MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act,1956

COURSE CONTENT

CONTROL SYSTEMS ENGINEERING							
III Semester: ECE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2530405	**Core**	2	0	0	2	40	60	100

Contact Classes: 32	**Tutorial Classes: Nil**	**Practical Classes: Nil**	**Total Classes:32**
Prerequisites: knowledge on control systems engineering			

Course Overview:

This course provides the foundation of control system analysis and design in both classical and modern approaches. It emphasizes mathematical modeling, time and frequency domain techniques, stability analysis, and controller design. Students gain skills to analyze, model, and design control systems for practical engineering applications.

Pre-requisite: Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables.

Course Objectives:

The students will try to learn
- Fundamentals of control systems, classifications, and mathematical modeling
- System responses in both time and frequency domains and assess stability
- Root locus, Nyquist, and Bode techniques for system analysis and design
- Compensators and controllers for performance improvement
- State-space analysis for modern control theory.

Course Outcomes:

After successful completion of the course, students shall be able to
- Describe open- and closed-loop systems, and develop mathematical models using block diagrams and signal flow graphs
- Analyze time response of second-order systems using time-domain specifications, and assess stability using Routh-Hurwitz criterion and root locus techniques
- Analyze frequency response plots including Bode, Polar, and Nyquist plots, and investigate System stability
- Design compensators and controllers to meet specific performance criteria in control systems.
- Apply the state-variable approach and analyze controllability and observability.

Module- I Control System Fundamentals   **5L**

Classification of control systems, Open and Closed loop systems. Mathematical modeling of mechanical systems. Effects of Feedback, Block diagram reduction techniques and Signal flow graphs.

Module II – Time Response Analysis & Root Locus   **7L**

Transfer function and Impulse response, types of input. Transient response of first order and second order system for step input. Time domain specifications. Static error coefficients, Routh-Hurwitz criterion for stability. Root locus techniques: Analysis of typical systems using root locus techniques.

Module III – Frequency Response Analysis   **7L**

Frequency domain specifications, Polar plot and bode plots, Gain margin and Phase Margin, Nyquist criterion for stability.

Module IV – Compensators and Controllers   **7L**

Introduction to compensators, Lag compensator, Lead compensator, Lag-Lead compensator, Introduction to controllers, P, I, D, PI, PD, PID controllers.

Module V – State Space Representation   **6L**

Concept of state and state variables. State models of linear time invariant systems, Transfer function from state model, State transition matrix, Solution of state equations. Controllability and observability.

TEXT BOOKS:
1. I.J. Nagrath and M. Gopal, Control System Engineering, 5ed., New Age Publishers, 2009.
2. Benjamin C. Kuo, Automatic Control Systems, 7ed., PHI, 2010.

REFERENCE BOOKS:
1. K. Ogata, Modern Control Engineering, 2ed, Prentice Hall, 2010.
2. M. Gopal, Control Systems: Principles and Design, Tata McGraw-Hill, 1997.
3. Norman S. Nise, Control Systems Engineering, 5ed., John Wiley & Sons, 2007.

REFERENCE LINK:
1. [https://www.youtube.com/watch?v=0LYdTrv1ZKY&list=PLwymdQ84KIzDPJZr3htPWijJr StCeCW5](https://www.youtube.com/watch?v=0LYdTrv1ZKY&list=PLwymdQ84KIzDPJZr3htPWijJrStCeCW5)
2. https://www.youtube.com/playlist?list=PLn8PRpmsu08pFBqgd_6Bi7msgkWFKL33b
3. https://zcoer.in/wp-content/uploads/2023/06/Control_Systems.p
4. [https://www.youtube.com/watch?v=0LYdTrv1ZKY&list=PLwymdQ84KIzDPJZr3htPWijJr StCeCW5](https://www.youtube.com/watch?v=0LYdTrv1ZKY&list=PLwymdQ84KIzDPJZr3htPWijJrStCeCW5)

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech Talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper–I
8. Model question paper–II
9. Lecture notes
10. Drshya Siksha Sangrah Videos(DSSV)