New Jersey Institute of Technology
Department of Engineering Technology
MET 415 Automatic Control Systems

COURSE NUMBER	MET 415
COURSE NAME	Automatic Control Systems
COURSE STRUCTURE	2-2-3 (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR/ INSTRUCTOR	Dr. J. Sodhi / Majd Awad
COURSE DESCRIPTION	Introduction to programmable logic controllers (PLC) as a tool for industrial controls of machines and process. Includes selections of hardware and software, ladder logic programming, wiring methods, maintenance and trouble shooting of.
PREREQUISITE(S)	(ECET 201 or ECE 405), and (CS 106 or CS 100 or CS 101 or CS 113), and (MET 105 or FED 101). Restriction: Senior Standing.
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Required
REQUIRED MATERIALS	**Programmable Logic Controllers, 6th Ed.** by Frank D. Petruzella, McGraw Hill, ISBN 9781264163342 **Programmable Logic Controllers Lab Manual, 6th Ed.** by Frank D. Petruzella, McGraw Hill, ISBN 9781264446766 **PLC Software,** http://thelearningpit.com "LogixPro Allen Bradley RSLogix Simulator"
COMPUTER USAGE	Software: ***RS Logix/RS Linx*** – Rockwell Engineering.
COURSE LEARNING OUTCOMES(CO)	By the end of the course students should be able to: 1. Develop simple PLC programs using basic PLC functions. 2. Develop PLC Ladder Diagrams. 3. Design and develop a PLC automated process. 4. Prepare and present a technical report.
CLASS TOPICS	PLC Memory, CPU, Interfaces, PLC Boolean Algebra, PLC Logic PLC Programming Procedures, Input and Output Ports, PLC Timer and Counter Functions, PLC Arithmetic, Conversion and

Comparison Functions, PLC Shift Register and Sequencer Functions, Creating Ladder Diagrams from Process-Control, Program Control Instructions, Analog PLC Instructions, PID Controller, Selecting PLC's, PLC Installation, Automation and selection of components, LAB Research Presentation:

Automation Project: Each group will design and develop an automated process, using PLCs, which will provide robotic and/or processes functions and PLC functions. A Project Report will be developed and presented to the class.

Research Presentation Each group will investigate a computer driven automated processes using PLC, determine its functions and specifications. Results will be presented to the class via PowerPoint.

STUDENT OUTCOMES

The Course Outcomes support the achievement of the following MET Student Outcomes:

Student Outcome (1) - an ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline
Related CO – 1, 2

Student Outcome (2) - an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.
Related CO – 3

Student Outcome (3) - an ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.
Related CO – 4

Student outcome (4) - an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes;
Related CO – 4

Student Outcome (5) - an ability to function effectively as a member as well as a leader on technical teams.
Related CO – 3, 4

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GRADING POLICY

Homework	10 %
PLC Exercises	20 %
PLC Project	20 %
Two Quizzes	20 %
Final Exam	30 %

Note: There are two quizzes during the semester. There will be no makeup quizzes.

ACADEMIC INTEGRITY

NJIT has a zero-tolerance policy regarding cheating of any kind and student behavior that is disruptive to a learning environment. Any incidents will be immediately reported to the Dean of Students. In the cases the Honor Code violations are detected, the punishments range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT with notations on students' permanent record. Avoid situations where honorable behavior could be misinterpreted. For more information on the honor code, go to https://www.njit.edu/dos/university-code-academic-integrity

GENERATIVE AI

Student use of artificial intelligence (AI) is permitted in this course for certain assignments and activities. It is not permitted to be used in the assignments noted by the instructor, as doing so would undermine student learning and achievement of course learning outcomes. Additionally, if and when students use AI in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments.

STUDENT BEHAVIOR

- No eating or drinking is allowed at the lectures, recitations, workshops, and laboratories.
- Cellular phones must be turned off during the class hours – if you are expecting an emergency call, leave it on vibrate.
- No headphones can be worn in class, unless allowed by the professor.

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- Unless the professor allows the use during lecture, laptops should be closed during lecture.
- During laboratory, if you are finished earlier, you must show the professor your work before you leave class
- Class time should be participative. You should try to be part of a discussion

MODIFICATION TO COURSE	The Course Outline may be modified at the discretion of the instructor or in the event of extenuating circumstances. Students will be notified in class of any changes to the Course outline.
PREPARED BY	Majd Awad/ Dr. J. Sodhi
COURSE COORDINATED BY	Dr. J. Sodhi

CLASS HOURS

Fridays 6:00 PM – 10:05 PM GITC 2310

OFFICE HOURS

By appointment: mga3@njit.edu

HOMEWORK, PLC EXERCISES, & PROJECT - IMPORTANT

Homework

1. Homework is due at the beginning of the class period, one week after it is assigned.
2. Late homework will be penalized one problem grade per week. Assignments more than one week late will not be accepted.
3. Homework will not be accepted after graded homework has been returned or reviewed.
4. Homework must be submitted in sets, arranged in order as in course outline. Sets must be stapled together in the upper left hand corner.

PLC Lab Exercises

1. Lab exercises must be demonstrated during the lab, and write up due at the beginning of the class period, one week after it is assigned.
2. Late Lab exercises will be penalized minus 25% each week. Assignments more than one week late will not be accepted.

3. PLC exercises must be submitted in sets, arranged in order as in course outline. Sets must be stapled together in the upper left hand corner.

Automation Final Project

1. The final project is due on the date indicated. No late projects will be accepted.
2. The Project should be submitted in the format provided by the professor.

GRADING LEGEND

GRADE	NUMERIC RANGE
A	90 to 100
B+	85 to 89
B	80 to 84
C+	75 to 79
C	70 to 74
D	60 to 69
F	0 to 59

NJIT ONLINE INFORMATION

The instructor will discuss these requirements on the first day of the course and/or post on their Learning Management System (LMS). Please become familiar

- Canvas: https://canvas.njit.edu/
- Zoom: https://njit-edu.zoom.us/
- Online Proctoring: https://ist.njit.edu/online-course-exam-proctoring

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MET 415 - COURSE OUTLINE

WEEK	DATE	TOPICS	SECTIONS	ASSIGNMENTS
1	Jan 24	Introduction to Electronics & PLCs Fundamentals of Ladder Logic Programming	1.1-1.3 5.6, 5.8-5.10	PLC Exercise 1 Ch. 1 Review Questions: 1, 3, 10 Ch. 5 Review Questions: 7 Lab Manual vii-xii
2	Jan 31	Application Development Part 1 PLC Addressing	5.1-5.5	PLC Exercise 2 Ch 5 Problems: 1 Lab Manual:1-2 through 1-5
3	Feb 7	Application Development Part 2 PLC Timers	Chapter 7	PLC Exercise 3 Lab Manual: 7-12 App Development Hmwk Part 1 (due week 6)
4	Feb 14	**Quiz No. 1** PLC Motor Control Part 1	Class Handouts 6.1-6.3	PLC Exercise 4 Lab Manual: 6-15 **Class Project Assigned**
5	Feb 21	PLC Counters PLC Motor Control Part 2	Chapter 8.1-8.4	Lab Manual: 8-3 PLC Exercise 5
6	Feb 28	PLC Pneumatic Cylinder Control Event Sequencing	Class Handouts 6.10-6.11	PLC Exercise 6 Lab Manual: 7-26
7	Mar 7	Overview of Number Systems Sensors	Chapter 3 6.4-6.6	PLC Exercise 6 Cont. PLC Exercise 7 Start

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WEEK	DATE	TOPICS	SECTIONS	ASSIGNMENTS
		Human Machine Interfaces Part 1		Ch. 3 Review Questions: 1-7 Lab Manual: 7-17
8	Mar 14	**Quiz No. 2** Human Machine Interfaces Part 2	9.1-9.3	PLC Exercise 7 Cont. Lab Manual 8-32
9	Mar 28 (No Class on Mar 21: Spring Break)	Installation & Wiring Automation Safety PLC Stop Functions Sub-Routine & Jump	13.1-13.4 9.6	PLC Exercise 8 Ch. 13 Review Questions 1,2,7 App Development Hmwk Part 2 due Week 11
10	Apr 4	Analog Sensors Stepper & Servo Motors	Class Notes 6.4-6.6	PLC Exercise 9 Lab Manual 6-11(a)
11	Apr 11	Math Instructions	11.1-11.6	PLC Exercise 10 Lab Manual 11-4
12	Apr 25 (No Class on Apr 18: Good Friday)	LAB TIME		PLC Exercise 11
13	May 2	LAB TIME		
14	May 7	Class Presentations		**Class Project Due**
	TBD	**FINAL EXAM**		