Reg No.:	Name:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DEC 2019

Course Code: EE303

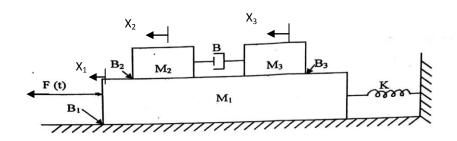
Course Name: LINEAR CONTROL SYSTEMS

Max. Marks: 100 **Duration: 3 Hours PART A** Marks Answer all questions, each carries 5 marks. 1 Explain Mason's gain formula? (5) 2 Obtain the unit step response of first order system? (5) 3 (5) A unity feedback system has an open loop transfer function 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) Explain about frequency domain specifications? 6 (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

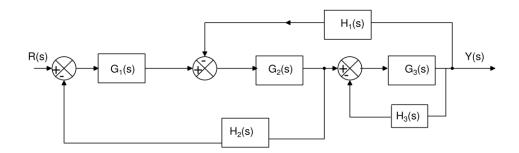
Answer any two full questions, each carries 10 marks.

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



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

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 (6) second order system for a step input?
 - b) Explain the construction and working principle of a synchro transmitter? (4)

PART C

Answer any two full questions, each carries 10 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 $r(t)=1+2t+t^2$
 - b) Explain important rules for root locus? (4)
- Sketch the root locus for a unity feedback system with open loop transfer (10) function $\frac{k}{s(s+2)(s+3)}$ and find the range of k for the system to exhibit sustained

oscillations?

- 14 a) Find the location of roots of the characteristic equation (5) $s^{6}+4s^{5}+3s^{4}-16s^{2}-64s-48=0 \text{ in LHS, RHS and imaginary axis.}$
 - b) Determine (i) type (ii)error constants (iii) steady state error for the parabolic (5) input if the open loop transfer function is $\frac{12(s+2)}{s^2(s^2+7s+12)}$

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

