

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

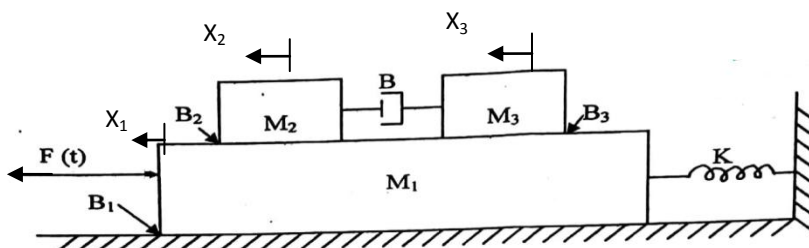
Answer all questions, each carries 5 marks.

- | | | 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 $\frac{20(s+5)}{s^2(s+0.1)(s+3)}$. Determine steady state error for unit parabolic input? | (5) |
| 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

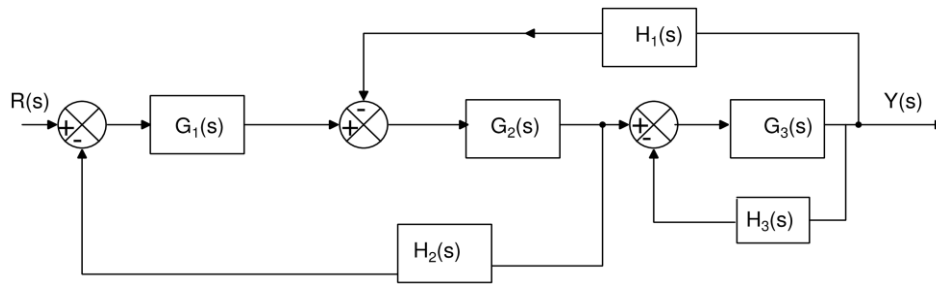
Answer any two full questions, each carries 10 marks.

- 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 (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 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 $r(t)=1+2t+t^2$ (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)

