ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Department of Electrical and Electronics Engineering

Control System and Simulation Lab

Information About Equipment

1. **Lab Photo**





2. Description of Control Systems Lab

The Control Systems Laboratory provides practical exposure to the principles, design, and performance evaluation of control systems widely used in electrical, electronics, and automation applications. This laboratory bridges the gap between theory and practice, enabling students to analyze system dynamics, stability, and control strategies through hands-on experiments.

In this lab, students perform experiments on time and frequency response of systems, stability analysis, and controller design using proportional (P), proportional–integral (PI), proportional–derivative (PD), and proportional–integral–derivative (PID) controllers. They also study compensators, state-space modeling, and digital simulation of control systems using software tools such as MATLAB/Simulink. Practical experiments include position and speed control of DC motors, synchro systems, and process control demonstrations.

The Control Systems Lab is equipped with DC/AC motor control trainers, PID controller modules, synchro transmitter-receiver sets, function generators, oscilloscopes, and simulation software for analysis and validation of control strategies. These facilities provide students with the opportunity to design, implement, and test control algorithms on both hardware and simulation platforms.

By working in this laboratory, students gain hands-on experience in modeling, analyzing, and stabilizing dynamic systems. The lab prepares them for applications in automation, robotics, power systems, process control, renewable energy integration, and advanced industrial drives.

3. Total Cost of the lab Rs. 5,11,798/-

4. Cost and quantity Information about the Equipment present in Control Systems Lab

Sl. No.	Item Description	Value (Rs.)	Quantity
1	Stabilizer	7,200	1
2	Process Control Simulator (ITB PSC 01)	13,650	1
3	Temperature Controller using PID	14,645	1
4	Temperature Controller (VTC-01)	7,700	1
5	Synchro Transmitter and Receiver pair	14,340	1
6	Oscilloscopes (CRO)	16,500	1
7	Desktop Computer	34,291	1
8	Basic PLC Trainer	28,663	1
9	Decade Induction Box	1,558	1
10	Digital Multimeters	3,642	1
11	Breadboard	2,392	1
12	Effect of Feedback on DC Servo motor	27,500	1
13	Transfer Function DC servomotor		1
14	Level Process Station	2,12,249	1
15	Digital Storage Oscilloscope	22,000	1
16	Effect of Feedback on DC Servo Motor	₹ 40, 000	1
17	Characteristic of Magnetic Amplifier	₹ 30, 000	1

5. List of experiments as per syllabus

Perform any ten experiments out of the following

1. Time response of Second order system
2. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
3. Effect of feedback on DC servo motor
4. Transfer function of DC Machine
5. Effect of P, PD, PI, PID Controller on a second order systems
6. Lag and lead compensation – Magnitude and phase plot
7. Temperature controller using PID
8. Characteristics of Magnetic amplifiers
9. Characteristics of Stepper motor
10. Characteristics of Synchros
11. Characteristics of AC servo motor
12. PSPICE simulation of Op-Amp based Integrator and Differentiator circuits.
13. Linear system analysis (Time domain analysis, Error analysis) using Simulation.
14. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using Simulation.
15. State space model for classical transfer function using Simulation. – Verification.
16. Effect of P-PI-PID controller on level processing unit.

6. List of experiments beyond syllabus

17. Real-time Speed Control of DC Motor using Arduino/DSC
18. Modeling and Control of Inverted Pendulum System (Simulation/Hardware Demonstration)

7. Out of Box experiments

19. Smart Fan Speed Control using IoT and PID
20. Renewable Energy Integration – MPPT Control of Solar PV using Perturb & Observe Method

8. Scope of Research carried through the lab

The Control Systems Laboratory provides a strong foundation for advanced research and innovation in automation, robotics, power systems, process control, renewable energy integration, and intelligent systems. By combining hardware-based experiments with modern simulation tools, the lab creates opportunities for students and researchers to model, analyze, and design advanced control strategies.

Research possibilities arising from this laboratory include:

- **Advanced Controller Design:** Development of adaptive, optimal, fuzzy logic, and neural network-based controllers to overcome the limitations of classical PID control.
- **Nonlinear and Robust Control:** Analysis and stabilization of nonlinear, uncertain, or time-varying systems such as robotic arms, drones, and self-balancing vehicles.
- **Industrial Process Control:** Application of modern control strategies to real-world processes such as chemical plants, thermal systems, and level/flow/temperature regulation.
- **Smart Grids and Renewable Energy Systems:** Integration of control techniques for power converters, energy storage, and grid stability in renewable-based microgrids.
- **Electric Drives and Automotive Systems:** Design and testing of control algorithms for electric vehicles, motor drives, and regenerative braking systems.
- **Cyber-Physical and IoT-Enabled Control:** Research in real-time monitoring and control through embedded systems, PLCs, and IoT platforms for Industry 4.0 applications.
- **Simulation and Digital Twins:** Use of MATLAB/Simulink, PSPICE, and other platforms to create digital replicas of real systems for predictive analysis and optimization.

Thus, the Control Systems Lab not only supports undergraduate learning but also lays the groundwork for cutting-edge research projects, M.Tech/Ph.D. dissertations, and industry collaborations in automation, robotics, power engineering, and smart technologies.