New Jersey Institute of Technology

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Summer 5-15-2020

MET 415-450: Automatic Control Systems

Majd Awad

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. A. Sengupta / 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)	MET senior standing
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Required
REQUIRED MATERIALS	**Programmable Logic Controllers, 5th Ed.** by Frank D. Petruzella, McGraw Hill, ISBN 978-0-07-337384-3
	Programmable Logic Controllers Lab Manual, 5th Ed. by Frank D. Petruzella, McGraw Hill, ISBN 978-1-259-68084-7
	PLC Software, http://thelearningpit.com "LogixPro Allen Bradley RSLogix Simulator"
COMPUTER USAGE COURSE LEARNING OUTCOMES(CLO)	Software: ***RS Logix/RS Linx*** – Rockwell Engineering. 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 Learning Outcomes support the achievement of the following MET Student Outcomes and TAC of ABET Criterion 9 requirements:

Student Outcome a - an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities
Related CLO – 1, 2

Student outcome b - an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
Related CLO – 1, 2

Student outcome c - an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
Related CLO – 4

Student Outcome d - an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives.
Related CLO – 3

Student Outcome e - an ability to function effectively as a member or leader on a technical team.
Related CLO – 3, 4

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

Student outcome f - an ability to identify, analyze, and solve broadly-defined engineering technology problems
Related CLO – 1, 2

Student Outcome g - an ability to communicate effectively regarding broadly-defined engineering technology activities
Related CLO – 4

Student Outcome m - technical expertise having added technical depth in mechanical design, solid mechanics, and electro-mechanical devices and controls.
Related CLO - 1-4

GRADING POLICY	Homework	15 %
	PLC Exercises	20 %
Note: Grading Policy may be modified by Instructor for each Section in the Course)	PLC Project	25 %
	Two Quizzes	20 %
	Final Exam	20 %

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 http://www.njit.edu/academics/honorcode.php

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

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.
- 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

COURSE COORDINATED BY

Dr. A. Sengupta

CLASS HOURS

Tuesday   5:45 PM – 9:50 PM   Instructor
                                                                  Scheduled
                                                                  Webex Meeting

OFFICE HOURS (GITC 2113)

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.

SYNCHRONOUS 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

- Webex: http://ist.njit.edu/webex
- Online Proctoring: https://ist.njit.edu/online-proctoring/

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

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

MET 415 - COURSE OUTLINE

WEEK	DATE	TOPICS	SECTIONS	ASSIGNMENTS
1	5/19	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	5/26	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	6/2	Application Development Part 2 PLC Timers	Chapter 7	PLC Exercise 3 Lab Manual: 7-12 App Development Hmwk Part 1 (due week 6)
4	6/9	**Quiz No. 1** PLC Motor Control	Class Handouts 6.1-6.3	PLC Exercise 4 Lab Manual: 6-15 **Class Project Assigned**
5	6/16	PLC Counters PLC Pneumatic Cylinder Control	Chapter 8.1-8.4 Class Handouts	Lab Manual: 8-3 PLC Exercise 5
6	6/23	Event Sequencing	6.10-6.11	PLC Exercise 6 Lab Manual: 7-26

WEEK	DATE	TOPICS	SECTIONS	ASSIGNMENTS
7	6/30	Overview of Number Systems. Industrial Sensors. Human Machine Interfaces.	Chapter 3 6.4-6.6	PLC Exercise 6 PLC Exercise 7 Ch. 3 Review Questions: 1-7 Lab Manual: 7-17
8	7/7	**Quiz No. 2** Installation & Wiring Automation Safety. PLC Stop Functions.	9.1-9.3 13.1-13.4	Lab Manual 8-32 Ch. 13 Review Questions 1,2,7 App Development Hmwk Part 2 due Week 11
9	7/14	Sub-Routine & Jump. Analog Sensors Stepper & Servo Motors.	9.6 Class Notes 6.4-6.6	PLC Exercise 8 PLC Exercise 9 Lab Manual 6-11(a)
10	7/21	Math Instructions	11.1-11.6	PLC Exercise 10 Lab Manual 11-4
11	7/28	Class Presentations		**Class Project Due**
	TBD	**FINAL EXAM**		