

Fall 2019

# IE 455-001: Robotics and PLC

Wen Zhu

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## **IE 455 Robotics & PLC Fall 2019 Syllabus**

Mechanical and Industrial Engineering Department

Instructor: Wen Zhu

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Office Hours: By Appointment

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### **Course Description**

This course provides a comprehensive description of the concepts of manufacturing systems, manufacturing metrics and economics with variety of examples on them. The objective of this course is to teach students the basics of robot systems and to give hands on experience with robots that are used in current production environments as well as PLC programming. The lab experiments of the course focus on two fundamental objectives: 1) PLCs programming and troubleshooting, using simulator and HMI which train students to execute real world projects; 2) Programming and troubleshooting techniques necessary to run industrial robots. Moreover, during the class students will gain exposure to quantitative methodologies and algorithms to analyze the automated manufacturing systems.

### **Teaching Assistant**

Thanapat Leelertkij Email: [ti375@njit.edu](mailto:ti375@njit.edu)

### **Moodle**

The course will make extensive use of the Moodle system to optimize student-instructor communication. All course materials including lecture slides and homework etc. will be distributed through Moodle. All submission of homework and other assignments will also be through Moodle. To access the system please go to <http://moodle.njit.edu>, you will need a valid UCID to login.

### **Course Material**

Textbook: Automation, Production Systems and Computer-Integrated Manufacturing, 5<sup>th</sup> Edition, by Mikell P. Groover, Pearson.

ISBN-10: 0-13-460546-2

ISBN-13: 978-0-13-460546-3

**Provided Material on Moodle:** PowerPoint Slides, Videos, Reading Material

### **Grading**

Based in individual and team performance as follows:

15% Homework #1

15% Homework #2

25% Midterm Exam

25% Final Exam

10% Lab Assignments

10% PLC Project & Report

### Lab Teams & Team Project

The course involves several experiments and PLC project that are to be completed by all students. All experiments and the project will be completed in teams of 4 students. Please select your teams to match your skills. During the lab class the corresponding experiment will be demonstrated by the instructor and the course TA.

WEEKS	CHAPTER	TOPIC
<b>Learning Module 1: Overview of Manufacturing, Automation and Control Technologies</b>		
Week 1	1	Introduction
Week 2	2	Manufacturing Operations
Week 3	3	Manufacturing Metrics and Economics
Week 4	4	Introduction to Automation
Week 5	5	Industrial Control Systems
		<b>HW #1</b>
<b>Learning Module 2: Industrial Robotics</b>		
Week 6 & 7	8	<b>Industrial Robotics</b>
		Robot Anatomy and Related Attributes
		Robot Control Systems
		Applications of Industrial Robots
		Robot Programming
		Robot Accuracy and Repeatability
		<b>Lab Experiments</b>
		<b>Midterm Exam Review</b>
Week 8		<b>Midterm Exam (10/22/2019)</b>
<b>Learning Module 3: Programmable Logic Controllers</b>		
Week 9 & 10	9	<b>Overall PLC System</b>
		Definition of the PLC System
		Major Components of a Common PLC
		Application of PLC
		PLC Cycle of Operation
		Ladder Diagram
		AND, OR and NOT Logics
		<b>Lab Experiments</b>
Week 11 & 12	9	<b>PLC Programming Methods</b>
		More examples on AND, OR and NOT Logics
		Timers (Timer on-delay and off-delay)
		Counter (Count-up Counter and Count-down Counter)
		<b>Lab Experiments</b>
		<b>HW #2</b>
Week 13 & 14	9	<b>Final Project Preparation &amp; Presentation</b>
Week 15		<b>Final Exam Review (2019/12/10)</b>
Week 16		<b>Final Exam (Date to be announced by Registrar)</b>