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Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Fifth Semester B.Tech Degree Regular and Supplementary Examination December 2020

Course Code: MR301

Course Name: LINEAR CONTROL SYSTEMS

Max. Marks: 100   Duration: 3 Hours

(Graph sheet, Polar graph sheet, Semi-log graph sheet are to be provided)

PART A
Answer all questions, each carries 5 marks.   Marks

1	What is a closed loop system? Derive its transfer function.	(5)
2	Write the differential equations of mass, spring and dashpot elements in mechanical translational system?	(5)
3	What is steady state error? Derive the expression.	(5)
4	Show the relation between stability of a system and the coefficients of its characteristic equation.	(5)
5	Define gain margin and phase margin of a system.	(5)
6	What is a non minimum phase system?	(5)
7	Write a short note on lead compensation.	(5)
8	What is a PD controller? Obtain its transfer function.	(5)

PART B
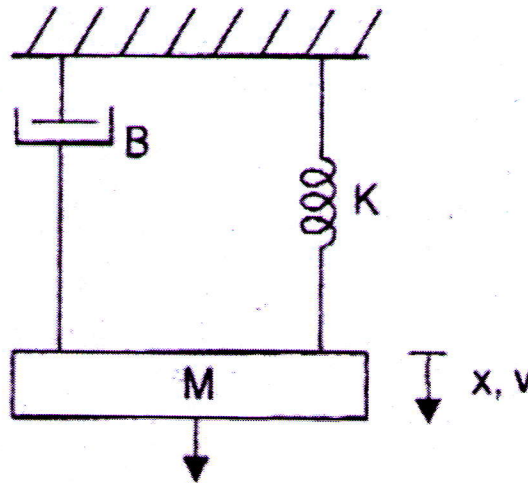*Answer any three questions, each carries 10 marks.*

9   a)   Define Mason's gain formula.   (3)

     b)   Find the overall gain C(s)/R(s) of the signal flow graph given below?   (7)
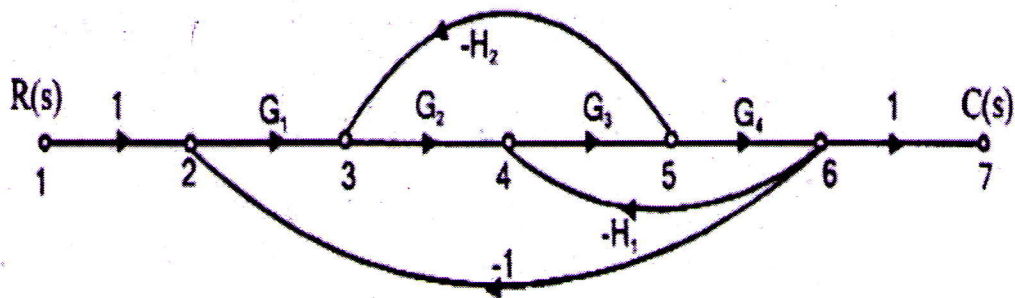
10   a)   Obtain the transfer function of the mechanical rotational system given below.   (5)
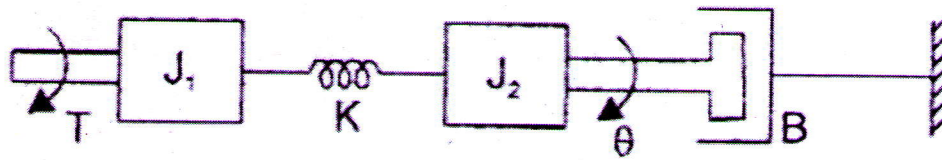
b) For the mechanical system given below, draw the force-voltage analogous circuit. (5)

11 a) The closed loop transfer function of a system is (4)

$$\frac{600}{(s+60)(s+10)}$$

Determine the undamped natural frequency and damping ratio?

b) A unity feedback system has a forward transfer function $G(s) = 50/s(s+10)$. Estimate (6) the steady state error of the system for the input $r(t)=1+2t+t^2$.

12 a) Construct Routh array and determine the stability of the system with characteristic (10) equation given as $s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$. Also find the location of poles in the s-plane.

13 a) A unity feedback control system has open loop transfer function (10)

$$G(s) = \frac{K}{s(s^2+4s+13)}$$

Sketch the root locus.

PART C
Answer any two questions, each carries 15 marks.

14 a) Sketch Bode diagram and obtain the gain and phase cross over frequency for the (15) following transfer function.

$$\frac{100(s+10)}{s(s+2)(s+5)}$$

15 a) Sketch the polar plot of a unity feedback system whose open loop transfer function is (15)

given below. Determine the phase margin and gain margin.

$$G(s) = \frac{1}{s(1+s)^2}$$

16 a) Explain about PI, PID controllers in detail and find their transfer functions.   (10)

b) Why compensation is necessary in feedback control system?   (5)

17 a) Explain automatic traffic control system and automatic street control system   (10)

b) Explain briefly about lead-lag compensation.   (5)

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