



NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

| COURSE PLAN - PART I | | | |
|---|--|--------------------------------------|----------------------|
| COURSE DETAILS | | | |
| Name of the Programme and Specialization | B.Tech. Instrumentation and Control Engineering | | |
| Course Title | Control Engineering Laboratory | | |
| Course Code | ICLR14 | No. of Credits | 2 |
| Course Code of Pre-requisite Subject(s) | N. A. | Name of Course Coordinator(s) | N. A. |
| Course Type | Laboratory Course | Section | A |
| Session | July 2023 | | |
| Name of Faculty | Dr. Rahul Kumar Sharma | | |
| Department | Instrumentation and Control Engineering | | |
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| SYLLABUS (Approved by BoS) | | | |
| List of Experiments: | | | |
| 1. Time Response characteristics of a Second-Order System. | | | |
| 2. Frequency Response characteristics of a Second-Order System. | | | |
| 3. Constant Gain Compensation in time and frequency domain. | | | |
| 4. Characteristics of Compensating Networks. | | | |
| 5. Design of Compensation Networks - Lead, Lag, Lead-Lag. | | | |
| 6. Design of State Feedback Controller. | | | |
| 7. Observer Design - Full Order and Reduced Order. | | | |
| 8. Real-time Control of AC / DC Servo System. | | | |
| 9. Real-time Control of 2-DOF Helicopter System. | | | |
| 10. Real-time Vibration Control of Cantilever Beam at Resonance with Piezoelectric Sensing and Actuation. | | | |
| 11. Real-time Control of 3-DOF GYRO. | | | |
| 12. Real-time Control of Inverted Pendulum. | | | |

Reference Books:

1. R. C. Dorf and R. H. Bishop, "Modern Control Systems", Prentice Hall (2010)
2. D. H. Sheingold, "Transducer Interfacing Handbook - A Guide to Analog Signal Conditioning", Analog Devices Inc. (1980)

COURSE OBJECTIVES

1. To impart knowledge on Analysis and Design of Control System in time and frequency domain.
2. To impart knowledge in Classical Control and State-Space based Control System Design.
3. To familiarize the Students with MATLAB Real-time Programming to collect and process data.

COURSE OUTCOMES (COs)

On completion of this Course, the Students should be able to:

CO1 Design Control Systems in both Classical and Modern techniques.

CO2 Design and implement Controllers to regulate and Control various Systems.

CO3 Design Full-Order and Reduced-Order State Observer.

MAPPING OF COURSE OUTCOMES (COs) WITH PROGRAMME OUTCOMES (POs)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | √ | √ | √ | √ | √ | - | - | - | - | - | - | √ | √ | √ | - |
| CO2 | √ | √ | √ | √ | √ | - | - | - | - | - | - | √ | √ | √ | - |
| CO3 | √ | √ | √ | √ | √ | - | - | - | - | - | - | √ | √ | √ | - |

COURSE PLAN - PART II**COURSE OVERVIEW**

The Course introduces the Students to various Design techniques of Control Systems in simulation environment and their implementation on experimental setups.

COURSE TEACHING AND LEARNING ACTIVITIES

| S. No. | Week / Contact Hours | Topic | Mode of Delivery |
|--------|----------------------|---|-----------------------|
| 1. | 1st Week | 1. Time Response characteristics of a Second-Order System. | Laboratory Experiment |
| 2. | 2nd Week | 2. Frequency Response characteristics of a Second-Order System. | Laboratory Experiment |
| 3. | 3rd Week | 3. Constant Gain Compensation in time and frequency domain. | Laboratory Experiment |
| 4. | 4th Week | 4. Characteristics of Compensating Networks. | Laboratory Experiment |
| 5. | 5th Week | 5. Design of Compensation Networks - Lead, Lag, Lead-Lag. | Laboratory Experiment |
| 6. | 6th Week | 6. Design of State Feedback Controller. | Laboratory Experiment |
| 7. | 7th Week | 7. Observer Design - Full Order and Reduced Order. | Laboratory Experiment |
| 8. | 8th Week | 8. Real-time Control of AC / DC Servo System. | Laboratory Experiment |
| 9. | 9th Week | 9. Real-time Control of 2-DOF Helicopter System. | Laboratory Experiment |
| 10. | 10th Week | 10. Real-time Vibration Control of Cantilever Beam at Resonance with Piezoelectric Sensing and Actuation. | Laboratory Experiment |
| 11. | 11th Week | 11. Real-time Control of 3-DOF GYRO. | Laboratory Experiment |
| 12. | 12th Week | 12. Real-time Control of Inverted Pendulum. | Laboratory Experiment |

COURSE ASSESSMENT METHODS (Ranging from 2 to 6)

| S. No. | Mode of Assessment | Week / Date | Duration | % Weightage |
|--------|-----------------------|--------------------------------|----------|-------------|
| 1. | Continuous Assessment | Weekly | | 40% |
| 2. | Viva | 1 Week before Final Assessment | | 20% |
| 3. | Final Assessment | End of the Semester | 3 hours | 40% |

COURSE EXIT SURVEY (The ways in which the Feedback about the Course will be assessed)

Feedback from Students will be obtained during the Course. The performance of the Students in the tests and their presentation during Classroom Discussion will be used to assess their understanding level.

COURSE POLICY (Including Compensation Assessment to be specified)

- 75% Attendance is must, inclusive of On Duty (OD) or medical grounds. Students not acquiring the required Attendance will be assigned V Grade.
- The Passing minimum for the Course will be 35% or Class Average / 2 whichever is maximum.
- Relative Grading with the Passing minimum or clustering will be followed on observing the overall performance of the Students at the end of the Semester.
- For the Students missing the Assessments for medical reasons, 1 Compensation Assessment will be conducted 1 Week before the Final Assessment for a weightage equal to that of the missed Assessment. But, Students are advised not to miss the Assessments.
- For Academic Dishonesty, Institute Policy will be followed.

ATTENDANCE POLICY (A uniform Attendance Policy will be followed as specified below)

- At least 75% Attendance is compulsory in each Course.
- A maximum of 10% Attendance will be allowed under On Duty (OD) or medical grounds.

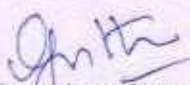
ACADEMIC DISHONESTY AND PLAGIARISM

Institute Policy will be followed. Students are expected to complete all the Assessments on their own; otherwise, zero mark will be awarded to all the Students co-operating one another in this regard.

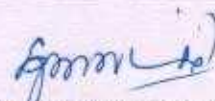
FOR APPROVAL



Course Faculty
Dr. Rahul Kumar Sharma



Class Committee Chairperson
Dr. Geetha C



Head of the Department
Dr. K. Dhanalakshmi