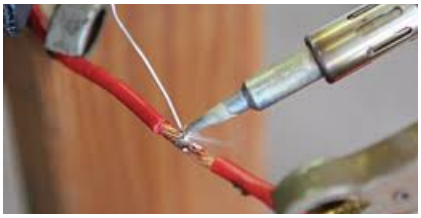
IME 156 – Basic Electronics Manufacturing Lab Syllabus

This is course is more than just building a Prism LED project…

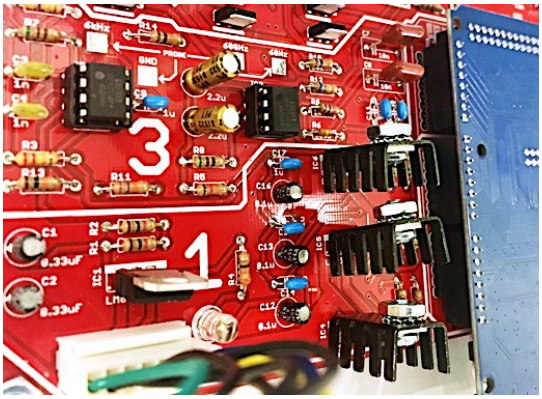
You may also learn to:

- Test and repair an electrical plug, appliance or device.
- Troubleshoot an electronic system in your home.
- Solder and assemble in a future electronics course or project.



Soldering wires.

Soldering drone circuitry.



Prism project circuit board

Course Learning Objectives:

- Capture an electrical schematic and develop a PCB layout design using Eagle software.
- Manufacture a two-piece aluminum chassis to house your electronics project assembly.
- Identify and distinguish between electrical hardware and components including various connectors, crimps, capacitors, resistors, transistors and voltage regulators.
- Solder through-hole and surface mount components to a PCB and solder wiring to terminals reliably and in accordance with specific acceptance criteria.
- Apply crimps to various wiring assemblies, assemble multi-pin connectors, install fasteners to secure PCBs, heat sinks and LEDs.
- Perform electrical testing using a multi-meter, troubleshoot operating issues and complete a working electronic project.

Course Information

Lab Instructor:
Rob Carter, email: rvcarter@calpoly.edu, Office: 41A-105
Office Hrs.: **M** 12-3, **R** 9-11, Cell Ph (805) 801-3250
For quick questions, I prefer email and will generally respond within 24 hrs M-F and 48 hrs on weekends. Visit me during off hrs for best communication.

Required Materials:
- Prism LED project kit - Required by Week 2 (available only at University Union Store)
- **Computer** (PC or Mac) – to work on Eagle circuit design outside class.

Recommended Material
Soldering Iron (available online, approx. $40). Not required, but recommended if you want to work independently.

Required Reading:
Lab Manual and reading assignments are provided on PolyLearn. They are required reading for daily lab operations and quizzes.

Grading:
Lab instructor assigns final course grade; 40% from lecture, 60% from lab.

Late Assignments:
To stay on schedule, assignments are due at the **start** of a lab period; late work **loses 10%** if on the same day and 50% on the next day. **No credit** may be given thereafter.

Lab Attendance:
On-time lab attendance is MANDATORY for this hands-on course. **Notice of any absence must be received via email no late than 12 pm the day of the absence** to be acceptable without consequences including zero quiz score and other penalties. Absences (excused or unexcused) or tardiness may jeopardize completing course requirements and affect grade.

Lab Work Assessments & Due Dates:

Computer-based quizzes – Quizzes will be administered in the IME156 CAD room at the **beginning** of lab during the weeks outlined below. **Undocumented absence or tardiness (after quiz starts) may result in a quiz score of zero**.

- **Eagle Assignment** – Continuity tester schematic and layout design is **due no later than the 5th week**.
- **LED PCB Evaluation** – Completed PCB assembly and Self-Evaluation form **due end of 8th week**.
- **LED Project Evaluation** – Due by the **last regular lab meeting of the quarter** (before final exams week).
- **Computer-based Final Quiz** – On-line lab final is administered in the IME156 CAD room **during last lab meeting**.

Required Homework Reading (Course reading is heavily front-loaded):
Lab instruction reading materials are available on PolyLearn site for your Lab Section. Large-type hard copies also provided in lab. Quiz questions for weekly quizzes 1-3 are given at the end of the reading assignment sections. Final quiz is comprehensive. See PolyLearn for final quiz study topics.

NOTE: Subject to change - Please see PolyLearn for your actual weekly assignments & quiz schedule since it varies depending on holidays. **Holiday**

Week 1: Intro/Safety & Syllabus Videos. Safety Quiz due before 1st lab.
Begin Eagle circuit design & sheet metal chassis fab.

Week 2: Kit inventory assignment (extra credit) due @ beginning of lab.
Continue circuit design & sheet metal chassis fab.

Week 3: Quiz 1 - PCB Fabrication reading assignment.

Week 4: Quiz 2 - Soldering videos & PCB Assembly reading assignment.

Week 5: Quiz 3 - Crimping reading assignment. Also, Eagle CAD assignment is due.

Week 6: Continue working on Prism project.

Week 7: Continue working on Prism project.

Week 8: PCB & completed Self-Evaluation Form due beginning of lab.

Week 9: Review lab reading assignments for lab final exam (50 questions comprehensive)

Week 10: Lab Final Exam & Prism LED Project Evaluation due (see PolyLearn for study guide)

Grading:

Lab assignments are weighted as follows:

- Attendance & Cleanup 5%
- Prism LED project 25% (PCB evaluation is in week 8),
- Lab final quiz 10%
- Lab quizzes 10%
- Eagle Schematic / Layout exercise 10%
- Lecture Grade 40%

Additional Important Policy Items to Know (Overviewed in Intro/Safety Videos):

- Lab cleanup and restoring of tools is required to be done by **ALL** students. **Cleanup supervisors** will be assigned each week to ensure complete BEFORE ANYONE LEAVES. Helping with cleanup is the quickest way to be excused. Clean up form must be completed for credit. Cleanup begins approximately 10-15 minutes before the end of lab. Every student is required to clean up their work area **AND** to share in the cleaning and maintenance of common areas and tools. Students who do not satisfactorily participate in clean up, will not be allowed to use the lab which will impact progress in the course.

- Attendance and being on-time are **MANDATORY**. Tardiness is arriving after roll is taken. Safety and procedural demos and instructions are primarily at the beginning of lab. Students who are late to class disrupt other students and will receive attendance point reduction (up to 5% of grade), score reduction and/or receive a zero on the day's quiz.

- Students may take brief breaks during lab as needed. However, if you must leave for more than a few minutes, please inform instructor so that if there is an emergency, we are all accounted for.

- Due to safety and lab policy, students **NOT** wearing closed-toed shoes will not be allowed to use the lab; they must change into appropriate attire. Students with long hair must tie hair up above their shoulders so that their hair cannot get caught in rotating equipment, soldering or other work.

- The lab instructor performs all grading. Teaching assistants offer experience and guidance, but do not know all of the instructor's particulars and do **NOT** grade. Ask instructor if you have a concern or question that involves grading.

- Quizzes & lab final are **CLOSED** book, notes, and no internet except as noted by the lab instructor.

- There are no 'open labs' available to attend alternate lab sections. Due to resource limitations, students may only attend their enrolled section, cannot attend other sections. There are no make-up labs available. This policy has several consequences: First, it is imperative to attend and be on time to lab meetings. Second, use your lab time efficiently and productively.

- If you're not sure about how to do something, or the order of operations, **consult the lab instructions first,** and then ask a TA or instructor for help. Common problem: Other students may not have the best information for efficient, accurate production. Ask the instructor if you want to be sure about any procedure or requirement.

- The **EE senior project lab (Bldg 20-Rm 111)** has many of the same tools as the IME 156 lab. Past IME 156 students have used this lab to either "catch up" or get ahead in their IME 156 work. However, IME 156 students are expected to attend ALL IME 156 regularly scheduled labs unless excused by instructor.

- Eagle CAD program is available for you to install onto your Windows or iOS machine **for free**. The Eagle tutorial provides installation guidance. Ask instructor for assistance.

IME 156 – Electronics Manufacturing Safety (Covered in Intro/Safety Video)

1. **In the event of a serious injury or accident, or if someone appears unconscious, or in need of medical attention CALL 911. The location is Building 192 – Room 105. Immediately notify you instructor.** Report all minor injuries, cuts, scrapes, etc. regardless of severity to your instructor. If you don't feel well for any reason, please talk with your instructor (privacy and discretion will be observed).

2. Approved safety glasses shall be worn at **ALL** times when working in the lab. Prescription glasses provide inadequate protection and do not shield from the sides. Properly sized safety glasses or goggles must be worn over prescription glasses. See your instructor if you have questions or concerns.
3. Never operate a machine unless you have been trained by an instructor or a TA. If you are uncertain about **ANYTHING**, please ask the instructor or a TA for a demonstration. **DO NOT GUESS**. There are important procedures to ensure your safety and of those around you. Specifically, training on the metal working equipment is essential for: turret punches, sheer, breaks, and pneumatic punch. Note that smaller tools such as drills, scratch awls, files and soldering irons can also cause injury if used improperly.
4. Fully closed shoes made of heavy material such as leather or canvas **ARE REQUIRED to work in lab**. Loose clothing such as hoodie ties or jewelry can be hazardous. Long hair must be tied up and back out of the way. When in doubt, check with your instructor. You may be working around oil, dirt, and chemicals, please dress in clothing appropriate for hands-on shop work.
5. Never take your hand off of a drill chuck key while it is in the drill chuck. This helps avoid leaving the key in the chuck when starting the motor and causing possible serious injury or equipment damage.
6. Immediately report suspected faulty operation or dangerous conditions of a tool or equipment to the instructor. Do not use a suspicious machine until deemed safe by the instructor. Immediately report any broken or missing tools to the instructor, whether broken by you or not. You will not be penalized for being honest. Please be mindful of everyone's safety and the use of tools in good working condition.
7. Cutting tools that can cut metal can also cut you! Freshly cut sheet metal can have a razor-sharp burr (rough or sharp edge). Treat tools and sheet metal with respect and de-burr your metal parts (with the proper use of a file) as you work to minimize the chance of getting cut.
8. Food, drinks, cell phone usage (other than for viewing lab instructions) or music systems with headphones are not permitted in the lab because they are distracting. Step outside if you must eat, drink or use your phone for other than class-related work. No food or drinks are allowed in the computer lab ever.
9. Table workspace is limited. Personal belongings that are not directly required for the activity being performed should be put in your book bags or backpacks. Store your bags on the metal shelves near the main lab entrance where they will not be stepped on or tripped over.
10. It is your responsibility to do your fair share of keeping the lab area clean. As a consequence, you are **REQUIRED TO REMAIN IN THE LAB THROUGH CLEANUP**, unless you receive the instructor's permission to leave early. All must clean up/sweep any mess you make, and return any tools that you used to the proper storage location. If you are asked by the instructor to do a special cleanup task, please assist. If everyone contributes, we will have a safe, efficient, and pleasant place to work.
11. Observe and practice professional courtesy. Remember that everyone needs the use of tools and the available working space, and the labs are often filled to the room's capacity. It is courteous to help put tools away during cleanup time, even if you did not use them. Clean-up will be complete sooner if we all help out.