TEXAS A&M UNIVERSITY

Course Syllabus

Course Information

Course Number:	ECEN 403
Course Title:	HNR-Electrical Design Lab I
Section:	Honors
Time:	*Meeting Times*
Location:	College Station
Credit Hours:	3

Instructor Details

Instructor:	Prasad Enjeti
Office:	WEB 301F
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E-Mail:	enjeti@tamu.edu
Office Hours:	Microsoft TEAMS and appointment as needed.

Course Description

Topic: WBG Devices-Based Matrix Converter for 3-Phase AC to DC Conversion in Industrial Computing Applications.

Objectives: Throughout the capstone courses, 403 and 404, students will collaborate on designing a 3-phase AC-DC matrix converter utilizing Wide-Bandgap Semiconductors (WBGs). At a high level, the system comprises two major subsystems: power electronics and control. In the power electronics subsystem, students will design a power circuit incorporating their acquired knowledge, including filters, 4-quadrant switches (GaN or SiC), sensors, and gate drivers to complete the matrix converter. For feedback control, the objective is to stabilize the power converter's output using sensor readings. This involves utilizing FPGA, DSP, or both to develop a control algorithm, which will then be implemented on a customized control board connected to the power module.

Tools required: Matlab Simulink, PLECS, TI Code Composer Studio, Altium, Vivado.

Course Prerequisites

COMM 205 or COMM 243 or ENGL 210; grade of C or better in ECEN 314, ECEN 325, and ECEN 350/CSCE 350 or CSCE 350/ECEN 350; grade of C or better in ECEN 303, ECEN 322, and ECEN 370, or grade C or better in CSCE 315, and ECEN 303 or STAT 211, and ECEN 449 or CSCE 462, or concurrent enrollment; senior classification.

Special Course Designation

This course has a special designation as a writing-intensive (W) course. As such, a student must have a passing grade in the written components to pass the course.

Course Learning Outcomes

At the end of the course, the student should be able to demonstrate skills in the categories below:

1. *Design Methodology*
    a. *Apply scientific methods and engineering principles learned in other courses to design, analyze, and demonstrate a non-trivial engineering system or process to meet the desired need.*
    b. *Describe the activities that occur during each stage of the design process.*
    c. *Analyze project needs to produce quantitative design requirements.*
    d. *Develop technical skills, including PCB design and soldering.*
2. *Societal Impact*
    a. *Recognize the ever-present role of design in human activity.*
    b. *Analyze and address risks associated with a concept.*
3. *Project Management*
    a. *Demonstrate the ability to work in a team environment.*
    b. *Assess risk in a project and assign appropriate contingency.*
    c. *Develop a project development and validation plan and execute it.*
    d. *Communicate and justify design choices through written and oral assignments. Oral presentations will be approximately 500 unique words, with 10-15 minutes per team per presentation.*

Textbook and/or Resource Materials

Course material will be available at: https://canvas.tamu.edu. There is no required textbook for this class. Below are a few books for reference:

- *Wiley Series in System Engineering and Management by Alexander Kossiakoff, Samuel Seymour*
- *Systems Design and Engineering: Facilitating Multidisciplinary Development Projects by Bonnema G. Maarten, Veenvliet T.*
- *Embedded System Design by Peter Marwedel*
- *Systems Engineering Design Principles and Models by Dahai Lu*
- *The Art of Electronics by Paul Horowitz and Winfield Hill*
- *IC Op-Amp Cookbook by Walter G. Jung*
- *Active Filter Cookbook by Don Lancaster*
- *The C++ Programming Language by Bjarne Stroustrup*
- *C by Dissection by Kelly Pohl*
- *Digital Image Processing by Rafael Gonzalez and Ricard Woods*
- *Pattern Recognition and Machine Learning by Christopher M. Bishop*
- *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron*
- *Machine Learning Yearning by Andrew Ng*.

Grading Policy

Grading Scale: A (90-100), B (80-89), C (70-79), D (60-69), F (< 60)

CONOPS Report	5% [5 points]	Rubric: Written Communication (1 point) Usage of English, clarity, etc. Content / Technical merit (4 points) Quality of the information presented regarding the concept of operations (CONOPS) and the problem is solved.
FSR, ICD, Milestones, and Validation Plan	5% [5 points]	Rubric: Written Communication (1 point) Usage of English, clarity, etc. Content / Technical merit (4 points) Quality of the information presented regarding technical requirements, integration, execution, and validation.
Presentation updates Midterm and Status Update	10% [5 pts/update]	Rubric: Technical Merit (3 points) Progress, skills, engineering reasoning, and execution Presentation skills (1 point) Slide clarity and oral presentation Validation (1 point) Plan, completeness, and execution
Final Presentation	10% [10 points]	Rubric: The final presentation of your functional subsystem. Technical Merit (6 points) Progress, skills, engineering reasoning, and execution Presentation Skills (2 points) Slide clarity and oral presentation Validation (2 points) Plan, completeness, and execution
Final Subsystem Demo	20% [20 points]	Rubric: The final demonstration of your functional subsystem. Technical Merit (10 points) The complexity of the subsystem and engineering skills Operation (4 points) The subsystem is operational as expected and required Validation (6 points) Completeness and execution
Final Report	45% [45 points]	Rubric: Written Communication (5 points) Usage of English, clarity, etc. Technical Merit (25 points) The complexity of the project and engineering skills Validation (15 points) Documented results, completeness, and execution
Quizzes	5% [1.25 pts/quiz]	Rubric: Successful completion of all quizzes.

Grading Policy Notes:

- *Submit all written and oral assignments in PDF format on Canvas ahead of the deadline or preferably before your presentation time.*
- *Your team will receive ZERO CREDIT for the presentation if your slides are not on Canvas.*
- *Submitting assignments is every team member's responsibility to ensure this occurs properly.*
- *Teams formed in ECEN 403 continue in ECEN 404.*
- *The class's written ("W") component needs a passing grade for the student to pass this class.*

Late Work Policy

Unexcused late work (submission of a deliverable after the established deadline) will not be accepted. Work submitted as makeup work for an excused absence is not considered late work and is exempted from the late work policy (See Student Rule 7).

Course Schedule

Include a list of topics, calendar of activities, major assignment dates, and exam dates.

The course schedule must include dates of major assignments. Dates for assignments should not be changed without written notification to all students in the course (notice via email or learning management system is acceptable). The calendar must include 15 weeks.

University Policies

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to Student Rule 7 in its entirety for information about excused absences, including definitions, and related documentation and timelines.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to Student Rule 7 in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" (Student Rule 7, Section 7.4.1).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" (Student Rule 7, Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See Student Rule 24.)

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" (Section 20.1.2.3, Student Rule 20).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact the Disability Resources office on your campus (resources listed below) Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu.

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see University Rule 08.01.01.M1):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with Counseling and Psychological Services (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's Title IX webpage.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care by utilizing available resources and services on your campus

Students who need someone to talk to can contact Counseling & Psychological Services (CAPS) or call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at 988lifeline.org.