ECE 49022 Course Syllabus

Electrical Engineering Senior Design Projects – 4 Credit Hours

Fall 2019

Course Description: Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design for manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on a challenging open-ended electrical engineering project that draws on previous course work. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations and detailed system descriptions) and include a number of realistic constraints (such as cost, safety, reliability, and aesthetics).

Role	Name	Email	Section
Instructor	Sutton Hathorn	shathorn@purdue.edu	
Faculty	Professor Bell	mrb@purdue.edu	1
	Professor Lin	linx@purdue.edu	2
	Professor Lee	csglee@purdue.edu	3
	Professor Gelfand	gelfand@ecn.purdue.edu	4
	Professor Hu	jianghai@purdue.edu	5
	Professor Jung	jungb@purdue.edu	11
GTA	Steve Rausch	srausch@purdue.edu	1
	Matthew Bliss	blissm@purdue.edu	2
	John Peterson	peter178@purdue.edu	3
	Nathan Conrad	conradn@purdue.edu	4
	Shabnam Ghotbi	sghotbi@purdue.edu	5
	Sean Kulinski	skulinsk@purdue.edu	11
Industry	Todd Wild	toddwild@purdue.edu	

Section	Room	CRN	Time
Lecture	EE 170	13524	MWF 11:30A-12:30P, Aug 19 - Oct 15 M 11:30A-12:30P, Oct 16 - Dec 7
1	TBD	17585	TR 8:30A-11:20A
2	TBD	17586	TR 2:30P-5:20P
3	TBD	17608	TR 11:30A-2:30P
4	TBD	17609	WF 1:30P-4:20P
5	TBD	17610	WF 8:30A-11:20A
11	TBD	22080	WF 1:30P-4:30P

1 Blackboard

The blackboard for the lecture section will contain all the course news and updates, rubrics, and other useful documents. All scores will be kept in Blackboard. Students should check for updates at least each lab period.

2 Course schedule

Assignments with multiple due dates listed are due on the same day as your lab section.

Graded item	Due date
Project proposal	Aug 19
Design document - rev 1	Aug 22/23
Solution proposal	Aug 29/30
Design document - rev 2	Sep 5/6
Manager meeting	Sep 17-20
Midterm demo	Oct 15-18
Design document - rev 3	Oct 21
PCB review	Oct 24/25
Skills assessment (deadline)	Oct 31/Nov 1
PCB exception requests due	Nov 26
Final demo	Dec 3/4
Final design review	Dec 5/6
Design document - final	Dec 8
ABET	Dec 8

Table 1: Major course due dates.

3 Grading scheme

Event	Individual	Group
Progress checks	12%	
Project proposal	1%	
Design document - rev 1		2%
Solution proposal[1]		2%
Design document - rev 2	7%	3%
Manager meeting	8%	
Skills assessment	5%	
Midterm demo		8%
Design document - rev 3	7%	3%
PCB review		2%
Final demo		12%
Final design review	7%	7%
Design document - final	6%	4%
ABET	2%	2%
Total:	55%	45%

Table 2: Grade scheme

3.1 Grade penalties

Grade penalties, seen in table 3 will be applied if a student fails to comply with the course policies. The penalties are assessed as absolute percent deducted from the students grade.

Incident	Penalty
Unexcused absence from solution proposal, midterm demo, final demo, or final design review	25%
Late submission of any document	10% + 5% per school day
Complaining to the customer at any design review or demonstration	up to 25%
Cheating, unethical behavior, unsafe behavior, plagiarism, or failure to credit sources.	Everything, up to failure.

Table 3: Grade penalties

3.2 Participation / contribution

The participation score is a discretionary part of your grade decided by your TA and Professor. By its very nature, it is not possible to put a fully defined grading scheme on a design project without potentially punishing good behavior and rewarding bad behavior. To ensure that this class can reward students appropriately participation is awarded for the following activities:

1. Helping weaker team members.
2. Preparing team documentation.
3. Carrying out a good plan, even if it ultimately fails to work correctly.

More detail on participation can be found in section 4.2.2.

4 Course requirements

To pass the course you must meet the below outcomes. Remediation may be possible at the discretion of the course instructor. Note that outcomes do not decide your grade, see section 3 for more details; however, you MUST meet to receive a passing grade.

4.1 Complete an accepted solution proposal

You must continue to modify your design document until it is accepted by the section TA and/or Professor. You will not be allowed to turn in assignments that are due after the solution proposal until the proposal is accepted. All assignment late penalties will apply.

4.2 Attendance

4.2.1 Miss no more than 6 lectures

You may miss no more than 6 lectures in total. Missing more than 6 may result in a course failure. We do not require documentation or evidence of absences. All lectures are assumed to be required unless specifically made optional or canceled by the course instructor.

[1]No assignments will be accepted after this point until the solution proposal is accepted by the section TA and course instructor. All late penalties will apply.

4.2.2 Fail to participate in no more than 6 laboratories

You may miss no more than 6 laboratories in total. We do not require documentation or evidence of absences; however, you are expected to contribute as if you were fully present that lab. Extensions due to unexcused absences will not be given. Participation is graded by the TA and Professor weekly, and is defined as being physically present and contributing to project goals. Examples of contributions are:

- being present for the entire scheduled laboratory,
- creating relevant documentation,
- creating relevant simulations,
- researching, designing, and constructing relevant hardware,
- researching, designing, and programming relevant software and firmware,
- conducting discussions about the project with the team, Professors, TAs, and/or corporate sponsors,
- preparing for presentations for the customer, and/or,
- any other activity relevant to the course requirements.

4.2.3 Penalty

A grade deduction will be applied after missing 5 or more labs and/or lectures. The number of absences, A, is computed as:

$$A = \max(\text{Lecture absences}, \text{Lab absences})$$

The overall course grade deduction is as follows:

$$A = 5 : -1\%$$

$$A = 6 : -5\%$$

$$A > 6 : \text{course failure}$$

4.3 Achieve a minimum level of deliverable

A minimum level of deliverable can, among other things, be demonstrated by producing:

1. accurate block diagram(s) that meet the major goals of the subsystem,
2. functional prototypes (breadboard circuits, software demonstrations, etc.) of the subsystem,
3. accurate schematics of what has been built, and
4. a basic understanding of the electrical and computer engineering theory behind the design.

4.4 Behave in a professional and ethical manner

It is an essential quality of any professional engineer that they be able to follow rules and ethics. Failure to follow these guidelines will result in severe penalties including failure of the course and reporting to the Dean of Students.

4.4.1 Protection of students' work and working space

Every team is allocated bench space to perform their work. Any outside interference, no matter how small, in that space is forbidden. Below are two examples; however, every situation is considered on its own merits and any penalty can be assessed.

No student may give another student permission to work on their bench.

Example 1: Using laboratory equipment on another team's bench
This incident involved a student setting up and developing their own circuit on an area of another team's bench. The student moved some of the other team's circuits slightly and used the laboratory equipment at that bench including a spare probe. Penalty assessed: loss of one letter grade.

Example 2: Removing chips from another student's completed prototype board
This incident involved a student removing chips from a completed prototype of another student. Penalty assessed: *F in the course*. Incident reported to the Dean of Students as theft.

4.4.2 External IP, plagiarism and honesty

You are expected to use ideas, concepts, source code and designs from other sources (external IP) to complete your project. This is normal engineering practice. However, to use external IP the following requirements must be met:

1. The source and license of the external IP must be recorded in your documentation, presentations, etc.
2. *You must understand the function of the external IP and be able to explain how it works on request.*

All work claimed by a student should be their own work. Passing off the work of others constitutes plagiarism with all the standard penalties usually associated with that activity.

In this course the following are examples of offenses:

1. Copying another person's overall design.
2. Copying another person's detailed design for an element of their subsystem.
3. Claiming external IP as their own.
4. Failing to cite a schematic not generated by the student.

4.4.3 Complete an ABET report on the course

Failure to complete an ABET report will results in all team members receiving an F.

5 Professor, staff, and volunteer responsibilities

The professors, teaching assistants, and volunteers serve as consultants to the teams. Their role is to advise teams toward achieving the design and production goals. **They are prohibited from doing the design for you. They do not know all of the answers.**

6 Laboratory rules

6.1 Safety

In the event of a serious injury of disablement

1. If needed, shut off the lab power at the breaker panel on the wall.
2. Call 911.
3. Describe the situation the best you can.
4. If available, send look-outs to the major building entrances to guide emergency personnel back to the laboratory.

You are in:
Room EE 159/160/161/163/165/167
465 Northwestern Ave, West Lafayette, IN

As soon as the situation allows, or in the event that the accident is not serious, notify the ECE shop (EE 162)

The danger of electrical shock is very real in any laboratory. Cuts and bruises from tools; burns from hot components and soldering irons; eye injuries from sparks and sharp objects; and head injuries from sharp corners are all possible. Be alert for hazards (possible sources of danger). Remember that almost anything can be a hazard. Usually accident or injury results from common things that are encountered unexpectedly in an unusual way. Water, for example, is ordinarily harmless. A pool of water on the floor is a hazard.

Frayed electrical cords, broken electrical plugs, wires stretched between benches, sharp tools in unexpected places, hot soldering irons, parts or instruments positioned precariously, and instruments or tools improperly placed or used are all hazards. A malfunctioning or badly calibrated instrument is also a hazard because one may act based on erroneous data.

If you notice a hazard, correct the situation if possible. Otherwise, make a warning or barrier to alert others to the hazard until it can be removed. Report hazards to your TA.

Take care to protect your eyes when working with tools or soldering irons. Safety glasses are provided for these tasks. Use toxin filtering fans when soldering.

6.2 Lab access

Each team is assigned two three-hour laboratory periods each week. A TA will be present during these periods. You may use the laboratory any other time, given:

1. You have permission from the TA of a laboratory class or help session in progress. In this case, be extra courteous and quiet. You are a guest.
2. The laboratory is not scheduled for a graded event.
3. There is at least **two** students present at all times. Students found working alone will receive a grade punishment of category "Unsafe behavior" (up to and including course failure).

6.3 Laboratory Etiquette

1. Do not move the computers without asking.

2. Do not "customize" or otherwise "improve" the operating system or programs on computers.
3. Do not steal software. It is not ethical.
4. Food and drink are not allowed in the laboratory. Accidentally eating sharp wire clippings can be very bad for you. Go to the hall to eat your snack. Clean up.
5. Give broken cables to the Electronics shop staff or TA.
6. Report malfunctioning instruments to the Electronics shop staff or TA.
7. Pick up your trash. Put paper in a recycle container in the hall. Put trash in a waste basket.

6.4 Storage

Each team may checkout a locker as needed from EE162. You will be given a code lock with a unique combination. You must use this lock and **no other**. Unregistered locks will be broken for security reasons.

6.5 Obtaining parts

A large stock of standard parts is maintained in the labs and in the Electronics Shop (EE162) for use in student projects.

You may order parts that are not kept in stock from components houses such as Digi-Key, mouser, etc. It is smart to discuss a order with the course staff before placing it. We may have a better suggestion or already stock the item!

The ECE business office will purchase components for you, given you have not exceed your team allotment and that the supplier is located in the US. Each team should appoint a single member as the business office liaison and only that person should contact the business office regarding orders. If the order does not require a custom process (such as PCB ordering) then you may use the template purchase request form and email it to the business office. If the order requires a custom process, you may go to the business office and use their computer to place the order. You may only send **one** set of orders per day to the business office. You orders will be delivered to Purdue and can be picked up in the lab at the designated location.

Occasionally, companies are willing to provide small quantities of their products to students engaged in design projects. Before contacting a company, discuss this option with the Course Coordinator.

6.6 Tools

Some tools may be available from the Electronics shop; however, larger construction projects should be brought to the ECE machine shop. Discuss your project with the machine shop early to ensure it is completed in a timely fashion. You may bring in your own hand tools, but make sure that any power tools are approved by the course staff. Also, you should label all of your tools with your name and contact information.

6.7 Machine shop work

To begin the process, talk over your idea with your TA or Professor. Do not go directly to the machine shop. In some cases we may recommend using the Bechtel Innovation Design Center (BIDC).

If specially machined parts are required, capable students are encouraged to use the ECE or BIDC machine shop to fabricate these parts. For this case:

1. A scale drawing and parts list are presented to your TA or Professor at least five working days before the "date needed."

2. Upon approval, a training session will be required before students may perform machine shop work.
3. All work will be performed in the presence of Chuck Harrington, the machine shop supervisor, or a staff member he designates.
4. Materials will be made available for qualified machine shop work.

The machine shop supervisor may perform difficult work beyond the capability of the student. For this case:

1. A scale drawing and parts list are presented to an instructor well in advance of the "date needed."
2. The instructor will discuss the project with the machine shop supervisor.
3. A conference with the machine shop supervisor may be required.

7 Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

7.1 Purdue Honor Pledge

"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

`https://www.purdue.edu/odos/osrr/honor-pledge/about.html`

8 Nondiscrimination statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue's nondiscrimination policy can be found at `http://www.purdue.edu/purdue/ea_eou_statement.html`

9 Students with disabilities

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

10 Mental Health

Purdue offers many resources to aid with any mental health issues, including the following:

- If you find yourself beginning to feel some stress, anxiety, and/or feeling slightly overwhelmed, try WellTrack, `https://purdue.welltrack.com/` Sign in and find information and tools at your fingertips, available to you at any time.

- If you need support and information about options and resources, please see the Office of the Dean of Students, `http://www.purdue.edu/odos`, for drop-in hours (M-F, 8 am- 5 pm).
- If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and `http://www.purdue.edu/caps/` during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

11 Course disclaimer

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. In such an event, information will be provided through MyPurdue.

11.1 Sponsored student class projects

SPONSORED STUDENT CLASS PROJECT NOTICE: This course permits you, the student to participate in a class project that has been sponsored by a third party other than the University. The University encourages and supports your participation in this practical learning experience. Although your course requirements may include a practical learning project, you are not required to participate in a project that is sponsored by an outside third party. Prior to your participation in a project sponsored by an outside third party, we would like you to carefully consider that your participation (i) may require you to assign your intellectual property rights to any intellectual property for which a student would retain ownership under the University's Policy I.A.1 on Intellectual Property and/or (ii) may require you sign a non-disclosure (confidentiality) agreement with the sponsor. If you sign an agreement regarding intellectual property rights or a non-disclosure agreement, you may incur personal liability (with respect to breach of a non-disclosure agreement) or you may lose economic benefits associated with your ownership of intellectual property (with respect to a license or assignment of intellectual property). You are encouraged to retain independent legal counsel for advice on these types of agreements. In addition, if you choose not to sign a non-disclosure or intellectual property rights agreement, your professor will provide you with an alternate project at no penalty to you.

12 Learning outcomes

- an ability to apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a system, component, or process to meet desired needs.
- an understanding of the engineering design process.
- an ability to function on an interdisciplinary team.
- an awareness of professional and ethical responsibility.
- effective communication skills, both oral and written.