Reg No.:_______________ Name:___________________________

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Regular and Supplementary Examination December 2020

Course Code: EE303

Course Name: LINEAR CONTROL SYSTEMS

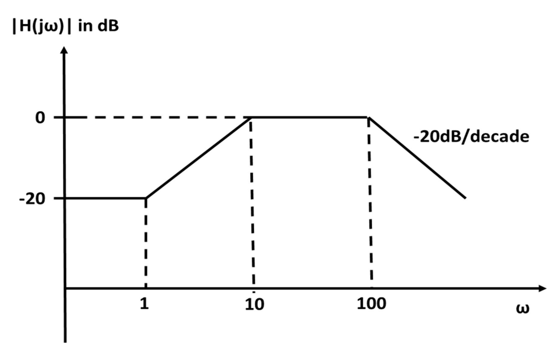
Max. Marks: 100 Duration: 3 Hours

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

PART A

Answer all questions, each carries5 marks. Marks

1	Obtain the transfer function of series RLC circuit. Take voltage across capacitor as the output voltage.	(5)
2	Explain the working principle of a synchro used as an error detector in a control circuit.	(5)
3	Consider a unity feedback system with transfer function $G(s) = \frac{50K}{s(s+5)(s+2)}$.Find the velocity error constantof the system with K=1. What will be the velocity error constant of the same system after adding a zero at s = -4?	(5)
4	How is the root locus technique useful in the analysis of a control system?	(5)
5	How gain margin and phase margin values help in studying relative stability of a system?	(5)
6	The asymptotic bode plot of a transfer function is shown in figure. Obtain the transfer function G(s) corresponding to this bode plot.	(5)



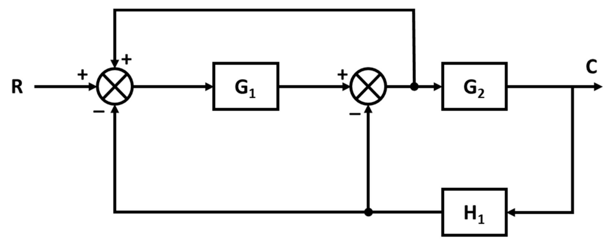
7	Write a short note on Nichols chart.	(5)

8 Differentiate between minimum phase and non-minimum phase system with suitable examples (5)

PART B

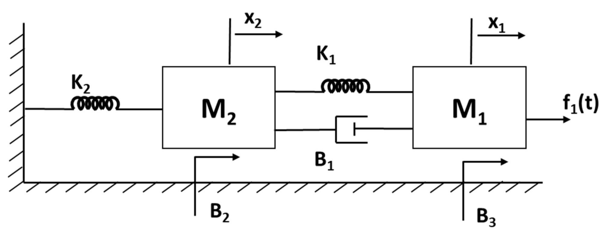
Answer any two full questions, each carries10 marks.

9 a) Obtain the overall transfer function of the system shown in figure using block reduction techniques. (5)



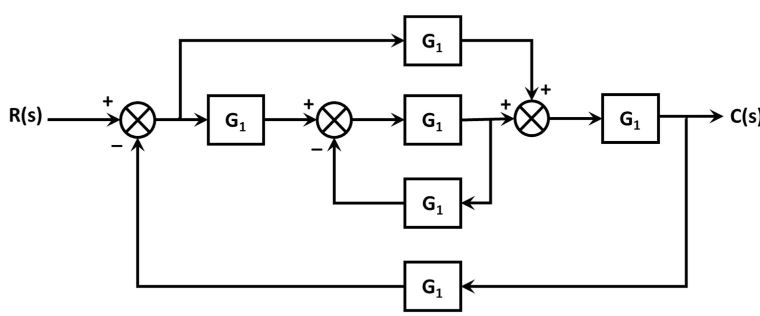
b) Obtain the transfer function of an armature-controlled DC motor. (5)

10 a) For the mechanical system shown in figure write the equilibrium equations and obtain electrical analogous circuit using force-voltage analogy. (5)



b) For a control system with negative feedback $G(s) = \frac{a}{s^2}$, $H(s) = 1 + bs$. Find the value of a and b so that peak overshoot = 6% and peak time = 1 sec when a unit step is applied to the system. (5)

11 a) For the system shown in figure obtain the closed loop transfer function C(s)/R(s) using Mason's gain formula. (6)



b) Briefly explain the effect of damping ratio on time response of a second order system. (4)

PART C

Answer any two full questions, each carries10 marks.

12 a) Using Routh-Hurwitz criterion find the number of poles on the left half of s-plane and comment on the stability of the system with characteristic equation $F(s) = s^6 + 4s^5 + 12s^4 + 16s^3 + 41s^2 + 36s + 72$. (6)

b) The closed loop transfer function of a unity feedback system is given by $\frac{C(s)}{R(s)} = \frac{Ks+\beta}{s^2+\alpha s+\beta}$. Determine the steady state error for unit ramp input. (4)

13 a) Sketch root locus for a system with $G(s)H(s) = \frac{K}{s(s+2)(s^2+4s+8)}$. Find the value of K for sustained oscillation. (10)

14 a) Write a note on angle and magnitude condition of root locus. (5)

b) For a unity feedback system with open loop transfer function $G(s) = \frac{K(s+0.5)}{s(s+1)^2(s+0.25)}$. Find the value of K so that steady state error is to be kept less than 0.05 for an input of $r(t) = 2 + 5t$. (5)

PART D

Answer any two full questions, each carries 10 marks.

15 a) The open-loop transfer function of a unity feedback system is $\frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$. Use asymptotic approach to plot the bode diagram and determine gain margin and phase margin. Also comment about the stability. (10)

16 a) Sketch the polar plot of a unity feedback control system having an open loop transfer function $G(s) = \frac{10(s+2)}{s(s+1)(s+3)}$. (6)

b) What is transportation lag in control system? (4)

17 a) State and explain Nyquist stability criterion. (5)

b) Draw Nyquist plot for the system the open loop transfer function given below $G(s)H(s) = \frac{(s+0.5)}{s^2(s+1)(s+2)}$. Comment on the closed loop stability. (5)

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