**EE 5377: PROGRAMMABLE LOGIC CONTROLLERS IN INDUSTRIAL AUTOMATION**

Fall 2014

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**Office Hours:** 8:30 AM – 11:30 AM, TUESDAY & WEDNESDAY (OTHER TIME BY APPOINTMENT)

**Section Information:** EE5377

**Time and Place of Class Meetings:** SH 331, 2:00 – 3:20PM, Tuesday and Thursday

Description of Course Content: In late 1960’s, Programmable Logic Controllers (PLC) were first introduced as a means of automating manufacturing process. Since then, PLCs have evolved into sophisticated and sometimes complex pieces of equipment. Nevertheless, their use and flexibility has reached a point where they are no longer discretionary pieces of equipment, but necessities. Very few industries exist today that do not employ PLCs. The relatively rapid integration of the PLC into the manufacturing sector has been called the second industrial revolution, and the revolution is far from over.

A successful engineer who is involved in nearly any manufacturing business needs a basic knowledge of the way in which PLCs are used. This course is established under the response of this demand for knowledge about PLCs. In addition to the PLC’s programming languages and hardware configurations, its typical applications in the manufacturing industry are also introduced. A hand-on design project is designed for the students to understand the typical PLC implementation process in industry.

**Student Learning Outcomes:** The application of programmable Logic Controllers (PLC) to the system automation is the trend of industry. As such this course is a joint enterprise between you and your instructor; an adventure in which you start your formal study of the theory, programming languages and possible applications of PLCs to the field of industrial automation. It is the faculty's intention that this course imbues you with a never ceasing quest for knowledge and experience that you may apply to the pursuit of your professional career. Since there is no so-called "standards" among PLC industry, the material of this course is not so much to be "covered" as to be "uncovered" and it is the faculty's hope that the study of this material will start your professional journey in the automatic control.

This course will provide engineer students comprehensive information on the operation and application of PLCs. Some hands-on projects will be designed to enhance the application and programming skills of the students. The knowledge of analog circuit analysis, digital circuit design, and computer programming is the prerequisite of this course.

**Required Textbooks and Other Course Materials:** L. A. Bryan and E. A. Bryan, "Programmable Controllers - Theory and Implementation", An Industrial Text Co. Publication, 2nd Edition

**Descriptions of major assignments and examinations: HOMEWORKS:** are due at the end of the class on the day the assignment is due. All work presented must meet professional standards regarding materials and format. Homework will be checked as to effort and number of problems presented. The homework grade is based on ten (10) points per problem per assignment. Since it is faculty’s strongly belief that a student’s success is directly proportional to success with homework, it is imperative that the homework be done.

It is the expressed policy of the faculty of the department to take decisive action involving any incidence relating to academic dishonesty. The instructor of this course will strictly enforce this policy!

**LATE HOMEWORK ASSIGNMENTS:** Homework must be turned in at the end of the class period on the day the assignment is due. No late homework will be accepted after the solution is posted in the copy center or web site. There will be a 25% grade reduction for each class period late.

**MAKE UP OF MISSED EXAMINATION:** There will be no makeup of a missed examination.

**CONSIDERATION OF RE-GRADING REQUEST:** It is the student’s responsibility to keep up with various grades assigned to their work by the instructor. If there is any question concerning the assigned grade, the instructor will accept a formal request to examine the grading in question if such a request is presented to the instructor within one-week following the returning of the material in question from the instructor. The entire original work in question must be submitted to the instructor. The instructor reserves the rights to re-grade the entire materials.

**Course Evaluation & Final Grade:**

# ITEM POINTS

1. HOMEWORK 10.00

2. FIRST EXAMINATION 15.00

3. FIRST PROJECT 15.00

4. SECOND PROJECT 15.00

5. THIRD PROJECT 20.00

5. FINAL EXAMINATION 25.00

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TOTAL COURSE POINTS 100.00

STUDENT COURSE AVERAGE FINAL LETTER GRADE

90.0 - 100.0 A

80.0 - 89.9 B

70.0 - 79.9 C

60.0 - 69.9 D

0.0 - 59.9 F

The grade of **W** will be assigned only if the conditions imposed by the University are met. The grade of **“Incomplete”** will be assigned only if the student has encountered circumstances beyond his or her control and the student’s previous actions have not created these circumstances. The assignment of this incomplete grade will be made at the decision of the instructor after consideration of the facts as presented in a written request from the student.

Attendance: The general format of the class will include formal lectures and lab sessions to develop the ideas and knowledge required for the understanding of Programmable Logic Controller and its applications. Since this is your education, you will be required to participate by:

* being aware of class procedures as set forth in this syllabus,
* attending all the lectures and labs,
* reading all assigned materials prior to the lecture,
* working the assigned homework problems,
* being aware of the course calendar, particularly examination times and dates

The grade of **W** will be assigned only if the conditions imposed by the University are met. The grade of **X** will be assigned only if the student has encountered circumstances beyond his or her control and the student’s previous actions have not created these circumstances. The assignment of this incomplete grade will be made at the decision of the instructor after consideration of the facts as presented in a written request from the student.

**See the Registrar’s Bulletin or the University Calendar in the front part of the UTA catalog for drop dates.**

**Grading**: **LATE HOMEWORK ASSIGNMENTS:** Homework must be turned in at the end of the class period on the day the assignment is due. No late homework will be accepted after the solution is posted in the copy center or web site. There will be a 25% grade reduction for each class period late.

**MAKE UP OF MISSED EXAMINATION:** There will be no makeup of a missed examination.

**CONSIDERATION OF RE-GRADING REQUEST:** It is the student’s responsibility to keep up with various grades assigned to their work by the instructor. If there is any question concerning the assigned grade, the instructor will accept a formal request to examine the grading in question if such a request is presented to the instructor within one-week following the returning of the material in question from the instructor. The entire original work in question must be submitted to the instructor. The instructor reserves the rights to re-grade the entire materials.

**Course Evaluation & Final Grade:**

# ITEM POINTS

1. HOMEWORK 10.00

2. FIRST EXAMINATION 20.00

3. FIRST PROJECT 15.00

4. SECOND PROJECT 30.00

5. FINAL EXAMINATION 25.00

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TOTAL COURSE POINTS 100.00

STUDENT COURSE AVERAGE FINAL LETTER GRADE

90.0 - 100.0 A

80.0 - 89.9 B

70.0 - 79.9 C

60.0 - 69.9 D

0.0 - 59.9 F

The grade of **W** will be assigned only if the conditions imposed by the University are met. The grade of **“Incomplete”** will be assigned only if the student has encountered circumstances beyond his or her control and the student’s previous actions have not created these circumstances. The assignment of this incomplete grade will be made at the decision of the instructor after consideration of the facts as presented in a written request from the student.

**Grade Grievances**: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current University Catalog. Please refer to <http://catalog.uta.edu/academicregulations/grades/#graduatetext> for additional information.

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wweb.uta.edu/aao/fao/>).

**Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Title IX:** The University of Texas at Arlington is committed to upholding U.S. Federal Law “Title IX” such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit [www.uta.edu/titleIX](http://www.uta.edu/titleIX).

**Academic Integrity:** Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington’s tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents’ Rule* 50101, §2.2, suspected violations of university’s standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student’s suspension or expulsion from the University.

**Lab Safety Training:**  **Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities.** Once completed, Lab Safety Training is valid for the remainder of the same academic year (i.e., through the following August) and must be completed anew in subsequent years. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in any lab activities, including those for which a grade is assigned.

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as “lecture,” “seminar,” or “laboratory” shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

**Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest building exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities. Please visit (<https://www.uta.edu/policy/procedure/7-6)> for additional information regarding Emergency/Fire Evacuation Procedures.

**Course Schedule**

**Tentative Lecture/Top Schedule (Course Content):**

0. Introduction of Utility Deregulation

\* Possible Applications of PLC

1. Introduction to PLCs

\* Principle of Operation

\* PLCs versus Other Type of Controls

\* Typical Areas of PLC Applications

\* The Benefits of Using PLCs

2. Number System and Logic Concepts

\* Number System and Number Conversion

\* Principles of Boolean Algebra and Logic

\* PLC Circuits and Logic Contact Symbology

3. Programming Languages

\* Types of PLC Instructions

\* Ladder Diagram Format

\* Basic Relay Instructions

\* Timer and Counter Instructions

\* Program/Flow Control Instructions

\* Arithmetic and Data Manipulation Instructions

\* Data Transfer and Network Communication Instructions

\* Other Non-Ladder Programming Languages

4. Implementing and Programming the PLC System

\* Implementing Guidelines

\* Programming Organization and Implementation

\* Discrete I/O Programming

\* Analog I/O Programming

5. Hardware Components of PLC

\* Processors, The Power Supply, and Programming Devices

\* Memory Systems and I/O Interaction

\* Discrete I/O Systems

\* Analog I/O Systems

\* Special Function I/O, Networking, and Serial Communication Interfacing

6. Data Measurements and Transducers

\* Basic Measurement Concepts

\* Interpreting Errors in Measurements

\* Implementation of Transducer Measurements

\* Thermal Transducers

\* Displacement Transducers

\* Pressure Transducers

\* Flow Transducers

\* Voltage and Current Transducers

\* Power Transducers

7. Applications of PLC in Industrial Automation

\* Remote Monitoring, Data Acquisition, and Control of a Substation

\* Power Plant Monitoring and Control

\* Applications on the Process Control

\* Other Applications

*As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.*

**Emergency Phone Numbers**: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911.

For non-emergencies, contact the UTA PD at 817-272-3381

**This final section is not part of the syllabus template, but a message from the UT Arlington Library.**

Faculty members should feel free to incorporate any of the following information into your course syllabus or other course materials.

Library Home Page <http://www.uta.edu/library>

Subject Guides <http://libguides.uta.edu>

Subject Librarians <http://www.uta.edu/library/help/subject-librarians.php>

Database List <http://www.uta.edu/library/databases/index.php>

Course Reserves <http://pulse.uta.edu/vwebv/enterCourseReserve.do>

Library Tutorials <http://www.uta.edu/library/help/tutorials.php>

Connecting from Off- Campus <http://libguides.uta.edu/offcampus>

Ask A Librarian [http://ask.uta.edu](http://ask.uta.edu/)

The following URL houses a page where we have gathered many commonly used resources needed by students in online courses: <http://www.uta.edu/library/services/distance.php>.

The subject librarian for your area can work with you to build a customized course page to support your class if you wish. For examples, visit <http://libguides.uta.edu/os> and <http://libguides.uta.edu/pols2311fm> . If you have any questions, please feel free to contact Suzanne Beckett, at [sbeckett@uta.edu](mailto:sbeckett@uta.edu) or at 817.272.0923.