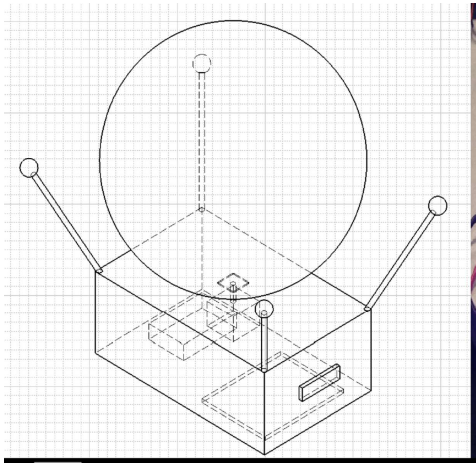
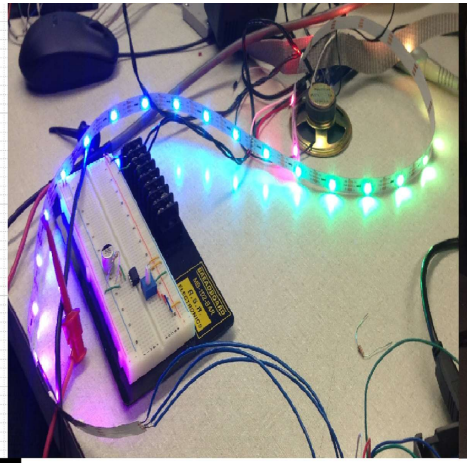

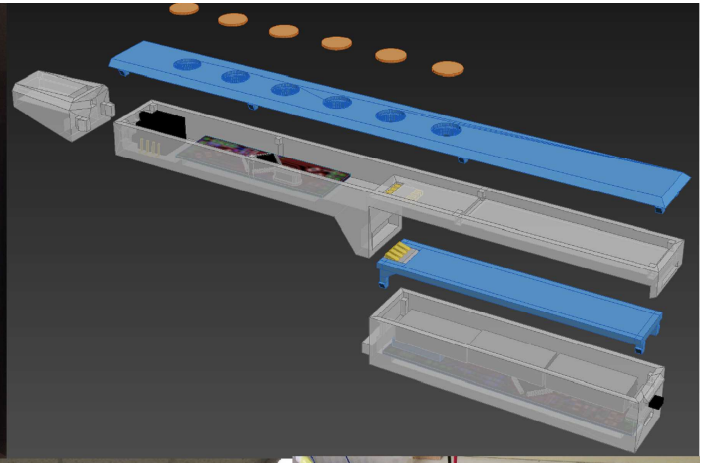
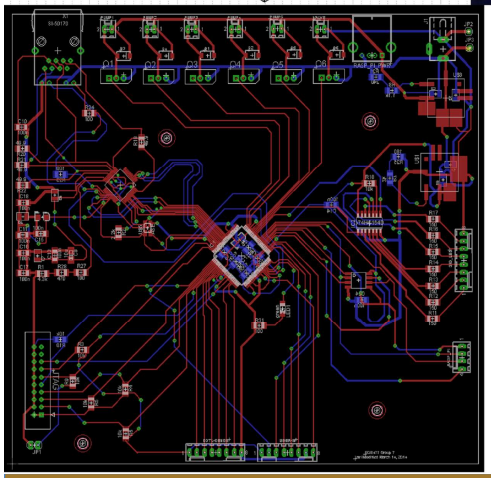


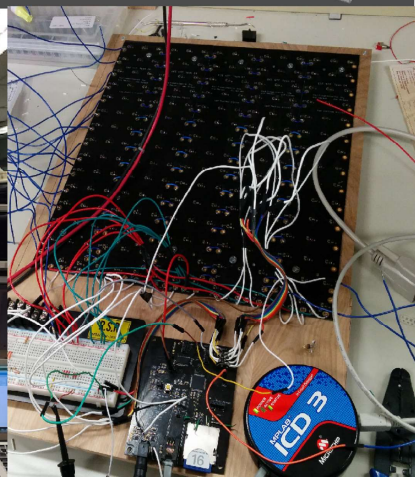

INTRODUCTION TO ECE 47700

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WELCOME

Who are we?

Prof. Mithuna Thottethodi

Purdue ECE Faculty since 2003

Research Area: Computer Architecture

Teaching ECE477 since 2014

Office: EE327

Email: mithuna@purdue.edu

Dr. Phil Walter

New Lecturer at Purdue

Control Theory, Embedded Systems

Teaching ECE477 since Today!

Office: EE266

Email: PhilWalter@purdue.edu

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OUTLINE

- Course Overview
- Course Communications
- Course Staff and TAs
- Schedule and Calendar
- Policies
- Grade Determination
- Sample ECE477 Projects
- Project Specific Success Criteria
- To Do List: Week 1

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COURSE OVERVIEW

- Purpose and Objectives:
  - To provide students with a practical, hands-on design project to apply their electrical engineering knowledge
  - To simulate conditions students are expected to experience in industry and/or research settings
- Teams:
  - Teams of 4 (team members chosen prior to semester)
- Projects:
  - Chosen by student teams (must be of interest to 2+ members)
  - Embedded design projects (utilize MCU, FPGA, or CPLD)
  - Project success evaluated through use of project-specific success criteria (PSSCs)

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COURSE OVERVIEW

- Laboratory Space:
  - EE007
  - 24/7 access available via electronic door lock
  - TA office hours held here
- Laboratory Equipment:
  - Permanent equipment (To remain in ECE477 lab areas)
  - Student laboratory equipment (hand tools, development boards, etc) available for check-out and use
- Mandatory Laboratory Times:
  - Students are required to show up in lab at the start of their TCSP session
  - Used to assess progress, provide feedback, and improve student/staff communication
  - Attendance will be taken and is MANDATORY (students may miss up to 2 sessions unexcused and still pass the course)
  - If you are late to Mandatory Lab it will could as a Half unexcused absence

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COURSE OVERVIEW

- Lectures:
  - Provided by Professor Mithuna Thottethodi and Dr. Phil Walter (occasional guest lecturers)
  - Held Tuesdays and Thursdays 4:30-2:20pm in ME 1061
  - Consult course calendar for lecture dates and topics
- Midterm and Final Presentations:
  - Formal presentations given before classmates and staff
  - Opportunity to showcase design and/or prototype, detail progress
- Weekly Progress Reports:
  - Used to detail individual design activities and progress
  - An important part of student grades and a REQUIRED COURSE OUTCOME (60%+ average required on progress reports to pass course).
  - Evaluated many times throughout the semester.

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COURSE COMMUNICATIONS

- **First: Ask your teammates!**
  - agree on and use a team communication app (slack, WeChat, Piazza Team Group, etc.)
- **Second: Ask on Piazza**
  - https://piazza.com/class/krqv7f9b4kf2i2
  - Primary method of communication about class issues, course info, etc.
  - All staff and TAs will monitor
  - Students encouraged to provide thoughtful answers
- **Third: ECE477 Course Email (ece477@ecn.purdue.edu)**
  - Primary method of communicating about grades, etc.
  - All staff and TA members
- **Finally: Individual Staff and TA Email**
  - If no other method gave you an acceptable response
  - follow up to a previous communication

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COURSE COMMUNICATIONS

- ECE477 Course Website
  - https://engineering.purdue.edu/ece477
  - Tested with Firefox, Chrome, IE, and Safari
  - Mobile device support not presently implemented
  - Please address any website issues to Phil Walter (PhilWalter@purdue.edu)

- Project Websites:
  - Website template available for teams by default
  - Created and maintained by ECE477 student teams
  - Primary method of sharing and communicating design and project progress with the world
  - Should be hosted in the webspace provided by course staff

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COURSE WEBSITE

- About – General course overview, staff information, history
- Course – Assignments, lectures, documents, policies, processes
- Teams – Information about current teams and links to websites
- Archive – Information about past teams and links to websites
- Sponsors – Information for corporate sponsors
- Incoming – Information for students looking to register for ECE477
- Contact – Course account email link for communications

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COURSE STAFF

- Professor Mithuna Thottethodi (mithuna@ecn.purdue.edu)
  Course Professor / Project Advisor

- Dr. Phil Walter (PhilWalter@purdue.edu)
  Course Instructor / Project Advisor

- Joseph Bougher (bougher@purdue.edu)
  Digital Systems Laboratory Engineer / Project Advisor

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COURSE TAS

- Fangda Li (li1208@purdue.edu)
  Head Teaching Assistant

- Andjey Ashwill (aashwill@purdue.edu)
  Teaching Assistant

- Sree Charan Gundabolu (sgundabo@purdue.edu)
  Teaching Assistant

- Rayane Chatrieux (rchatrie@purdue.edu)
  Teaching Assistant

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COURSE SCHEDULE/CALENDAR

- Weeks 1-4: Concept Development:
  - Functional Project Proposal: *"Our idea seems sound… what do we need to get started?"*
  - Functional Analysis: *"How will our project be used? What are our project's requirements?"*
  - Electrical and Software Overviews: *"At a high level, how will our project function?"*
  - Component Analysis and Bill of Materials: *"What parts does our project need to use?"*
  - Ordering/Acquisition of parts, tools, and prototyping hardware

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COURSE SCHEDULE/CALENDAR

- Weeks 5-9: Design:
  - Mechanical Overview: *"What will our project look like? What form factor does it need to fit within?"*
  - Software Formalization: *"What software components will our design use? How will we verify and test the software?"*
  - Printed Circuit Board Layout
  - Midterm Design Review
  - PCB Submission and Verification

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COURSE SCHEDULE/CALENDAR

- Weeks 10-15: Testing and Integration:
  - Legal Analysis: *"What steps must be taken to ensure our project can be legally sold to our customers?"*
  - Reliability and Safety Analysis: *"What risks are associated with use of our product? What parts are most likely to fail?"*
  - Ethical and Environmental Analysis: *"What resources does our project use? How can we responsibly manage our project's life cycle? What ethical issues does our project present?"*
  - User Manual: Guide to your project for the end user
- Week 16: Demos, Final Presentations, and Final Documentation

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Monday	Tuesday	Wednesday	Thursday	Friday	Monday	Tuesday	Wednesday	Thursday	Friday
8/23/2021 Begin Week 1	8/24/2021 Intro to 477	8/25/2021 Mandatory Lab	8/26/2021 Defining Requirements	8/27/2021 Final Project Proposal	10/18/2021 Begin Week 9	10/19/2021 PCB Ordering	10/20/2021 Mandatory Lab	10/21/2021 PCB Debugging	10/22/2021 PCB Verification & Submission
8/30/2021 Begin Week 2	8/31/2021 Hardware Interfacing	9/1/2021 Mandatory Lab	9/2/2021 Hardware Interfacing	9/3/2021 Functional Specification	10/25/2021 Begin Week 10	10/26/2021 Legal & Regulatory	10/27/2021 Mandatory Lab	10/28/2021 Legal & Regulatory	10/29/2021 Legal Analysis
9/6/2021 Labor Day (No Classes)	9/7/2021 Discrete Components	9/8/2021 Mandatory Lab	9/9/2021 Discrete Components	9/10/2021 Software Overview, Component Analysis	11/1/2021 Begin Week 11	11/2/2021 Reliability & Safety	11/3/2021 Mandatory Lab	11/4/2021 Reliability & Safety	11/5/2021 Reliability & Safety Analysis
9/13/2021 Begin Week 4	9/14/2021 Power Design	9/15/2021 Mandatory Lab	9/16/2021 Power Design	9/17/2021 Bill of Materials, Electrical Overview	11/8/2021 Begin Week 12	11/9/2021 Ethical Considerations	11/10/2021 Mandatory Lab	11/11/2021 Environmental Concerns	11/12/2021 Ethical & Environmental Analysis
9/20/2021 Begin Week 5	9/21/2021 Firmware Design	9/22/2021 Mandatory Lab	9/23/2021 Hardware Design 1	9/24/2021 Mechanical Overview	11/15/2021 Begin Week 13	11/16/2021 Final Steps	11/17/2021 Mandatory Lab	11/18/2021 No Lecture	11/19/2021 User Manual
9/27/2021 Begin Week 6	9/28/2021 Hardware Design 2	9/29/2021 Mandatory Lab	9/30/2021 PCB Assembly	10/1/2021 PCB Footprints & Schematic	11/22/2021 Begin Week 14	11/23/2021 No Lecture	11/24/2021 Thanksgiving Break	11/25/2021 Thanksgiving Break	11/26/2021 Thanksgiving Break
10/4/2021 Begin Week 7	10/5/2021 PCB Assembly	10/6/2021 Mandatory Lab	10/7/2021 Design Review Lecture	10/8/2021 PCB Layout Draft Software Formalization	11/29/2021 Begin Week 15	11/30/2021 No Lecture	12/1/2021 No Lab	12/2/2021 No Lecture	12/3/2021 Senior Design Report
10/11/2021 October Break	10/12/2021 October Break	10/13/2021 Midterm Design Review	10/14/2021 Midterm Design Review	10/15/2021 Midterm Design Review	12/6/2021 Begin Week 16	12/7/2021 No Lecture	12/8/2021 No Lab	12/9/2021 No Lecture	12/10/2021 No Homework Due

Final Presentations session will be on Wednesday of Finals Week.
(Time and Location TBA)

COURSE POLICIES

- The Golden Rule: ECE477 course staff are the final arbiters of all course policies
- The Golden Guideline: In the event of an ECE477 issue (team issue, absence, course issue, etc.), always Always ALWAYS contact course staff
  - Email is preferred (easier to recall a well-documented paper trail)
- All ECE477 course policies are subject to the above rule and guideline, even where not explicitly stated
- Course policies are available for viewing and download from the ECE477 course website

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COURSE POLICIES

- Lab Equipment and Usage Policy:
  - Common sense (don't intentionally break things, no food/drink/drugs/alcohol, etc.)
  - Safety (wear proper safety gear, 2 people in the lab at all times, etc.)
  - Certain lab equipment can be checked out of the lab (consult the Digital Systems Laboratory Engineer for details)
  - Lab equipment must be checked back in at the end of the semester to avoid academic penalties
  - Do not sabotage, steal from, or otherwise interfere with other ECE477 teams (members, workspaces, projects, etc.)

COURSE POLICIES

- Project Hardware:
  - Prototyping Hardware: any hardware you use to prototype aspects of your design
  - Final Hardware: hardware used to satisfy PSSCs, grades, and course outcomes
  - Q: Can we use <x> to prototype our design?
    A: Sure, go right ahead.
  - Q: Can we use <Arduino or similar, trivial breakout board, etc.> in our final design?
    A: Probably not.
  - Q: We're unsure if <piece of hardware> is allowed, what should we do?
    A: Contact course staff

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COURSE POLICIES

- Online Collaboration Policy:
  - use of github, Sourceforge, Google Code, etc. is allowed BUT:
    - All students must maintain an online progress report using provided formatting
    - All students must maintain a project website hosted on the provided server space
  - Open source and third-party libraries may be used, provided they are properly attributed
  - Accepting patches and modifications from third parties to team member source code is explicitly forbidden
    - Cheating and other academic dishonesty will result in automatic course failure (so don't do it)

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GRADE DETERMINATION

Team Components (40% of total)		Individual Components (60% of total)	
Project Success Criteria Satisfaction*	20.0%	Weekly Progress Update Reports*	20.0%
Design Review*	15.0%	Design Component Report*	15.0%
Final Presentation*	10.0%	Professional Component Report*	15.0%
Final Project Archive*	15.0%	Individual Contribution	20.0%
Concept Development Assignments	10.0%	Class Attendance and/or Participation	10.0%
System Integration and Packaging	20.0%	Mandatory Lab Session Attendance	10.0%
Educational (Senior Design) Report*	5.0%	Midterm and Final Confidential Peer Reviews	5.0%
PCB Completion and Submission*	5.0%	Design Review and Final Presentation Peer Evals	5.0%

Bonus Components (added to grade total)	
Early completion	1.0% per week early (team)
Design bonus contracts	(variable – negotiated with course staff)
Design Showcase participation	1.0% per individual
Design Showcase poster	1.0% per team
Motorola Award voting	0.5% per individual
Purdue mycourseval Evaluation	0.5% per individual
Instructor discretion (borderline resolution)	0.5% per individual

** items directly related to ABET course outcome assessment*

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GRADE DETERMINATION

- Late Policy
  - Deliverables in this class are like project deliverables to a customer
  - A late penalty of -10% per day will be assessed for any items turned in after the deadline
  - If an assignment is more than 3 days late, course staff will have final determination on whether to grade the assignment or not

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GRADE DETERMINATION

- **Learning Outcomes: (must be satisfied in order to pass the course)**

i. An ability to apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

ii. An ability to develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience.

iii. An ability to identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics.

Continued on next slide…

GRADE DETERMINATION

- **Learning Outcomes: (continued)**

iv. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience.

v. An ability to communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation.

vi. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course.

vii. An ability to recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts.

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GRADE DETERMINATION

- Failures, Conditional Failures, and Incompletes
  - Students are responsible for their actions in ECE477; some actions may lead to failing grades
  - Be aware of your academic situation in ECE477 and other courses before considering post-graduation plans or accepting job offers
  - In some situations, students may be assigned an incomplete (I) or conditional failure (E) in lieu of a failing grade (F)
  - Report all University-eligible absences (death, illness, family emergency, etc.) to course staff as soon as possible

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GRADE DETERMINATION

- Cheating and Academic Dishonesty
  - Not tolerated at Purdue
  - Automatic failure from ECE477, possible disciplinary action
  - All cases of academic dishonesty will be reported to the Office of the Dean of Students
- In Summary…
  - Don't.
- A professional does not take credit for the work of somebody else

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PROJECT SPECIFIC SUCCESS CRITERIA (PSSCS)

- What are PSSCs?
  - Used to measure the degree to which teams have successfully implemented their projects
  - 5 objectives that should be accomplished by the final design (Approved by course staff); begin each PSSC with the phrase “An ability to…”
  - Each PSSC should describe some aspect of the functionality of the final design
  - In order to pass the course, 3 PSSCs must be successfully demonstrated
    - 2 of the PSSCs must focus on hardware built by team
    - 1 of the PSSCs can focus on an external item (such as an app)

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PROJECT SPECIFIC SUCCESS CRITERIA (PSSCS)

- Default Functionality of a Component Rule
  - PSSCs cannot be based on functionality that an aspect of the design is able to do trivially or out of the box
  - Examples:
    - "An ability to transmit data over a wireless connection"
    - "An ability to take pictures with a camera"
    - "An ability to emit light from a light emitting diode"
- Preliminary and Final PSSCs
  - Preliminary PSSCs: Aspects of the project can be demonstrated without full integration; used to pass outcomes
  - Final PSSCs: Must be demonstrated with a fully-integrated project; used to receive points and for early completion bonus credit

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PROJECT SPECIFIC SUCCESS CRITERIA (PSSCS)

- Examples of Unacceptable PSSCs:
  - "Interface with the flight controller to achieve stable flight" (Start all PSSCs with the phrase "an ability to")
  - "An ability to design a motor controller for our project" (PSSCs must be based on the capabilities of your end project)
  - "An ability to receive GPS coordinates and send them to the microcontroller" (Default functionality of a component rule)
  - "An ability to filter out high frequency noise from a received RF signal" (Unacceptable if being done by a filter IC; acceptable if performed by a user design)

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PROJECT SPECIFIC SUCCESS CRITERIA (PSSCS)

- Common subjects for PSSCs:
  - Communication interfaces (acceptable IF you specify the types of data being transmitted over the interface)
  - User interfaces (define types of data being displayed to the user interface as well as the nature of the UI)
  - Motor control and robotics techniques (GPS waypoint navigation, obstacle avoidance, PID control, etc.)
  - Power techniques (battery monitoring/charging/ notifications, backup power supplies, low power modes)
  - Audio techniques (sound effects, audio synthesis, voice recognition, video/audio/signal processing, FFTs – may be acceptable depending on circumstances of use)

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TO DO LIST: WEEK 1

Coursework:

1. Assignment 1: Final Project Proposal

- 1. Select team roles and responsibilities
- 2. Determine homework assignment responsibilities
- 3. Develop a preliminary project budget
- 4. Select project specific success criteria (PSSCs) – see coursework item 2, below

2. PSSC Selection: Select 5 project-specific success criteria on which your project will be assessed. For more information on course policy regarding PSSCs, see the PSSC Policy, available here: https://engineering.purdue.edu/ece477/Course/Policies/PsscPolicy.pdf

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TO DO LIST: WEEK 1

Coursework:

3. Assignment 1: Final Project Proposal

- Due **Friday at 11:59pm** for teams in Wednesday Labs (use website submission tool)
- Due **Sunday at 11:59pm** for teams in Friday Labs (use website submission tool)

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TO DO LIST: WEEK 1

Manlab:

Note: Lab workstations are only equipped with a single PC per team, but for much of the course students will need access to more computing resources. Therefore, for this and future weeks, students are advised to bring their own laptop or other computing equipment to manlab. For students who lack their own computers or don't desire to use them for school work, a limited number of laptops are available for checkout from course staff.

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TO DO LIST: WEEK 1

Manlab: (continued…)

1. Team Photos: Some time will be spent at the beginning of manlab taking team photos. These photos will be used on the course website for identifying teams and may also be used in student project websites.

2. Student Project Websites: Students will be given access to course accounts and are asked to set up their teams' student project websites Website templates are provided to students to assist with this process, and website setup instructions are available here:

https://engineering.purdue.edu/ece477/Course/Process/WebsiteSetupProcess.pdf

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TO DO LIST: WEEK 1

Manlab: (continued…)

3. Discussion of your Project with Lab Staff: During Manlab each team will give an overview of their proposed project and spend time brainstorming possible PSSCs

4. Team Member Contact Information: If it hasn't already been done, students should exchange contact information with one another, including names, phone numbers, emails, other forms of contact. All team members should have this information for all other team members, so that student communication is steady and reliable throughout the semester.

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TO DO LIST: WEEK 1

Manlab: (continued…)

5. Calendars and Collaboration Tools: Student team members should exchange schedules, and be aware of the availability of other team members. In addition, a variety of online collaboration tools can help make the design and collaboration process easier. A few examples:

- **Issue Tracking:** Maintain a list or use a pre-existing bug tracker tool to identify major project issues, assign people to address tasks, and keep notes on technical approaches attempted and any fixes that were determined (BugTower, Yodiz, etc.)
- **File Storage:** Maintain important files or datasheets online and share them with other team members (Google Drive, DropBox, etc.)
- **Source Control:** Handle concurrent edits, manage file versions, back up files in the event of data loss (github, Bitbucket, etc.)

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