COURSE HANDOUT

CONTROL SYSTEM (EE-603)

EE-6TH SEMESTER

ACADEMIC YEAR (2023-24)

Dr. Satyendra Kumar Singh

Assistant Professor

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Department of Electrical Engineering

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
ECE-604	Control System	PCC	4	3	1	0	50	150	150

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Explain the concept for modeling of physical systems in open loop and closed loop.
CO2	Determine the transfer function using block diagram technique and signal flow graph.
CO3	Illustrate the various linear feedback systems for frequency and time domain.
CO4	Design PID controller for linear time invariant system.
CO5	Analyze state space approach for discrete-time systems.

Unit-I

Control systems, types of control systems, feedback and its effects, mathematical modeling of physical, systems, block diagrams, representation of control systems, transfer functions, signal flow graphs, mason's gain formula, time domain analysis of control systems: time domain analysis of first and 2nd order control systems, typical test signals for time response of control systems, time domain performance of first and second order control systems. (10 Hours)

Unit-II

AC and D.C. Servomotors, AC tachometer, synchro transmitter and receiver, synchro pair as control transformer, AC and DC position control system, stepper motor, magnetic amplifier and adaptive control. (8 Hours)

Unit-III

Stability characteristic equation, stability of linear time invariant systems, Routh-Hurwitz stability Criterion, Root locus plot, Bode plot, Polar Plot, Nyquest Criterion. (12 Hours)

Unit- IV

Design specifications in time domain and frequency domain, phase lead, and phase lag design using Bode-plot and root locus techniques, Introduction to P, PI and PID controllers, tuning of PID controllers. (10 Hours)

Unit-V

State Space Approach for discrete time systems: State space models of discrete systems, state space analysis. Lyapunov Stability, controllability and observability analysis, effect of pole zero cancellation on the controllability and observability. (8 Hours)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Modern Control Engineering	K. Ogatta	McGraw Hill Education	5th (2010)
2.	Control System Engineering	I J Nagrath and M Gopal	New Age International	5th (2016)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)

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श्रेष्ठ   श्रम   नवीनता

Please Do Not Print Unless Necessary

| 1 | B. S. Manke | Linear control Systems | Khanna Publishers | 12th (2016) |

COURSE PLAN

Unit-I Introduction to Managerial Economics

S.No	Topics	Recommended Books
1	Control Systems, Types of Control Systems	Book 1, Ch.1
2	Feedback and Its Effects	Book 2, Ch.3
3	Mathematical Modeling of Physical Systems	Book 1, Ch.2
4	Block diagrams representation of control systems	Book 2, Ch.2
5	Transfer Functions	Book 2, Ch.2
6	Signal Flow Graphs, Mason's Gain Formula	Book 2, Ch.2
7	Time Domain Analysis of Control Systems	Book 2, Ch.5
8	Time Domain Analysis of First and 2nd Order Control Systems	Book 2, Ch.5
9	Typical Test Signals for Time Response of Control Systems	Book 2, Ch.5
10	Time Domain Performance of First and Second Order Control Systems	Book 2, Ch.5

Unit-II Production Theory

S.No	Topics	Recommended Books
8	AC and D.C. Servomotors	Book 1, Ch.1
9	AC Tachometer	Book 1, Ch.1
10	Synchro Transmitter and Receiver	Book 1, Ch.1
11	Synchro Pair as Control Transformer	Book 2, Ch.1
12	AC and DC position control system	Book 2, Ch.1
13	Stepper motor	Book 2, Ch.1
14	Magnetic Amplifier and Adaptive Control	Book 2, Ch.1

Unit-III Stability Analysis

S.No	Topics	Recommended Books
15	Stability characteristic equation	Book 2, Ch.6
16	Stability of Linear Time Invariant Systems	Book 2, Ch.6
17	Routh-Hurwitz Stability Criterion	Book 2, Ch.6
18	Root Locus Plot	Book 2, Ch.7
19	Bode Plot	Book 2, Ch.8
20	Polar Plot	Book 2, Ch.8
21	Nyquest Criterion	Book 2, Ch.9

Unit-IV Pricing of Goods and Services

S.No	Topics	Recommended Books
22	Design Specifications in Time Domain	Book 2, Ch.10
23	Design Specifications in Frequency Domain	Book 1, Ch.10
24	Phase Lead and Phase Lag Design Using Bode-Plot	Book 1, Ch.10
25	Root Locus Techniques	Book 2, Ch.10
26	Introduction to P, PI and PID Controllers	Book 1, Ch.10
27	Tuning of PID Controllers	Book 2, Ch.10

Unit-V Macroeconomics		
28	State Space Approach for Discrete Time Systems	Book 2, Ch.12
29	State Space Models Of Discrete Systems	Book 1, Ch.12
30	State Space Analysis	Book 2, Ch.12
31	Lyapunov Stability	Book 1, Ch.13
32	Controllability Analysis	Book 2, Ch.8
33	Observability Analysis	Book2, Ch. 8
34	Effect of Pole Zero Cancellation on the Controllability	Book2, Ch. 6
35	Effect of Pole Zero Cancellation on the Observability	Book2, Ch. 6

ADDITIONAL WEB RESOURCES

1.	**MOOC:** Modeling of Feedback Systems https://www.coursera.org/learn/modeling-feedback-systems/discussions
2.	**NPTEL:** Video lectures on Control Systems Lecture series by Prof. Ramkrishna Pasumarthy Department of Electrical Engineering, IIT Bombay https://archive.nptel.ac.in/courses/108/106/108106098/

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**
  Monday (12:05 PM - 12:55 PM)
  Wednesday (12:05 PM - 12:55 PM)

- **Contact Information**
  satyendra.ece@mietjammu.in