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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DEC 2019

Name:

Course Code: EE303

Course Name: LINEAR CONTROL SYSTEMS

Max. M	larks: 100 Duration: 3	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 (6) 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?

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



- b) What are the standard test signals used for time domain analysis? (4)
- 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 carries10 marks.

- 12 a) Evaluate the static error coefficients and steady state error for a unity feedback (6) 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)
- 13 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) $s^{6}+4s^{5}+3s^{4}-16s^{2}-64s-48=0$ 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 $\frac{12(s+2)}{s^2(s^2+7s+12)}$

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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 (10) system has a) phase margin of 60° b) gain margin 15 dB using Bode plot

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

