Reg No.:_____ Name:_____

1100MRT303122102

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Examination December 2021 (2019 scheme)

Course Code: MRT303

Course Name: LINEAR CONTROL SYSTEMS

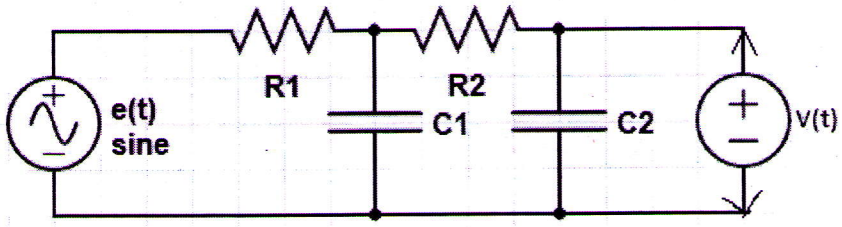
Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1 Mention any three advantages and disadvantages of closed loop systems. (3)

2 Obtain the transfer function of the given electrical network. (3)



3 Prepare a table showing analogous quantities in the torque - voltage and torque-current electrical analogy of mechanical rotational system. (3)

4 State D'Alembert's principle. Explain with an example. (3)

5 Draw the response of the first order system when it is excited with an impulse signal. (3)

6 Discuss the importance of test input signals. (3)

7 How is stability connected to location of poles? (3)

8 List various frequency domain specifications. (3)

9 What is the role of control system in mechatronics? (3)

10 Devise a way to solve offset error. (3)

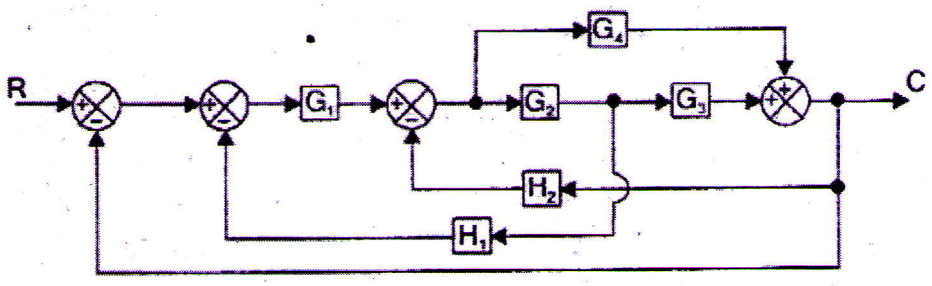
PART B

(Answer one full question from each module, each question carries 14 marks)

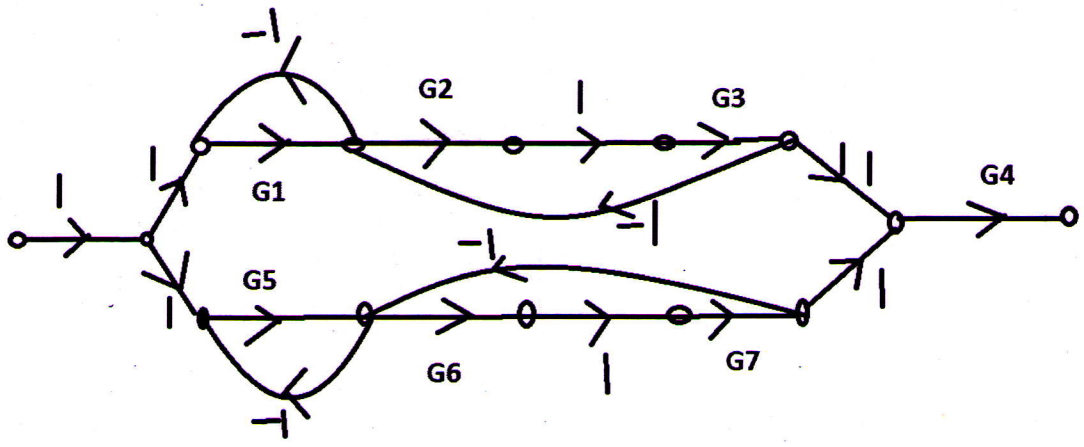
Module -1

11 a) Explain Masons gain formula and its significance. (4)

b) Determine the overall transfer function C(S)/R(S) for the system shown in figure. (10)



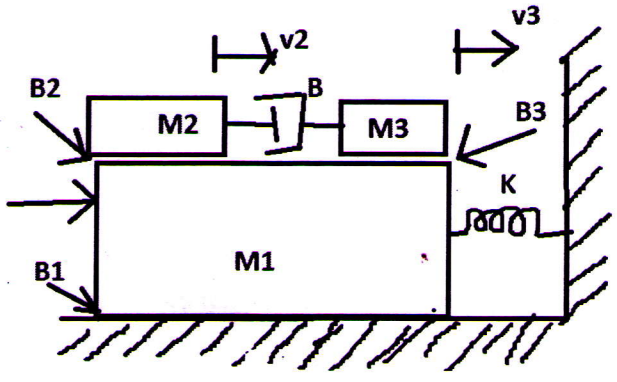
12 a) Consider the system shown in figure. Obtain the transfer function using Mason's gain formula. (14)



Module -2

13 a) Obtain the transfer function and develop the block diagram of armature-controlled DC motor (14)

14 a) Consider the mechanical translational system shown in figure. Write the differential equations governing the system. (6)



b) Draw force-voltage and force-current analogous circuits of system for the above figure [14a)]. (8)

Module -3

15 a) Define rise time. Derive the expression for rise time of an underdamped second order control system 7

b) Evaluate steady state error when the input is unit ramp signal for type 0, type 1 and type 2 systems. 7

16 a) A unity feedback control system has an open loop transfer function G(S)=10/s(s+2). Calculate the rise time, peak time ,percentage overshoot and settling time' 14

Module -4

17 a) What do you mean by conditional stability and marginal stability? 2

b) Using Routh criterion, determine the location of poles of the following characteristic equations and comment on the stability. 12

i) $S^4 + 10S^3 + 5S^2 + 5S + 3 = 0$

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

18 a) A unity feedback system has an open loop transfer function G(S)=K/S($S^2 + 8S + 32$). Sketch the root locus and determine the dominant closed loop poles with $\xi = 0.5$. determine the value of K at this point 14

Module -5

19 a) Illustrate an automatic traffic light control system suitable for automation 10

b) How lead compensator aids in stability? Explain. 4

20 a) Why compensation is necessary in feedback control system? 2

b) Realise a lag compensator using electrical network and plot the frequency response. 12

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