EE 4349-002
Engineering Design Project

Fall 2011
Dr. David Wetz
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Catalog Course Description:
EE4349 Engineering Design Project (0-3)
Students will design, construct, and evaluate a device or system, building on knowledge and skills from earlier engineering coursework, supplemented with information from other sources, and incorporating appropriate engineering standards. Working as members of multidisciplinary teams they will apply project management techniques in order to meet design specifications through the effective allocation of team resources, time scheduling, and budgetary planning. Each team will demonstrate a prototype of their finished design, supported by an oral presentation and a formal, written project report.

Prerequisite:
EE4340, Concepts and Exercises in Engineering Practice

Instructor:
Dr. David Wetz
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Phone: (817) 272-1058
Office Hours: Monday and Wednesday 9:00 AM – 12:00 PM

GTA:
TBD

Section Information: EE4349-002

Times and Location:
Tuesday and Thursday, 9:30am to 12:20pm, NH129.

Required Textbook: None

Project Assignments:
Students will continue with and complete projects assigned during EE4340. If students were not assigned projects during EE4340 in the previous semester they will bid for and be assigned to projects and teams immediately after the first class period.

Project	Description	Members / Sponsor
P62B DC/DC and AC/DC Converter	Context: UTA is currently installing a Microgrid testbed. The current project funding supports the installation of a few wind turbines, photovoltaic solar panels, two battery backup units, a 1.2 kW hydrogen fuel cell, and NI Compact Rio central controller. Project: The goal of this project is to continue to design and installation of the DC/DC and AC/DC power electronic converters that was started by a previous senior design group. Tasks: 1) Research MicroGrid systems and understand the tradeoffs between having a DC or AC central bus, 2) Research Buck, Boost, and H-Bridge Circuit Topologies, 3) Evaluate the design of each of the converters topologies (DC/DC and AC/DC) already developed and change them as needed, 4) Design the software required to make each converter	Nicholas Armenta, Laxman Raj, and Dennis Mathew / Dr. David Wetz

	function on the UTA MicroGrid platform using either LabVIEW or a TIMSP430 processor, 5) Demonstrate their functionality on the system. Detailed specification must be determined from student research, sponsor discussions, and negotiation.	
P66 Wireless Physiological Parameter Monitoring Module	Context: Development of wireless biomedical devices. The device will utilize a pressure sensor mounted to a human wrist to measure heart beats. The wireless unit will include a rechargeable battery, the sensor driver (amplifier and filter), a microcontroller, a RF communications module (2.4 GHz). The reader will consist of the same RF communication module. Range - 5m, battery life optimized for test protocols (estimated - 4 hours without recharge). Data rate: low but sufficient to recognize heart beats. There are two possible ways to design the systems: (1) transmit the analog signals of heat beat directly to the reader which will record continuously the signals; or (2) digitally convert and process the signals into characteristics of heartbeat signals and transmit the information to the reader. The signals will be displayed in a Labview interface.	Marco Jaime, Wenyuan Shi, and Sandesh Kafle / Dr. J.C. Chiao
P67 Cruise Control	Context: Interest in electric and hybrid vehicles. Project: The purpose of this project is to design, build, calibrate, and demonstrate a functional cruise control. "Controls: On/Off, Set, Accelerate, Decelerate functions (detailed definition of these controls/functions will be provided). Performance: maintains its set speed within 0.5 MPH. The output of the cruise control is a 0 to 10 VDC signal that (1) directly represents the throttle position when the cruise control is disabled or (2) gives the drive signal to the motor to maintain the vehicle's speed at a desired value. Other issues: The 12 Volt system in an automobile is inherently noisy, and may contain extreme voltage spikes. This circuit should have input protection, filtering, and voltage regulation to prevent noise, voltage spikes or reverse polarity from reaching the Cruise Control module. The Cruise Control should have two connectors, each designed to be unique so that misconnections cannot be made. The first connector is for SW1 and SW2a&b. The second is for all other signals: power, ground, the brake signal, the throttle signal, and the voltage out to the motor speed control. "	Steven Chen, Amit Gandhi, and Azeem Mahmood / Dr. R.S. Gibbs
P68 Electric Vehical Charge Converter (from a current popular standard to the SAE J1772 standard)	Context: Interest in electric and hybrid vehicles. A charger will be provided that takes 220V Split Phase in and provides 350V 20A DC to a specific electric vehicle. The converter will take the output of this charger and convert it to be compatible with the SAE J1772 standard. Details of this standard can be easily found on the internet.	Khoi Nguyen, Francisco Serna, and Baikuntha Raj Kafle / Dr. R.S. Gibbs
P69 Modeling of a MicroGrid Testbed	Context: UTA is currently designing and installing a MicroGrid testbed as part of an effort sponsored by the US Dept. of Energy. A MicroGrid is an electrical grid architecture that utilizes a wide range of distributed energy sources, such as battery storage and renewable energy generators, to supply the load rather than a single connection to the existing electrical grid. Along with all good hardware installations, a software model of the system is needed. Project: This project is focused on developing a Matlab/Simulink model of the testbed. The model should include a PEM fuel cell, a battery energy storage system, a wind turbine, a solar panel, and a	James Reed, Leonardo Munoz Jr, Roberto Garcia, and Mohammad Qurashi / Dr. David Wetz

	connection to the legacy electrical grid. All of the components in the model can be validated using small table top experimental setups. For example, a small AC motor - generator pair can be used to model the output of a wind turbine, a small solar cell under a heat lamp can be used to model a solar cell, etc. Tasks: 1) Develop a Matlab/Simulink model of a MicroGrid which has a fuel cell, solar panel, wind turbine, battery backup system, and legacy grid connection installed and connected to a single DC or AC bus. 2) Validate the components in the model using data from the UTA MicroGrid and from small table top experiments designed and fabricated by the team.	
P70 Golf Swing Analyzer	Golfers always want to know how fast they are swinging their club and whether or not they are transferring their weight properly. Your task is to help them answer those You must design a microprocessor or LabVIEW based system that measures how fast the club head is moving through impact with the ball, how fast the ball is traveling as it leaves the club head, and measure how the weight was transferred through the swing. All of this should be output to display that enables the user to see all of this information quickly after hitting the ball.	Johnny Nelson, Jay Kelley, Samuel Quinn, Samuel / Dr. David Wetz
P71 Digitally Controlled Transmission System for a Formula SAE	Context: UTA's SAE Race Car Program: Project: The students will implement, using a microcontroller, a system to take input from the driver via paddle shifters and operate the transmission. The students must perform preliminary data acquisition to determine the force required to actuate the transmission and the desired method of actuation given weight restrictions, current restrictions, etc (i.e. CO2, pneumatic, compressor, servo). The students will design and integrate a mounting system to an existing vehicle and fabricate the paddle shifting system. A computer will be designed to control throttle/fuel, clutch, transmission, etc. A PIC microcontroller would be ideal. Much of the design challenge will be targeting the exact timings/delays needed for the system to function properly. For example, determining how early to cut the fuel prior to performing the shifting sequence, how long to delay the throttle, delays from human factors, duration of idling during the shifting sequence, etc. Once the computer is designed, significant time will be spent testing and performing data acquisition on the vehicle to determine how the computer timings need to be tuned for the car's performance to resemble that of its current transmission system.	Shayek Rezwan, Justin Blassingame, and Justin Bailey / Dr. Bob Woods

Grading:

Each project has a sponsor, who is considered to be the customer or client. The project is considered to be a real-world deliverable of interest and value to the project sponsor – and is not simply an academic exercise. The project grade will be determined from performance on several key identified elements of the course. You are working as a group but will be graded individually so don't expect your group to carry you. It is expected that each student will carry his or her own weight and that you will work together as a team. This course is supposed to model the real world and that is how it is when you leave UTA. It is recognized that each individual project can have different progressions depending on both the project and team members.

Class Attendance – 10%
Peer Evaluation – 5%
Weekly Presentations – 10%
Interim Report and Presentation – 25% (12.5% each)
Final Project Report and Presentation – 50% (25% each)

Class attendance will account for 10% of the course grade. It is mandatory to attend all classes unless the instructor is notified ahead of time and a good excuse is given. One unexcused absence will be accepted with no impact to the grade but no more will be tolerated.

Your peers will evaluate you every week. Your group members will evaluate your contributions every week and the entire class will grade you on your short weekly presentation

Every week you will give, as a group, a weekly powerpoint presentation on the work you have completed. The presentations will last no longer than 15 minutes each. Your peers will grade you on how much effort they think you put in.

Intermediate grades –*for teams and individuals* – will reflect "status/progress at a given point in time". The final grade will, however, depend most heavily on the final result as determined by the Final Deliverable Review Presentation (see below).

Thus, poor performance – and poor grades - at intermediate points *provide warnings* that students are on a path that needs immediate attention and correction, as well as to support in part a final grade reflecting a poor final result.

If a successful final result is delivered, poor intermediate grades can be adjusted at the discretion of the instructor thereby allowing you to earn a very good final grade but don't think that is an easy way out of the first half of the course. Likewise, good intermediate grades are no guarantee of a good final grade. It is considered, however, that it will be more likely for a team to meet final objectives if intermediate objectives are met and steady progress is made (and this will be reflected by intermediate grades).

Each team member should have designated individual responsibilities and he or she will be accountable to the team – and in large part for their course grade - for these stated responsibilities. Efforts will be made to assess both team and individual performance as the semester and project progresses. Remember, final grades are provided for individuals, not teams. I reserve the opportunity to receive and take into account (in determining final grades) additional input regarding individual team member performance from other team members.

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 undergraduate / graduate catalog. [Some instructors opt to cut and paste the relevant policy here. For undergraduate courses, see: http://wweb.uta.edu/catalog/content/general/academic_regulations.aspx#10; for graduate courses, see http://www.uta.edu/gradcatalog/2012/general/regulations/#grades.]

Project Deliverable: The project deliverable is the outcome of your work, which takes on two forms: 1) the report (which documents the design "thinking", implementation, and test results) and 2) the physical "system" produced (i.e., the hardware and software). These will be evaluated based on the **Project Report**, the **Project Presentation/Demo,** and the **Final Deliverable Review Presentation.** Any or all of these elements will have significant evaluation impact from your project sponsor or their designated representative.

The Project Plan: During the first week of the semester you need to put together your project plan which should include a description of the work to be accomplished, including specifications, a hierarchical task analysis, and resource allocation (task assignments) schedule, and budget.

Weekly Reports: The weekly project presentation along with a roughly one page description from each member of what they accomplished this week will act as a weekly report

Weekly presentations should be roughly 10 power point slides that describe what your project is and what has been accomplished thus far. We will take no more than 15 minutes for each presentation each week.

The Final Project Report: The Final Project Report will be submitted when the project is presented in class. This should be sufficiently detailed to allow the project sponsor to implement and/or replicate your work. It should contain the following sections:

- Short background section
- A description of the system/device.
- The design specifications to which the project was intended to be built.
- Design options considered and rationale for choice made, including decision matrices wherever applicable.
- A Theory of Operation section describing in detail how the final design achieves the desired functionality and performance.
- Test procedures and results used to demonstrate that the project met *(or how well final result met)* design specifications.

The Appendix should contain:

- Schematic diagrams (complete except for subassemblies, such as a microprocessor board integrated into your design).
- Software code listing for all code developed as part of the project. This should be fully documented at multiple hierarchical levels, including: 1) a description of the purpose of each major section of code (and subprograms), including:
- A Parts Layout Diagram for each circuit board, ideally linked to the schematic diagram (but this may be different for different project sponsors and their requirements).
- A Detailed Parts List, including package description (e.g., SOIC-8), Mfg. Part No., Description, Vendor Part No., and cost.
- A copy of the Project Plan, including any modifications made as the semester progressed.
- A Detailed Description of each person's unique contribution to the team.
- Summary of the learning accomplished as a result of performing this project.
- A detailed reference list of all sources reviewed in the design of the project and cited in other documentation.
- Any additional support material deemed to be relevant to the project.

The entire report and all data should be submitted on a CD.

Project Presentation/Demo: This is a formal public presentation/demo of the project. The presentation should be a complete project description. The Project Demonstration will take place during the final week of the class.

Project Poster: Each team will set up a display showing both their deliverable and a Poster showing relevant details related to the final project. The display will be set up during the morning of the final day of the semester. This display will take place in conjunction with the EE Department's Industry Advisory Board meeting.

Final Deliverable Review Presentation: This will be individually arranged with each team. You will present your final results to the project sponsor. The sponsor will have receipt a pre-final draft of your project report beforehand. The sponsor will provide comments regarding the final demonstration as well as comments and required revisions for the final report.

Engineer's Notebook: In keeping with standard industry practice, each student must keep a formal Engineer's Notebook during the execution of this project. The volume must be bound so that pages cannot be removed. All work performed on the project should be documented in the Notebook. PROJECT NOTEBOOKS will contribute significantly to determining individual team member performance. All entries must be dated. This will support determination of intermediate and final grades.

Semester grades will be assigned using the following scale:

90% - 100%	A
80% - 89%	B
70% - 79%	C
60% - 69%	D
0% - 59%	F

Sponsored Projects:

The project sponsor should be regarded as the customer. As such, the project sponsor is invited to participate at each assessment and throughout the project period. In addition, students meet with the sponsor prior to submitting the Project Plan to ensure that they understand the Design Specifications the sponsor expects in the Project Deliverable. Additional interactions with the project sponsor are outlined above.

Design Constraints:

The system/device(s) must be designed and constructed by the team. Commercial products may not be purchased and reverse engineered, but reference to texts and outside sources is highly encouraged. This design constraint against reverse engineering also applies to sub-assemblies within the project. Don't plagiarize, it isn't worth it.

Similarly, the design must be built using discrete components. That is, kits may not be purchased and integrated into the design unless specifically approved in writing by the course instructor and project sponsor. The purchase of individual IC chips to perform desired functions is within the scope of the project. As needed, subassemblies such as microprocessor development boards may be purchased and integrated into the project as approved by the project sponsor and course instructor.

Project Planning:

Each team will select a team leader who will coordinate the team's activities. The team leader will be responsible for liaison between the team and the faculty member.

Each team is responsible to break the project down into individual tasks, assign members to each task, plan a project schedule that takes into account all tasks and ensures completion by the assigned date. A GANTT chart relating tasks (including assigned individual) and schedule should be included in the Project Plan.

The Project Plan must be turned in no later than the 4th class meeting. A paper copy will be due at the beginning of the class period. An electronic copy should be sent to the Instructor and to the GTA.

Weekly Reporting:

An email containing your weekly power point presentation and one page report should be sent to the Instructor and to the GTA by Monday night at Midnight. In the one page report be sure to include:

- A single statement telling whether the project is on schedule, ahead of schedule, or behind schedule. If ahead or behind schedule, tell by how many days.
- Time expended per person.
- Cumulative time per person.
- Total team time invested this week.
- Total time invested to date.
- A brief and HONEST description of work accomplished, difficulties encountered, and other outstanding events that may have occurred during the previous week. This may be in bullet form, and should not require more than a single.

A MS Excel file shall be maintained by the team leader that calculates each of the time measurements and other factors listed above. An updated version of the spreadsheet should be attached to the weekly email

Communicating Effectively:

During the course of project execution, there will be much communication (mostly via e-mail) between project members, teams and sponsors, and the course instructor. This document raises key issues and describes guidelines that you should follow to achieve a professional level of communication and good results.

Learning Objectives:

EE 1205-022 Course Learning Objectives and Assessment Approach			
Number	Course Learning Objective	ABET Outcome	Assessment Approach

1	Learn how to take a project definition, as assigned by a sponsor, and effectively transform it into a to system design	A,C,E	
2	Learn how to apply the theoretical solutions of the problem into a physical system that achieves the desired results	A,C	
3	Learn how to effectively present the theoretical and applied aspects of the project to others in PowerPoint presentation form	B,G	
4	Learn how to write a technical report that describes the theoretical and applied aspects of a system design	B,G	
5	Learn how to apply electrical engineering theory and design into a project that is non-electrical engineering in nature	A,E,D	
6	Learn how to document research and laboratory work in an ongoing research notebook	A,B,G	
7	Learn how to effectively present the theoretical and applied aspects of the project to others in poster presentation form	B,G	
8	Learn how to work collaboratively in a group with others to solve a technical problem	D	
9	Learn how to design and create a professional printed circuit board	A,B,C	
10	Learn how to prototype electrical circuits and test them in the laboratory	A,B,C,E	
11	Learn how to utilize and combine numerous different electrical engineering disciplines to meet the project goals	A,D,E,K	

Outcomes a-k
(a-k as listed by ABET)

a. an ability to apply knowledge of mathematics, science, and engineering;
b. an ability to design and construct experiments, as well as to analyze and interpret data;
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
d. an ability to function on multidisciplinary teams;
e. an ability to identify, formulate, and solve engineering problems;
f. an understanding of professional and ethical responsibility;
g. an ability to communicate effectively;
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context;
i. a recognition of the need for, and an ability to engage in lifelong learning;
j. a knowledge of contemporary issues;
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Lab Safety Training: <u>Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities</u>. 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 <u>no</u> 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.

E-mail Topics: Do not embed too many topics in e-mails; one is best. Especially when you are asking questions of someone, this will delay the response. It is better, for example, to send two separate e-mails than it is to send one e-mail that attempts to address two issues.

E-mail Subject Headings: You should always consider the recipient when generating e-mails. This will also serve you well. Recipients may have many different ongoing projects. Well-organize engineers will most likely be filing e-mails for easy future reference. You can assist this by incorporating descriptive subject headings. For this course, the subject header should be structured as follows:

EE4349_SP10_Pnn_Topic

Where *Pnn* is the project ID (e.g., P54) and *Topic* identifies what the e-mail is about.

Files and File Naming: Major problems can occur when various documentation files (Word project descriptions, Excel files containing various elements, printed circuit layouts, etc.) are distributed to the various project participants – IF file naming is done without careful thought.

File names should be descriptive. To avoid confusion (and disasters in some cases), they should also consider whether or not there is likely to be a revision of the file by someone at a later time.

Here are some examples of appropriate file names:

Pnn_Final_Report_fv1.doc (fv1 represents "file version 1")

Pnn_Final_Report_ApndxA_fv3.doc

Pnn_Schematic_fv2.sch

Within the document itself (whenever possible), include a statement that clearly describes what the document is – and include a date that indicates when the document was prepared.
Students should adhere to these conventions.

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/ses/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 or by calling the Office for Students with Disabilities at (817) 272-3364.

Academic Integrity:
At UT Arlington, academic dishonesty is completely unacceptable and will not be tolerated in any form, including (but not limited to) "cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts" (UT System Regents' Rule 50101, §2.2). Suspected violations of academic integrity standards 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.

The application of this policy to EE 4349 will take two dimensions. The first is that your design must represent the work of your team, and cannot be taken directly from other sources, whether published in book, magazine, or on the internet. The second is that each team must work independently of all other teams, and may neither receive nor give design assistance to a member of another team.

Student Support Services:
UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may contact the Maverick Resource Hotline by calling 817-272-6107, sending a message to resources@uta.edu, or visiting www.uta.edu/resources.

Student Feedback Survey:
At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory will be asked to complete an online Student Feedback Survey (SFS) about the course and how it was taught. Instructions on how to access the SFS system will be sent directly to students through MavMail approximately 10 days before the end of the term. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback data is required by state law; student participation in the SFS program is voluntary.

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.

The following is an excerpt from the College of Engineering's statement on Ethics, Professionalism, and Conduct of Engineering Students. Read the statement carefully, sign it, and return it to your instructor. You may make a copy for your records. Additional copies of this statement can be obtained from your instructor or the Office of the Dean of Engineering.

STATEMENT ON ETHICS, PROFESSIONALISM, AND CONDUCT
FOR ENGINEERING STUDENTS
COLLEGE OF ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON

The College cannot and will not tolerate any form of academic dishonesty by its students. This includes, but is not limited to cheating on examination, plagiarism, or collusion.

Cheating on an examination includes:

1. Copying from another's paper, any means of communication with another during examination, giving aid to or receiving aid from another during examination;
2. Using any material during examination that is unauthorized by the proctor;
3. Taking or attempting to take an examination for another student or allowing another student to take or attempt to take an examination for oneself.
4. Using, obtaining, or attempting to obtain by any means the whole or any part of an un-administered examination.

Plagiarism is the unacknowledged incorporation of another's work into work which the student offers for credit.
Collusion is the unauthorized collaboration of another in preparing work that a student offers for credit.

I have read and I understand the above statement.

In addition, I understand that, in order to ensure fairness to all students, exams will be proctored and possibly videotaped.

Course and section number: ____EE 4349-002____________________

Date: ___________________________________

Student's signature: ___________________________________

Student's name, printed: ___________________________________

Student’s ID number: ___________________________________

Student’s e-mail address: ___________________________________
(please print clearly)