STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

ELEC 243 – COMPUTER AUTOMATED CONTROL SYSTEMS

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CANINO SCHOOL OF ENGINEERING TECHNOLOGY
ELECTRICAL ENGINEERING TECHNOLOGY AND ENGINEERING SCIENCE DEPARTMENT
FALL2018

ELEC 243 - AUTOMATED CONTROL SYSTEMS

A. **TITLE**: Automated Control Systems

B. **COURSE NUMBER**: ELEC 243

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 2
 # Lecture Hours: 1 **per week**
 # Lab Hours: 3 **per week**

Other: per week

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: NO.

E. **GER CATEGORY**: NONE

F. **SEMESTER(S) OFFERED**: Spring

G. **COURSE DESCRIPTION**: An introduction to some of the control software systems in use in industry. The student is introduced to the architecture of the Arduino platform using the ATmega328P Microcontroller to the extent that various control functions can be identified and modified. Memory addressed I/O and the relationship of memory location access (analog and digital) by an Arduino microcontroller Program.

H. **PRE-REQUISITES**: [ELEC 231] Electronic Circuits, [ELEC141] Industrial Controls, and [ELEC213] Microprocessors or permission of the instructor .

CO-REQUISITES: NONE

I. **STUDENT LEARNING OUTCOMES:**

Institutional Student Learning Outcome (ISLO's)
(1) Communication Skills (2) Critical Thinking (3) Foundational Skills
(4) Social Responsibility (5) Industry, Professional, Discipline-Specific Knowledge and Skills.

Accreditation Board for Engineering and Technology ABET- Student Outcomes (a-k)

Course Objectives	**ABET-Student Outcomes (a-k)**	***Institutional SLO's***
a. Become familiar with the Arduino microcontroller platform.	(a) An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities.	(5) Industry, Professional, Discipline-Specific Knowledge and Skills.
b. Understand the techniques to create software to communicate with the Digital input and output ports on the Arduino microcontroller	(c) An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes	(2) Critical Thinking (5) Industry, Professional, Discipline-Specific Knowledge and Skills.
c. Be able to develop Direct Current (DC) motor control programs and circuitry to provide speed control using Pulse Width Modulation.	(c) An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.	(2) Critical Thinking (5) Industry, Professional, Discipline-Specific Knowledge and Skills.
d. Be able to develop programs to implement a digital voltmeter with a PC Screen Display using an external analog to digital conversion chip.	(c) An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.	(2) Critical Thinking (5) Industry, Professional, Discipline-Specific Knowledge and Skills.

e. Be able to develop programs to provide real time digitally controlled outputs for positioning, speed and direction control of Stepper Motors.	(c) An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.	(2) Critical Thinking (5) Industry, Professional, Discipline-Specific Knowledge and Skills.

J. **APPLIED LEARNING COMPONENT:** CLASSROOM/LAB

K. **TEXTBOOK** : Blum, Richard, *Sams Teach Yourself Arduino Programing in 24 hours*. Pearson, 2014, ISBN-13: 978-0-672-33712-3

L. **REFERENCES**: As specified by the instructor.

M. **EQUIPMENT**: As specified by the instructor.

N. **GRADING METHOD:** A-F

O. **SUGGESTED MEASUREMENT CRITERIA/METHODS:**

- Exams
- Quizzes
- Graded Laboratory Report
- Laboratory Practicum

P. **DETAILED COURSE OUTLINE:**

I. Introduction to the Arduino platform using the ATmega 328P microcontroller

A. Device Overview
B. Pin Diagram
C. Memory Organization
   1. Program Memory Organization
   2. Data Memory Organization
   3. Special Function Registers
   4. I/O Ports
   5. Addressing: Words and Bit
D. Structured Programming

1. Initialization
2. Use of subroutines to “Section” or “Block” program
3. Flow Charting
4. Sequential Execution of code

II. Introduction to Arduino platform using the ATmega 328P microcontroller /Lab Board

A. System Connections
   1. Schematic
   2. Ports
   3. Addressing
B. Input/Output Lines
   1. Digital
   2. Analog

III. ! Digital Input/output

A. Digital input test program, reading ports.
B. Digital output test program, writing to ports.
C. PIC Basic Input and Output Commands
D. Digital circuit interface.

IV. Combined Digital/Analog Applications

A. DC Motor Speed Control using Pulse Width Modulation
B. Digital Voltmeter with a On Screen Display
C. Positioning, speed and direction control of Stepper Motors.

Q. **LABORATORY OUTLINE**

NOTE: Some of the experiments in this laboratory are very lengthy and complex, will require two weeks for completion.

EXPERIMENT TITLE

1. ! Introduction to Arduino platform using the ATmega 328P microcontroller URO board. Sample Blink program. Digital Outputs.

2. ! Structured Basic Sample Programs. Reading Digital Inputs.

3. ! BCD encoder and pulse width modulated variable speed DC Motor Drive. (2 weeks)

4. DC Motor Drive Sequencer Control System. (2 weeks)
5. Laboratory Practical Exam
6. Analog to Digital Conversion, digital voltmeter. (2 weeks)
7. Stepper Motors: Positioning, Speed, and Direction control. (2 weeks)
8. Laboratory Practical Exam