)}$$

Also determine the value of K so that:

i) Gain margin is 20dB ii)Phase margin is 30^0

17 Draw Nyquist plot for the system whose open loop transfer function is (10)

$$G(s)H(s) = \frac{K}{s(S+2)(s+10)}$$

Determine the range of K for which the closed loop system is stable

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