TEXAS A&M UNIVERSITY

IDIS 400-Industrial Automation

Spring 2019 Syllabus

SECTIONS 501 & 512

Instructor: **Pat Wallace**
Industrial Distribution Program
Email: pat.wallace@tamu.edu Tel: 979-845-4660

Class Schedules:
Sections 501 – 504: TR 2:20 PM – 3:35 PM (ZACH 218)
Sections 505 – 508: MW 4:10 PM – 5:25 PM (ZACH 218)
Sections 509 – 512: MWF 1:50 PM – 2:40 PM (ZACH 441)

Lab Schedules: The following lab days and times are listed in Howdy.

501 = F	12:00 –1:50 PM	Thompson 115C	Samin Moosavi
502 = T	12:00 –1:50 PM	Thompson 115C	Amrita Bal
503 = W	6:20 – 8:10 PM	Thompson 115C	John Chen
504 = T	8:20 – 10:10 PM	Thompson 115C	Amrita Bal
505 = F	2:00 – 3:50 PM	Thompson 115C	Samin Moosavi
506 = R	8:00 – 9:50 PM	Thompson 115C	Samin Moosavi
507 = T	2:00 – 3:50 PM	Thompson 115C	John Chen
508 = M	8:20 – 10:10 PM	Thompson 115C	John Chen
509 = T	6:20 – 8 :10 PM	Thompson 115C	Amrita Bal
510 = T	8:00 – 9:50 AM	Thompson 115C	Amrita Bal
512 = W	8 :20 – 10 :10 PM	Thompson 115C	John Chen

Office and Hours:

Room 304B, Fermier Hall	**Room 424, Zachry**
11:00 – 12:30 M-F or by appointment	12:30 – 1:30 M-F or by appointment

TA's:
Amrita Bal (Email: abal@tamu.edu)
Zhong (John) Chen (Email: Zhongchen@tamu.edu)
Samin Moosavi (Email: saminmoosavi@tamu.edu)

Course Web site: *http://ecampus.tamu.edu.* Login using your *NetID* and *Password*.

E- Communication:

E-mail and e-campus will be the primary sources of communication for the class information, assignments, handouts and announcements. Therefore, it is the student's responsibility to check his/her **e-mails and e-campus** on a regular basis.

Prerequisites: Successful completion of IDIS 300

Textbooks:

Required:

Programmable Controllers – R. Cox and T. Borden – Thomson/Dellmar, 6th edition.
ISBN 978-1-111-54409-6 (Print $148.96/e-book $26.97)
Lab Manual, TAMU Book Store or Textbooks Solutions

Course Notes, Slides, and Assignments are available on e-campus – these may be modified during the semester as new material or activities are developed.

Course Description:

Applications of industrial automation, theory and practice using Allen-Bradley PLCs, and RSLogix™5000 software, I/O modules, Processor Unit, Memory Organization, Ladder Diagrams, Programming with RSLogix™5000, Timers, Counters, Data Manipulation, Math Functions, PID control, and Communication Networks.

Course Topics

1. Describe components and function of a PLC.
2. Identify circuit of input and output modules of a PLC as well as their electronic components.
3. Write, T/S, download, and run ladder programs to solve simulated problems with a PLC.
4. Compute conversions between decimal, hexadecimal, octal, binary & BCD number systems.
5. Write negative numbers using signed-binary-numbers.
6. Write ladder programs using Timers and Counters to solve simulated problems with a PLC.
7. Incorporate data move, data compare and math functions to the ladder programs to solve problems with a PLC.
8. Apply Proportional + Integral + Derivative (PID) theory to design stable systems in engineering.
9. Recognize hardware, software, & systems used in communication networks between PLCs.

Learning Outcomes and Course Objectives

1. Select and apply knowledge and skills to write, troubleshoot, download, and run ladder programs (including input/output devices, timers, counters, data move, data compare and math functions) to solve simulated problems with a PLC.
2. To conduct, analyze, and interpret experiments using a PLC.
3. To apply experiments using a PLC to improve results of an intended task.
4. To function effectively when working in a PLC team.
5. Select and apply knowledge of computer number system conversions (decimal, hexadecimal, octal, signed/binary and BCD) in order to incorporate it to ladder programs to solve PLC problems.
6. Apply Proportional + Integral + Derivative (PID) theory to design stable systems in engineering using a PLC.
7. Recognize hardware, software, and systems used in digital logical communications NETWORK between PLCs.

Note: *If you are having difficulty during this course, please come and talk to me. I will be available every day during the semester and I am very interested in you being able grasp of the course material. I will do my best to help you achieve these learning outcomes and course objectives.*

Course Format:

The course will consist of readings from the text, lectures, labs, and exams as shown in the table below.

Tentative Class and Lab Schedule for IDIS 400 – Spring 2019 – Pages and questions refer to 6th edition of textbook.

Wk	Wk	Topics	Text Chapter	Pages (Reading homework)	Homework for practice & understanding	Lab practices
1	**Jan. 14 – 18**	Course Overview What is a PLC? Input/Output Section	Ch. 1 Ch. 2	Ch 1: All: 1-9 Ch 2: 10-29 & 28,29	Ch 1: All: 1-10 Ch 2: 1-4,6,11,14	No Lab Jan. 14 – 18th
2	**Jan. 21 – 25**	The Processor Unit Memory Organization	Ch. 3 Ch. 4	Ch 3: 44-49,52,54,59 Ch 4: 61,62,74,75,76, 96, 97 & Addressing Format in Lab Manual.	Ch 3: 1-3& 13-15 Ch 4: 2-3	Lab Intro. – Rules, equipment, security. Lab 1 – Logic Circuits
3	**Jan. 28 – Feb 1**	Ladder Diagrams	Ch. 6	Ch 6: 121-138	Ch 6: 1-10 & 13	Lab 2 – Transition – Hardwiring vs. PLC
4	**Feb. 4 – 8** **T1**	Review for Test 1 **Wed/Thu: Test 1: Ch. 1-4, 6 & Labs 1-3** Relay Type Instructions	Ch. 7	Ch 7: 139-147 Examine On/Off in Lab Manual	Ch 7: 1-7	Lab 3 – Ladder Schematics and Diagrams
5	**Feb. 11 – 15**	Timers	Ch. 11	Ch 11: 223-229 & 231-234 Timers in Lab Manual	Ch 11: 2-7	Lab 4– Intro to RSLogix 5000 Software and ControlLogix 5550
6	**Feb. 18 – 22**	Counters	Ch. 12	Ch 12: 235-243 & 245-247 Counters in Lab Manual	Ch 12: 1-7 & 9-13	Lab 5- Advanced Ladder Diagrams
7	**Feb. 25 – Mar. 1**	Number Systems	Ch. 5	Ch 5: 98-118	Ch 5: 1-14	Lab 6 - Timers
8	**Mar. 4 – 8** **T2**	Review for Test 2 **Wed/Thu: Test 2: Ch. 5, 7, 11, 12 & Labs 5-7**		Assignment: Conference Room Energy Savings Problem.		***Assignment: Conference Room Energy Saving Problem.*** Lab 7 - Counters
	Mar. 11 – 15	Spring Break				
9	**Mar. 18 – 22**	Data Manipulation Math Functions **Paper/Presentation Assignments**	Ch. 13 Ch. 14	Ch 13: 248 – 264 Ch 14: 265 - 272	Ch 13: 1-7 Ch 14: 1,2 & 4-8	Lab 11 Lab 8: (A)Arithmetic & Comparison Instructions
10	**Mar. 25 – 29**	Programming Considerations Program Control Instructions	Ch. 9 Ch. 10	Ch 9: 192-201 & 205-206 Ch 10: All	Ch 9: 1-5 & 7 Ch 10: All	(B) Timers, Counters, & Arith. Combinations Lab 9, 10, 12, 13 – DEMOs
11	**Apr. 1 – 5** **T3**	Review for Test 3 **Wed/Thu: Test 3: Ch. 5, 9,-10, 13,14 & Lab 8-12** PID Control	Ch. 17	Ch 17: Read pages needed to answer questions 1-4. PID Control in Lab Manual pp. 119 – 127	Ch 17: 1-4	Project Week – Conference Room Problem
12	**Apr. 8 – 12**	Mon/Tue: Student Papers Due PID Control continued Student Presentations - Ch 20		Reference Ch 20: 358-392 Individual Paper Submission		Project Week – Conference Room Problem
13	**Apr. 15 - 19** **Apr. 19** **Reading Day**	Student Presentations - Ch 20	Ch. 20	Ch 20: 358-392 Oral Present. In Lab Manual	Ch 20: 1-11	Last chance to show Final Project assignment to your TA.
14	**Apr. 22 – 26** **T4**	Review for test 4 **Wed/Thu: Test 4: Ch. 17, 20** Student Presentations - Ch 20				Lab make-up
15	**Apr. 29 – May 1** Refined Friday	Student Presentations - Ch 20				No lab.
	May 2 – 7	No Final Exam				No lab.

Student Presentations: Oral Presentations based on Chapter 20: Communication Networks. Topics will be assigned near the end of the semester.

Rules for the oral presentation:

1. Grade: Your presentation will be graded as follows:
   a. Written peer evaluation 1 point
   b. Team participation in the oral presentation 0.5 points
   c. Subjective instructor evaluation 3.5 points
2. Four to Eight minute Power-Point presentation
3. Use Textbook as reference, additional references are required.
4. Use pictures and graphs to enhance your presentation.
5. Some questions of final test will come from these topics.
6. No humor (of any kind) is allowed during the presentations.
7. **Attendance is not optional**. If you do not attend and participate, you will charged 0.5 points on your final grade. Your peer evaluation will be my record of your attendance and participation. A form will be provided for your evaluation of the presentation. Remember that you will also be evaluated so be fair and professional to the other members of the class.

Rules for course paper:

1. This is an individual assignment.
2. The paper is only a two page paper on your assigned topic.
3. Papers will be submitted on-line through "Turn-it-in" and checked for plagiarism.
4. Format
   a. Cover page
   b. Text (two full pages)
   c. References

Student Final Project:
This is an individual project assigned to verify if each student is capable to write a simple PLC program, download it, and troubleshoot it. The student has to solve a Conference Room Energy Saving Problem. This is a compulsory task and fail to complete it earns an Incomplete. The grade will count as a lab grade.

Grading:

Exam 1	15 %	A = 90 – 100	89.5 is a B	Students will be allowed to use a 3" x 5" card with notes in selected tests. They can write anything on both sides of the card.	If a student needs to use their cell phone for calls he/she has to leave the classroom as quite as possible.
Exam 2	15 %	B = 80 – 89	79.5 is a C		
Exam 3	15 %	C = 70 – 79	69.5 is a D		
Exam 4	15 %	D = 60 – 69	59.5 is an F		
Presentation/Paper	10 %	F = 0 – 59			
Homework/Pop Quiz	10 %				
Laboratory	20 %				
Total	100 %				

Exams: There will be 4 regular exams. Everybody must take the last exam when offered. The dates for the exams are tentative. Missing test policy: If you have a valid reason, you can arrange with the instructor, prior to the exam, to take the test a day after the assigned exam date. If you miss a test and you have a valid excuse but cannot take the test within one day of assigned date, you must talk to the instructor to set a date.

"Documentation must be provided for excused absences. Written documentation from a medical professional is required in the event of an illness."

Pop Quizzes: Pop quizzes are used to determine mastery of topics covered in previous classes and will verify attendance and participation. These will be multiple-choice questions answered using the I-clicker system. Be sure to have your I-clicker registered to receive credit. It is your responsibility to make sure you are getting credit. In the past, students **lost a letter grade** because they did not come to class or missed too many pop quiz questions.

Homework: Homework is assigned in the above class schedule to help reinforce the topics presented but will not be graded. It consists of readings and problems pertaining to the current lecture material. **Homework to be collected and graded will be assigned in class**. Consider homework as preparation for tests and lab.

Laboratory: The lab is not optional. Any missed lab must be made up on the following lab session or by arrangement with your TA. The student must have a grade of 70% or higher in the lab to pass the course. A lab grade below 70% will give an automatic "F" in the course. **EACH STUDENT MUST ATTEND LAB AT THE HOUR SHOWN IN HIS/HER REGISTRATION SLIP.** Lab grade formula: 50% Lab work + 20% Written report + 20% Quiz + 10% Safety.

Quizzes: Quizzes may be given during lectures and labs to determine how well a concept is understood.

Classroom Expectations:

1. You will try your best to come on time.
2. You are expected to be alert and attentive in class. Ask questions and participate in the class discussion.
3. Respect the instructor, your fellow students and the learning environment in the classroom.
4. Zachry Engineering is a new building with tons of technology. You are expected to treat the opportunity with respect by following the rules. The technology is new and will require you to connect to the room computer, so you can expect issues/problems to surface. This will require patience from both students and faculty. Just saying! It is hopeful that we can make good use of the technology which means that you will be able to use your laptops or tablets in class. However, these tools are for class work only. Everything else is considered in appropriate in the class and a distraction, so please wait until class is over.
5. Seating will be assigned after the first class because each table will form a collaboration team for the course.
6. The class arrangement is unique as you will see when you get to enter the building, which by design, is set for collaboration among team members. This means that you will be assigned to a team and workstation for the semester. Activities will be planned upon which you will be asked to present your solution and the rest of the class will be asked to evaluate your solution and seek best practices for a solution. This should be fun and more engaging than in past classes. We will see how this works out. You will be the second class for this teaching style.
7. Do not hesitate to discuss with the instructor if you have any questions. If you do not want to ask in the class, take advantage please arrange an appointment with the instructor.
8. If you attend class, it would be appreciated if you stay until the end. If you have to leave early for any reason, please let me know before the class and sit close to the door.
9. Keeping in mind building rules, please no food, drinks, tobacco products or animals (unless approved) within the classroom.
10. I will try my best to ensure there is a positive learning environment in the classroom. Let me know how I can help you to make your learning experience more enjoyable.
11. After class, if the room is straight and free of litter, I will offer **1 bonus point to your final grade**; however, if I have to clean up after class, you can forget it.

Disabilities:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit **http://disability.tamu.edu**.

Aggie Code of Conduct:

Students are expected to abide by the Aggie Honor Code: ***"An Aggie does not lie, cheat or steal, or tolerate those who do.*** "Academic dishonesty will not be tolerated and will be dealt with in accordance with Texas A&M University Regulations. http://aggiehonor.tamu.edu/Rules-and-Procedures/Rules/Honor-System-Rules

IDIS 400-Industrial Automation

Relation between IDIS 400 Course Objectives and IDIS Program Outcomes

An Industrial Distribution graduate has the following abilities at the time of graduation.

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.*
2. *An ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.*
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.*
4. *An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes.*
5. *An ability to function effectively as a member or leader on a technical team.*
6. *Accomplish the integration of systems using appropriate analytical, computational, and application practices and procedures.*
7. *Apply knowledge of probability, statistics, engineering economic analysis and cost control, and other technical sciences and specialties necessary in the field of industrial engineering technology.*

The following table indicates how this course contributes to the achievement of the overall programmatic educational outcomes. Entries with an "H", "M", and "L", refer to high, medium, and low relevancy, respectively.

Course Objective	IDIS Program Educational Outcome							Assessment Method
	1	2	3	4	5	6	7	
Select and apply knowledge and skills to write, troubleshoot, download, and run ladder programs (including input/output devices, timers, counters, data move, data compare and math functions) to solve simulated problems with a PLC. **(Understand**)	M							Exams 1-3 Labs 2-10 Project
To conduct, analyze, and interpret experiments using a PLC. **(Evaluate)**	H	M	M	H	M			Exams 1-3 Labs 2-10 Course Project
To apply experiments using a PLC to improve results of an intended task. **(Apply**)	H		M	H	M			Exams 1-3 Labs 2-10 Course Project
To function effectively when working in a PLC team. **(Apply**)					H			All Labs Oral Presentations
Select and apply knowledge of compute number system conversions (decimal, hexadecimal, octal, signed/binary and BCD) in order to incorporate it to ladder programs to solve PLC problems. **(Apply**)	H	M		M				Exams 2-3 Labs 7-8
Apply Proportional + Integral + Derivative theory to design stable systems in engineering using a PLC.**(Create)**	M			M				Exam 4
Recognize hardware, software, and systems used in digital logical communications NETWORK between PLCs. **(Understand)**			H		M			Exam 4 Oral Presentations

Laboratory Safety:

Basic Student Guidelines

Save this document for your own reference

*Please read these Safety Guidelines, complete and sign the **Lab Safety Agreement (LSA)** on line using Howdy.*

It is a requisite to complete the LSA on line before working in the lab.

Safety is a priority at Texas A&M University!
While it may seem unlikely that an accident could happen to you, you should know the accident rate in universities is 10 to 100 times greater than in the chemical industry. To help prevent accidents, safety notes are included in the lab manual. In addition, any relevant Material Safety Data Sheets (MSDS) are in a laboratory binder and guidelines are posted.

Pay close attention to this information – our goals are:

1. To avoid accidents in the lab, and
2. To respond promptly and appropriately should an accident occur.

Safety depends on you!
It is your responsibility to follow the instructions in the lab manual and any additional guidelines provided by your instructor. It is also your responsibility to be familiar with the location and operation of safety equipment such as eyewash units, showers, fire extinguishers, chemical spill cleanup kits etc.

General Laboratory Safety Guidelines
This is part of the IDIS 300 and 400 Syllabus.

- **Wear appropriate protective clothing**. Do not wear open-toed shoes, sandals, or shirts with dangling sleeves. Tie back long hair and avoid dangling jewelry.
- **Clean** your workstation after each lab period, and return all equipment and materials to appropriate stations **before** leaving the lab.
- Always **turn off the power** before working on any electric circuit or electronic device.
- When operating with electric circuits and electronic devices other than just a computer, you must **work in pairs or teams**.
- When in doubt about the operation of any circuit or device in lab, always **have an instructor check your work** before connecting power to your system.
- **Report any safety issues or violations** that you are aware of as soon as possible to your course instructor and program director.
- Ensure that you have a **safe buffer area around you** and that you are working on an appropriate surface when using soldering irons in the lab.
- Always make sure that all lab equipment, soldering irons, project circuits are **powered down** before leaving your lab area.
- Ensure that your work environment is clear and free of debris before starting your work **AND** after finishing your project.
- **Never block** walkways in the laboratory with lab equipment, cables, and electrical power cords.
- **Do not eat, drink, smoke, or apply cosmetics** in the laboratory.
- **Avoid all horseplay** in the laboratory.
- **Dispose of sharps** waste properly — place broken glass in the glass discard container, metal in the metal waste container, and place other waste materials in the designated container(s). Secure all sharps, including needles, blades, probes, knives, etc.