

Course:

Python for Control System Laboratory Works - From Basic Control System to PID Control System

Course Description:

This course is a hands-on laboratory-based course that focuses on implementing control systems using Python programming. Students will gain practical experience in designing, simulating, and implementing control systems, starting from basic control system principles and progressing to the implementation of PID (Proportional-Integral-Derivative) control systems. By the end of the course, students will have acquired knowledge and skills in implementing various control systems using Python.

Prerequisites:

- Basic knowledge of control system theory
- Proficiency in Python programming language

Course Objectives:

Upon completion of this course, students will be able to:

1. Understand the principles and components of control systems.
2. Apply Python programming for system analysis and design.
3. Design and implement basic feedback control systems.
4. Implement and fine-tune PID control systems using Python.
5. Analyze and optimize the performance of control systems.
6. Develop control system applications using Python.

Course Outline:**Week 1:** Introduction to Control Systems and Python (1 week)

- Overview of control system engineering
- Introduction to Python programming for control systems
- Setting up the Python environment for control system laboratory works

Week 2: System Modeling and Simulation with Python (1 week)

- Mathematical modeling of dynamic systems using Python
- Numerical simulation and analysis of control systems
- System response analysis and visualization using Python libraries

Week 3: Control System Design and Analysis (1 week)

- Designing and analyzing feedback control systems using Python
- Performance evaluation and stability analysis
- Introduction to controller tuning methods

Week 4: Implementing Proportional Control Systems (1 week)

- Designing and implementing proportional control using Python
- Evaluating and fine-tuning proportional control system performance
- Case studies and laboratory exercises with Python

Week 5: Implementing Integral Control Systems (1 week)

- Designing and implementing integral control using Python
- Evaluating and fine-tuning integral control system performance
- Case studies and laboratory exercises with Python

Week 6: Implementing Derivative Control Systems (1 week)

- Designing and implementing derivative control using Python
- Evaluating and fine-tuning derivative control system performance
- Case studies and laboratory exercises with Python

Week 7: Implementing PID Control Systems (1 week)

- Designing and implementing PID control using Python
- Tuning PID controller parameters for desired performance
- Simulation, analysis, and optimization of PID control systems

Week 8: Control System Integration and Project Work (1 week)

- Integrating control systems with real-world applications using Python
- Collaborative project work implementing control systems with Python
- Presentation and evaluation of project outcomes

Assessment Methods:

- Laboratory exercises and assignments
- Project work and presentations
- Midterm and final examinations