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Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019
Course Code: MR301
Course Name: LINEAR CONTROL SYSTEMS

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

Max. Marks: 100   Duration: 3 Hours

PART A
Answer all questions, each carries 5 marks.

Marks

1   Explain the Mason's gain formula with reference to signal flow graph technique   (5)

2   Write the force balance equation of ideal mass and dashpot element.   (5)

3   Find the position (K_P), velocity (K_V), and acceleration(K_a) error constants of unity feedback control system whose open loop transfer function is   (5)
$$G(S) = \frac{10(S+2)}{S^2(S+1)}$$

4   How Routh-Hurwitz Criterion is helpful for determining the stability of a control system?   (5)

5   Define gain margin and phase margin of a system.   (5)

6   Define any four frequency domain specifications used for the design of control system?   (5)

7   What are proportional derivative controllers? Derive the generalized transfer function of a PD controller.   (5)

8   What is a lead compensator? Draw its pole-zero plot.   (5)

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

9   Explain various time domain specifications of the system with necessary sketch.   (10)

10   Determine the differential equations governing the mechanical system shown in figure. Draw the force voltage and force current electrical analogous circuits by using force voltage and force current analogy.   (10)
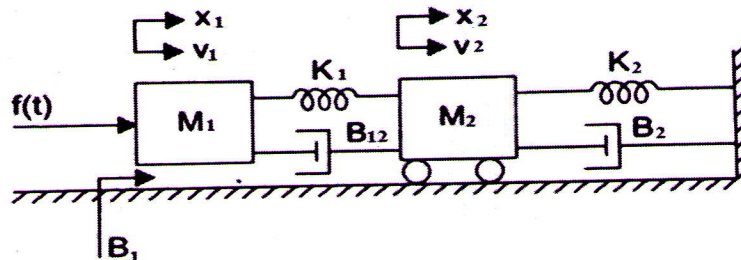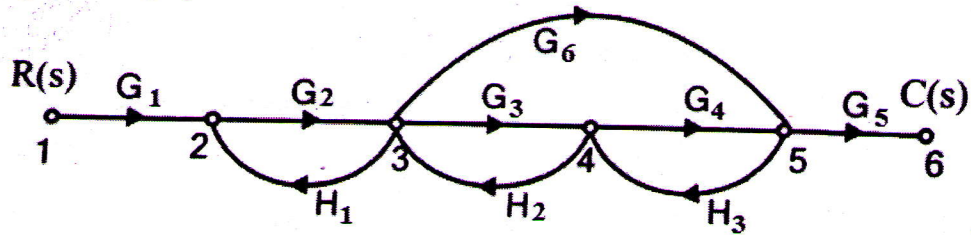
11 Determine the stability of the system represented by the characteristic equation (10) by using Routh stability criterion.

$$S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$$

Also comment the location of roots of characteristic equation.

12 Use Mason's Gain Formula to develop the transfer function of the following (10) signal flow graph.

13 Sketch the root locus of a unity feedback control system whose open loop transfer (10) function is

$$G(S) = \frac{K}{S(S+2)(S+4)}$$

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

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

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

Sketch the polar plot and determine the gain margin and phase margin.

15 Sketch Bode plot for the following transfer function and obtain the gain cross over (15) frequency.

$$G(s) = \frac{20}{s(1+3s)(1+4s)}$$

16 a) Explain about lag and lead compensators lag in detail (10)

b) Compare the features of various types of controllers used in control system. (5)

17 a) Explain automatic traffic light control with necessary sketches. (10)

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