

Reg No.: _____

Name: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree (S,FE) Examination January 2022 (2018 Scheme)



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.

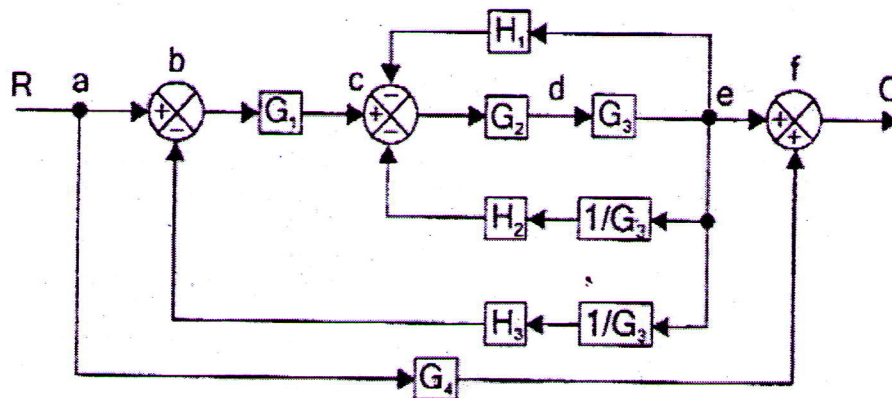
Marks

- 1 Derive the transfer function of RLC circuit. (5)
- 2 What are analogous systems? Give an example. (5)
- 3 Determine the unit step response of a first order system with closed loop transfer function $1/(1+sT)$? (5)
- 4 What are the advantages and limitations of Routh's criterion? (5)
- 5 What is Polar plot and write how to plot it on a polar graph? (5)
- 6 Define gain cross over frequency and phase cross over frequency. (5)
- 7 What is a PID controller? Obtain its Transfer function. (5)
- 8 What is a lag compensator? Draw its pole-zero plot. (5)

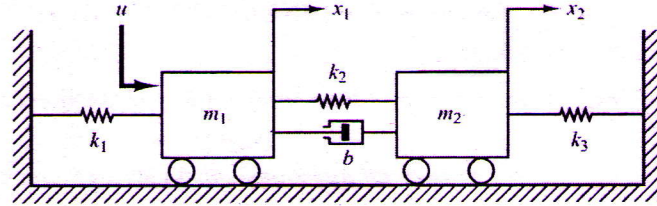
PART B

Answer any three questions, each carries 10 marks.

- 9 Convert the block diagram shown below to signal flow graph and find the transfer function of the system? (10)



- 10 a) Obtain the transfer functions $\frac{X_1(s)}{U(s)}$ and $\frac{X_2(s)}{U(s)}$ of the mechanical system shown in figure (10)



- 11 a) A unity feedback system has a forward transfer function $G(s) = K/s(s+10)$. Determine the gain 'K' so that the system will have a damping ratio of 0.5? (4)
- b) Find the minimum value of K, when input is $r(t) = 1+6t$, to get a steady state error $e_{ss} < 0.5$ for a unity feedback system with forward transfer function (6)

$$G(s) = \frac{K(2s+1)}{s(5s+1)(1+s^2)}$$

- 12 a) What is Routh stability criterion? (3)
- b) Determine the range of K for the stability of a unit feedback system whose open loop transfer function is (7)

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

- 13 a) Sketch the root locus of a unity feedback control system with open loop transfer function as (10)

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

PART C

Answer any two questions, each carries 15 marks.

- 14 a) Draw the bode plot and obtain the gain and phase cross over frequencies (15)

$$G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}$$

- 15 a) Sketch the polar plot of a unity feedback system whose open loop transfer function is given below. Determine the phase margin and gain margin (15)

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

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- 16 a) Explain automatic traffic light control with necessary sketches. (10)
b) Explain the need for cascade compensation in control system (5)
- 17 a) Design an automatic street light control system (7)
b) Discuss briefly about PI, PID controllers and find transfer functions (8)
