Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DEC 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 Explain Mason's gain formula? (5)

2 Obtain the unit step response of first order system? (5)

3 A unity feedback system has an open loop transfer function $\frac{20(s+5)}{s^2(s+0.1)(s+3)}$. (5)

Determine steady state error for unit parabolic input?

4 Explain the effect of adding poles and zeros on root locus? (5)

5 Sketch the bode plot for given $G(s)H(s)=\frac{10}{s(s+2)}$ without using semi log sheet? (5)

6 Explain about frequency domain specifications? (5)

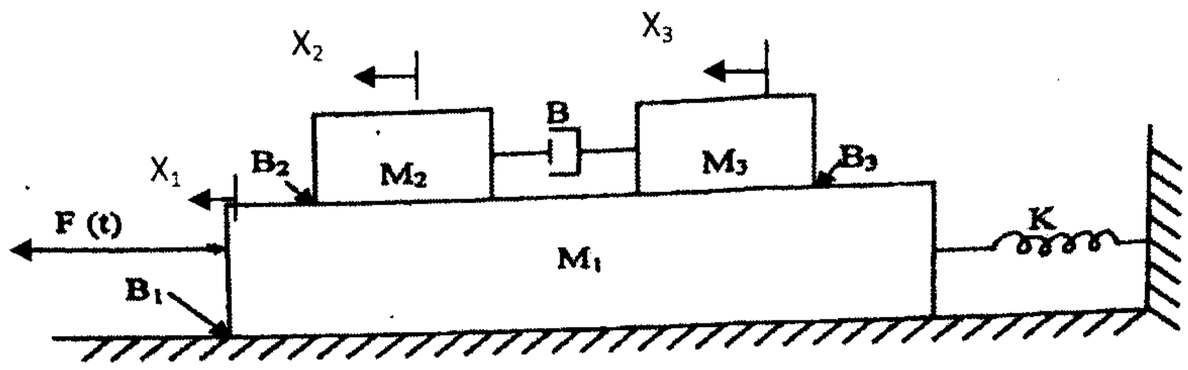
7 Draw the polar plot of type 0 second order system? (5)

8 Explain transportation lag and non-minimum phase systems? (5)

PART B

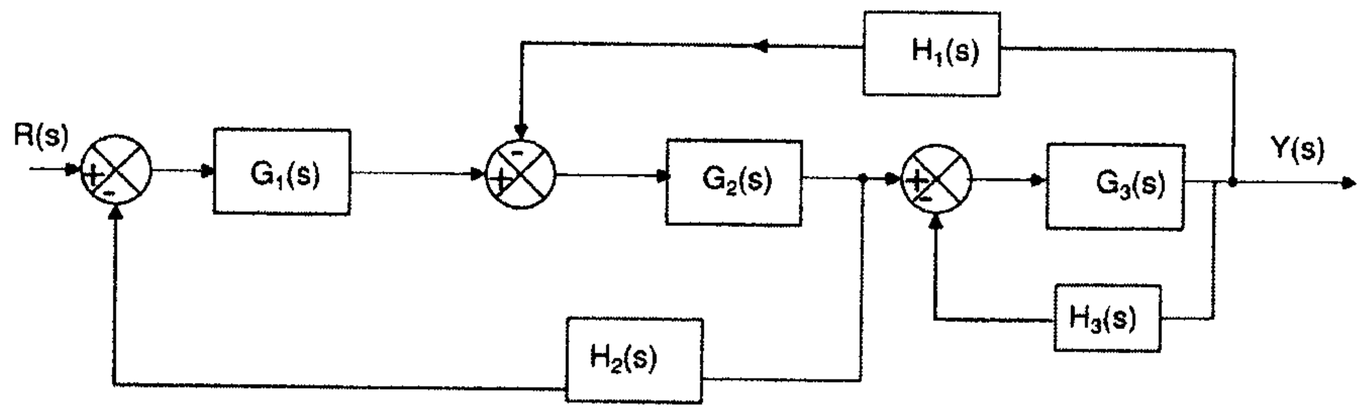
Answer any two full questions, each carries10 marks.

9 a) Write the differential equations governing the mechanical system and hence draw the electrical analogous circuit using F-V analogy and F-I analogy (6)



b) Derive the transfer function of an armature controlled dc motor with block diagram? (4)

10 a) Obtain the overall transfer function using block reduction techniques? (6)



b) What are the standard test signals used for time domain analysis? (4)

11 a) Derive the expression for maximum peak overshoot, rise time and peak time of a second order system for a step input? (6)

b) Explain the construction and working principle of a synchro - transmitter? (4)

PART C

Answer any two full questions, each carries10 marks.

12 a) Evaluate the static error coefficients and steady state error for a unity feedback system having a forward path transfer function $\frac{50}{s(s+10)}$ for the input $r(t)=1+2t+t^2$ (6)

b) Explain important rules for root locus? (4)

13 Sketch the root locus for a unity feedback system with open loop transfer function $\frac{k}{s(s+2)(s+3)}$ and find the range of k for the system to exhibit sustained oscillations? (10)

14 a) Find the location of roots of the characteristic equation $s^6+4s^5+3s^4-16s^2-64s-48=0$ in LHS, RHS and imaginary axis. (5)

b) Determine (i) type (ii)error constants (iii) steady state error for the parabolic input if the open loop transfer function is $\frac{12(s+2)}{s^2(s^2+7s+12)}$ (5)

PART D

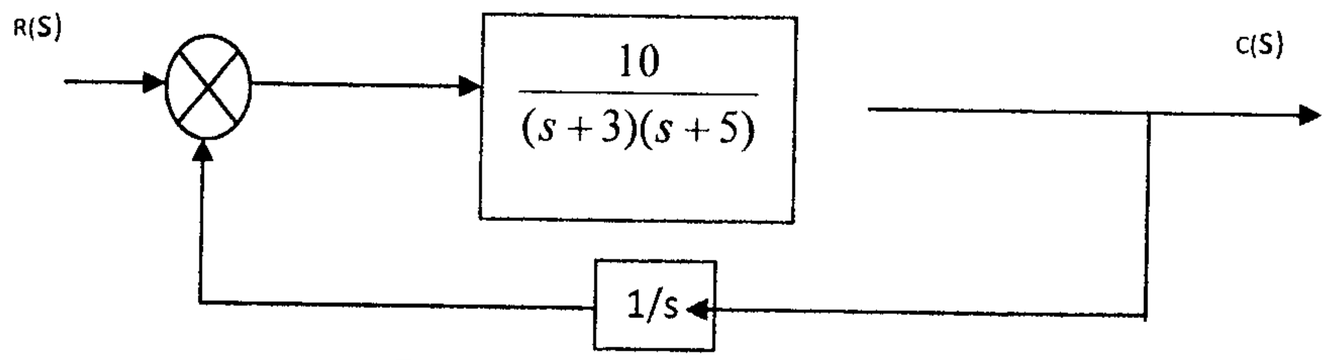
Answer any two full questions, each carries 10 marks.

15 a) Sketch the polar plot for the following transfer function $\frac{10}{s(1+s)(1+0.05s)}$. (6)

b) Explain gain margin and phase margin of a system using Bode plot? (4)

16 Find the value of open loop gain k for $G(s)H(s)=\frac{k}{s(1+0.1s)(1+s)}$ so that the system has a) phase margin of 60° b) gain margin 15 dB using Bode plot (10)

17 For the system shown in figure determine the stability using Nyquist plot. (10)



****