

ETEE 3373 01 Industrial Electronics (3 cr. Hrs, 4-contact Hrs.) MW: 8:00 – 9:50 AM PETC 220 & 142 (*Robotics Lab*) Instructor: Dr. Reg Pecen, Quanta Endowed Professor Office: PETC 420D @ 936-294-4137 e-mail: regpecen@shsu.edu Office Hours: MW: 11:00 – 11:50 AM and 1:00-3:00 PM

(You can also call or e-mail me and arrange extra office hours by appointment). **Textbook:** Industrial Automated Systems Instrumentation and Motion Control, Terry Bartelt, Delmar Cengage Learning, 2011. ISBN: 978-1-4354-8888-5.

Laboratory Manual/Workbook: Laboratory experiments documentation will be provided by the course instructor.

Course Catalog Description: The principles and operation of electrical switching, timing and control devices are studied with emphasis on industrial solid state and digital controls. Topics of coverage include servomechanisms, transducers, motor control systems and closed-loop industrial systems. (3-credits, 4-contact hours). *Prerequisite: ETEE 2320 and ETEE 1340. Sophomore standing.*

Required Supplies: A notebook and a TI scientific/engineering type calculator.

<u>Course Objective</u>: This course is designed to provide the student with significant knowledge in the principles and operation of electrical and electronic control systems. The objectives of this course are to expose the students to the concept of magnetic circuits, principle of operation of AC and DC machines including their construction and operating characteristics. DC and AC Motors/Generators principles and operation as well as Sensors and their control electronics will be covered.

Major Measurable Learning Outcomes:

Electrical motor and industrial control systems constitute some of the main pillars of Electrical/Electronics/Computer Engineering Technology using Mathematics and Physics, fundamentals of circuits and systems, electrical machinery, and control techniques. The term *Industrial controls* is used to define feedback control system which automatically monitors manufacturing processes being executed and takes appropriate corrective actions if the operation is not performing properly. Industrial control systems safely and effectively facilitate the different scales of electrical, electronics, pneumatic, hydraulic, electromechanical applications or any combination of all systems in the industry. The learning outcomes of this class are listed as follows:

- Analyze the steady state and small signal AC response of simple electronic circuits containing diodes, transistors, and operational amplifiers
- Apply performance criteria in the design of basic amplifier circuits and verify that the criteria were met.
- Design, wire, and analyze circuits containing power electronics switches, analog/digital controllers, motor drives, servo motors, and process control modules.
- Analyze and evaluate performance parameters of AC and DC motors.
- Analyze and evaluate open-loop and closed loop control systems.



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Computer Software Tool: MindSight Learning Software that will provide an easy access to review lab and lecture material and quizzes will be available for students.

Class Structure and Attendance: This is an important fundamental class and your attendance is <u>highly encouraged.</u> Lectures, laboratory experimental projects, homework assignments and a design project with a final report will constitute the structure of the course. The make-up labs and exams will be given only in the case of <u>documented physical illness</u> (In this case, students must inform instructor at least 24 hours before the exam). *You will also be given pop-quizzes. There will be no make-up option if you are not in the class during the pop-quiz time.*

Labs: There are regular scheduled labs for this course. There will be total 20 Labs are planned to be covered through three separate subject matters; Basic Controls, Motor Drives, and Sensors. Example: Lab#10 E5-2 Soft Starters (after each Lab answer review questions for your own study and after each Unit, take and submit online-Review Test at *MindSight*).

All laboratory project assignments must be completed for your lab grading. You must attend and successfully complete the each lab to pass the class. Lab reports will be due on the day of labs completed at Industrial Control Trainers. Lab Reports will be submitted electronically through *MindSight*. Necessary tables, simulation results, and graphics may be needed. Every student must submit his/her lab **report individually**. Lab report grading will be based on a maximum grade of 20 (A). You must earn a **minimum of 13**/20 for a passing grade in lab activities.

Homework (HW) Assignments: Homework assignments will be available through SHSU Blackboard. The HW assignments will be either automatically graded by *Blackboard* system or by instructor and be available to students after completion of each HW assignment. The HW assignments may not be available to the students after the due dates. *Late homework assignments will be accepted based on 10 pts off for each day delayed* (except documented physical illness or family emergency cases). Please submit your assignment ON TIME even if it is missing few problems.

• Students are encouraged to work and discuss with others on the lab reports and homework assignments, however, submissions must consist of the students own work, in accordance with departmental policies. Please work neatly, showing all calculations, manipulations, plots, and simulation program files (if any) required reaching your solution.

Control Systems Project with Simulation & Design: All students are expected to complete an applied research design project based on their interest using the components available in the ECET laboratory. The project can be directed to a specific electrical/electronics/computer engineering technology circuit, device, application, or assigned process. The project will involve a proposed control solution with a demonstration of specific aspects of the process of the circuit.

- You must submit a proposal of the project by Wed, March 28, 2018. All projects must be approved by Monday, April 2nd, 2018.
- You will be expected to present and submit your project reports in the class on the last day of the classes (Wednesday, May 2nd, 2018).
- All the project reports should include (a) the purpose of the project, (b) technical details, (c) schematic diagrams, (d) simulation, (e) practical design, (f) measurements, (g) results, (h) graphs (as needed), and (i) conclusion.



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Program Outcomes Supported by Course Objectives http://www.shsu.edu

Directly supported ECET program outcomes:

Analyze, design, and simulate electric circuits and systems (1).

Design and carry out experiments (5).

Collaborate in laboratory and classroom to work effectively in teams (9).

Indirectly supported ECET program outcomes:

Have knowledge of fundamental principles of science and mathematics and apply them to solve practical problems of engineering technology (6).

Produce clear, precise and effective technical documents and oral presentations with the help of modern information technologies (8).

Course Content: The tentative course content will include the topics shown on page 4. Depending upon extra handouts/simulations/homework assignment explanations, the tentative course content may be shifted slightly.

Lab Schedule: The tentative lab schedule includes the topics listed on page 4. Depending upon extra handouts/simulations/homework assignment explanations, the following tentative lab projects may be shifted slightly.

Grading: The final grade will be calculated based on the following requirements.

Mid-term Exa	m		20%
Final Exam			20%
Laboratory Experimental Projects (10 Lab Sessions)			15%
Homework Assignments (10 assignments)			15%
Attendance, Participation, Attitude			10%
Quizzes (5-8)			10%
Class Design Project			10%
Total			100%
	Percentage Range	Letter Grade	
	00 100	•	

Percentage Range	Letter Grade
90 - 100	А
80 - 89	В
70 - 79	C
60-69	D
0-59	F

Course Content and Lab Schedule: The tentative course content and lab schedule will include the following topics. Depending upon extra handouts/simulations/homework assignment explanations, *the following tentative course content may be shifted slightly*.

		ETEE 3373 01 Industrial Electronics - Spring 2018	
Week	Date	Subject	Readings- Assignments- Resources
1	1/17	Intr. & Course Syllabus Review & Discussion	pp. 3-15



Department of Engineering Technology College of Science and Engineering Technology SAM HOUSTON STATE UNIVERSITY

		1	
		Sect. 1. Ind Control Overview Ch 1. Intro. to	
	4/00 4/04	Industrial Control Systems	
2	1/22 – 1/24	Cont. to Ch. 1 Sect 2. The Controller Ch 4:	
		Controller Operation HW#1 (Ch 1); Due 1/29	
3	1/29 – 1/31	Ch. 4: Controller Operation HW#2 (Ch 4); Due 2/7	
4	2/5 - 2/7	Intro to Laboratory Equipment and Parts	There are 3 areas of Lab
		Lab #1 BC E1-1 Lockout/Tagout Procedure	Projects/Activities:
		Lab#2 BC E1-2 Control Panels Devices	1. Basic Controls (BC)
		Lab#3 BC E1-3 Manual Starters	2. Motor Drives (MD)
		Lab#4 BC E1-4 Contactors & Control Relays	3. Sensors (S)
		Lab#5 BC E1-5 Current Protection Devices	Answer Review
		Lab Reports Due immediately after Labs	Questions on MindSight
			Submit BC Unit 1 Test
		Answer the review questions for each Lab on	Basic Principles of
		MindSight	Motor Control
			@MindSight
5	2/12 – 2/14	Sect. 3 Electric Motors Ch. 5 DC Motors – Power	Answer review questions
		and Controls	for each Lab @MindSight
		HW#3 (Ch 5) ; Due 2/21	
		Lab#6 BC E2-1 Specs Reading	
6	2/19 - 2/21	Ch. 6 AC Motors – Power and Controls HW#4 (Ch	Submit BC Unit 2 Test
		6) ; Due 2/28 Lab#7 BC E2-2 Symbols,	Layouts & Specs
		Designations, and Diagrams	@MindSight
		Answer review questions for each Lab	
7	2/26-2/28	Cont. to Ch 6 AC Motors	Answer Review Qs for
		Lab#8 BC E3-1 Motor Starters	Labs 8-10
		Lab#9 BC E5-1 Primary Resistor Starters	Submit BC Unit 5 Test
		Lab#10 E5-2 Soft Starters	Reduced AC Volt
			Starters @MindSight
8	3/5 – 3/7	Ch. 7 Servo Motors	Midterm Test,
		HW#5 (Ch 7); Due 3/21 Mid-Term Test (Chapters	Wednesday, March 7
		1, 4, 5,6 and Labs Covered)	<mark>Ch. 1, 4, 5, 6 and Labs</mark>
9	3/12 – 3/14	Spring Break	٢
10	3/19 – 3/21	Ch. 8 DC Drives	Answer Review Questions
		HW#6 (Ch 6); Due 3/28	for Labs 11-12
		Lab#11 Motor Drives (MD) E2-1 DC Drive	@MindSight
		Overview (Page 71 on Motor Drives)	Submit MD Unit 2 DC
		Lab#12 MD E2-2 Current Limiting & IR Compens.	Drives @MindSight
11	3/26 – 3/28	Ch. 9 AC Drives	3/29 Project Proposals Due
		HW#7; Due 4/4 Lab #13 MD E1-1 AC Drive	Answer Review Questions
		Overview Lab#14 MD E1-2 Volts per Hertz	for Labs 13-14
		Characteristics	@MindSight
12	4/2 - 4/4	Cont. to Ch 9 AC Drives	Answer Review Questions
		Lab#15 MD E 1-5 Braking Jogging	for Lab #15 @MindSight
13	4/9 – 4/11	Ch. 10 Pressure Systems and Ch. 11 Temp Control	v
		SENSORS	
		HW#8 (Ch 10-11): Due 4/18	



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14	4/16 - 4/18	Sensor Labs	Answer Sensors Review
		Lab#16 Sensors (S) E1 Int to Sensors	Questions for Lab#16-18
		Lab#17 S E2 Background Suppression Photoelectric	@MindSight
		Switch	
		Lab#18 S E3 Polarized Retroreflective Photoelectric	
		Switch	
15	4/23 – 4/25	Lab#19 S E4 Capacitive Proximity Switch	Answer Review Questions
		Lab#20 S E5 Inductive Proximity Switch	for Labs 19-20
		Make-Up Labs (if any)	@MindSight
16	4/30 – 5/2	Last Week of Classes – Applied Research Projects	Design Project Presentations;
			May 3 rd
17	Finals Week	<mark>Monday, May 7, 2018, 8:00-10:00 am</mark>	Wíshes best luck
	May 7-9, 2018	Final Exam is Cumulative	

Laboratory Assignments: There are regular labs will be announced by the instructor during the lectures for this course. All laboratory project assignments must be completed for your lab grading. You must obey departmental laboratory safety rules & policies. *You must attend and successfully complete the each lab.* If hand-writing is needed; make sure you write clearly and neatly! Student misses the lab section of the class should submit lab report individually if a specific reason for the absence is provided to instructor.

Note: It is the student's responsibility to arrange make-up labs with the instructor. Make-up labs may be considered with a report proven medical reason.

Lab Submission Procedure:

Submit the laboratory workbook pages indicating your work and a well-written report of conclusion. Lab reports are due on the same day after completed the labs on the industrial Controls Trainers through **MindSight** e-Submission. Late lab reports accepted based on 2 pts off for each delayed day.

Rules and Recommendations for Effective and Safe Use of the Laboratory and Work Benches in PETC 140/142 Laboratories

- 1. DO NOT turn on the power before the instructor checks your circuit!
- 2. Use the coat racks for neat laboratory appearance as well as safety. Do not place coats or book bags on workbenches.
- 3. Refrain from drinking beverages in the laboratory. The hall may be used for intervals of relaxation.
- 4. The lab bench must be cleaned and all wires must be returned to the hooks provided in the lab room before leaving the room.
- 5. Report all component and equipment failures to your Instructor lab TA. Neglecting to report faulty equipment causes problems for the next group that uses the bench and may result in injuries.
- 6. When using the instruments *DO NOT STACK THEM*, as the combined heat may cause component failure.
- 7. Place all of the trainer units, transformers, motors, DMMs, resistors, inductors, capacitors, etc., back to their original places and/or *original rated* boxes after you are done with the laboratory.
- 8. All power switches should be turned off before leaving the lab bench.
- 9. Rings and other jewelry, which may cause a potential hazard, must be removed before working in the laboratory.
- 10. No individual should operate equipment in the laboratory until the appropriate examinations are passed and/or demonstrations by instructor are safely observed.



Department of Engineering Technology College of Science and Engineering Technology SAM HOUSTON STATE UNIVERSITY **Classroom Rules of Conduct:** Students will avoid doing behavior in the classroom that intentionally or unintentionally disrupts the learning process and, thus, obstructs the mission of the university. *Cellular telephones and pagers must be turned off before class begins*. The use of cell phones or other electronic devices is prohibited without permission of the instructor. Students are prohibited from *eating in class, using tobacco products, making offensive remarks, reading newspapers, sleeping, talking at inappropriate times, or engaging in any other form of distraction*. Inappropriate behavior in the classroom shall result in a directive to leave class. One warning will be given for a violation and all additional violations will result in a one letter grade reduction. If academic dishonesty is suspected, the student will be reported to the Dean of Students for disciplinary action in accordance with university policy.

Digital Protocol: *Cell phones must be placed on either vibrate or silent mode* and are to be accessed in emergency cases only. <u>There will be NO ear-phones or headphones allowed during the class or lab times.</u> The use of laptops or any other digital device is permitted in order to facilitate note-taking relative or circuit simulation needs to the instruction. The electronic recording of the time on Blackboard will be considered the time of assignment submission. Take necessary steps to ensure that your assignments are submitted manually on the due time or electronically on "Blackboard" time. Back-up and/or additional copies of all assignments submitted is encouraged. Computers/printers are available to students in the Library or designated departmental labs; therefore, not having access to a computer/printer due to technical issues (crash; corrupted files) will not be considered as an acceptable reason for not completing assignments.

I encourage you to utilize the Professional and Academic Center for Excellence (PACE)'s **free assistance** with writing, math, science, reading, and learning strategies. The PACE is dedicated to providing professional development for administration, faculty, staff, and students. Using programs and services founded on evidence-based teaching and leadership strategies, our ultimate goal is effective student learning and development. Please contact; CHSS Room C002 or e-mail: <u>PACE@shsu.edu</u>; Tel: 936-294-2688

General Safety Procedures – Introduced by the instructor		
I. Introduction: How Electricity Works	II. Hazards of Electricity	
a. Conductors	III. Electrical shock	
b. Insulators	IV. Electrical burns	
c. Grounding	V. Electrical fires	
	VI. Case Studies of Electrical Accidents	
VII. Types of Electrical Hazards	VIII. How to Protect Yourself from	
a. Working on energized circuits	Electricity	
b. Loose connections	a. General electrical safety rules	
c. Frayed or missing insulation	b. Properly grounded electrical	
d. Missing ground prongs on plugs	circuits	
e. Water and electricity don't mix	c. Ground fault protection near	
f. Damaged power tools	water sources	
g. Ungrounded equipment	d. Insulated power tools	
h. Improper use of extension cords	e. Proper housekeeping	
	f. Don't overload circuits	
IX. Soldering Hazards		
a. General soldering safety rules		
b.Proper handling of soldering equipment		

Academic Dishonesty: All students are expected to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain honesty and integrity in the academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. The University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including but not limited to, cheating on an



Department of Engineering Technology College of Science and Engineering Technology SAM HOUSTON STATE UNIVERSITY

http://www.shsu.edu/etec

examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials.

Student Absences on Religious Holy Days Policy: Section 51.911(b) of the TX Education Code requires that an institution of higher education excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. A student who is excused under this subsection may not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused within a reasonable time after the absence. University policy 861001 provides the procedures to be followed by the student and instructor. A student desiring to absent himself/herself from a scheduled class in order to observe (a) religious holy day(s) shall present to each instructor involved a written statement concerning the religious holy day(s). This request must be made in the first fifteen days of the semester or the first seven days of a summer session in which the absence(s) will occur. The instructor will complete a form notifying the student of a reasonable timeframe in which the missed assignments and/or examinations are to be completed. Services for Students with Disability (SSD): The mission of the Services for Students with Disabilities (SSD) is to promote full and equal access on the part of students with disabilities to educational and extracurricular programs and activities at SHSU.It is the policy of SHSU that individuals otherwise qualified shall not be excluded, solely by reason of their disability, from participation in any academic program of the university. Further, they shall not be denied the benefits of these programs nor shall they be subjected to discrimination. Students with disabilities that might affect their academic performance should register with the Office of Services for Students with Disabilities located in the Lee Drain Annex (telephone 936-294-3512, TDD 936-294-3786, and e-mail disability@shsu.edu). They should then make arrangements with their individual instructors so that appropriate strategies can be considered and helpful procedures can be developed to ensure that participation and achievement opportunities are not impaired.

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Services for Students with Disabilities and to talk with me about how I can best help you. All disclosures of disabilities will be kept strictly confidential. NOTE: No accommodation can be made until you register with the SSD. For a complete listing of the university policy, see: http://www.shsu.edu/dept/academic-affairs/documents/aps/students/811006.pdf

Tobacco Policy: In order to promote a healthy, safe, and aesthetically pleasing work, educational, and living environment, SHSU will endorse a smoke-free and tobacco-free environment. The primary purpose of this policy is to establish guidelines prohibiting smoking and the use of all tobacco products. Tobacco products include cigarettes, cigars, pipes, smokeless tobacco, and all other tobacco products. This policy applies to all faculty, staff, students, employees of contractors, and visitors of SHSU on the premises of the university.

Visitors in the Classroom: Only registered students may attend class. Exceptions can be made on a case-bycase basis by the professor. In all cases, visitors must not present a disruption to the class by their attendance. Students wishing to audit a class must apply to do so through the Registrar's Office.

"The aforementioned schedule, policies, and assignments in this course are subject to change in the event of extenuating circumstances or by mutual agreement between the instructor and the students."

<u>Please do not hesitate to ask help from me. I am here to enhance your learning efforts to be successful;</u> <u>and ready to help gaining for one more well-qualified engineering technologist for our nation.</u>

