

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Fifth Semester B.Tech Degree (S, FE) Examination December 2023 (2015 Scheme)



Course Code: MR301

Course Name: LINEAR CONTROL SYSTEMS

Max. Marks: 100

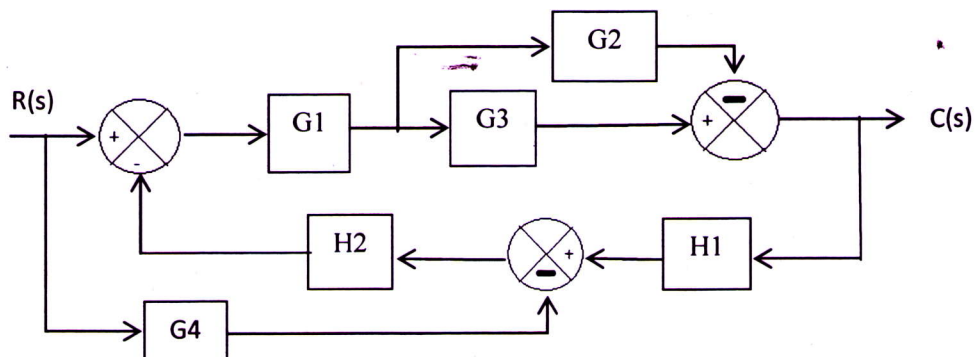
Duration: 3 Hours

PART A*Answer all the questions, each carry 5 marks.*

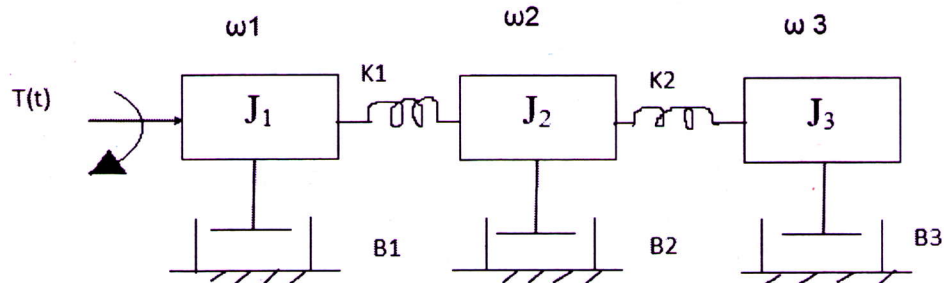
- | | | Marks |
|---|--|-------|
| 1 | Explain closed loop control system with an example. | (5) |
| 2 | What are the basic elements used for modelling mechanical rotational system?
Write the torque balance equations for these elements. | (5) |
| 3 | Define the parameters that specify the performance of control systems in time domain. | (5) |
| 4 | Construct a Routh array and determine the stability of system characterized by the equation $9s^5 - 20s^4 + 10s^3 - s^2 - 9s - 10 = 0$. | (5) |
| 5 | Give an example for transportation lag in a system. | (5) |
| 6 | Recall a non-minimum phase system. | (5) |
| 7 | Enumerate any five applications of control system in mechatronics. | (5) |
| 8 | Cite any five features of lead compensator. | (5) |

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

- 9 Draw a signal flow diagram and evaluate the closed loop transfer function of the given system. (10)



- 10 Determine the torque-voltage analogous equations of the given mechanical rotational system. Also draw its analogous electrical circuit. (10)



- 11 Obtain the response of an over-damped second order system for a unit step signal. Plot its waveform. (10)
- 12 A unity negative feedback system is characterized by an open loop transfer function $G(s) = \frac{K}{s(s+10)}$. Calculate gain K , so that the system has a damping ratio of 0.5. Determine peak overshoot and time at peak overshoot for a unit step signal. (10)
- 13 The open loop transfer function of a unity feedback system is $G(s) = \frac{K(s+9)}{s^2+4s+11}$. Sketch the root locus of the system. (10)

PART C

Answer any two questions, each carry 15 marks.

- 14 Draw Bode plot and obtain gain cross over frequency for the given transfer function. $G(s) = \frac{20}{s(1+3s)(1+4s)}$. (15)
- 15 The open loop transfer function of a unity feedback system is given by $G(s) = \frac{1}{s^2(1+s)(2s)}$. Sketch the polar plot. Determine the gain margin and phase margin. (15)
- 16 Discuss the different types of controllers employed in control system with necessary equation. (15)
- 17 Describe any two examples of closed loop control systems with its block diagram. (15)
