

FALL 2021
ECE4871: ECE Culminating Design I
(0-2-0-1)

Instructors: **Professor Bruno Frazier** **Contact: Bruno.Frazier@ece.gatech.edu**
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Office hours: Preceding or following studio sessions or by appointment

Prerequisites: (*=concurrency allowed)

CmpE Majors: Undergraduate Semester level [ECE 3057](#) Minimum Grade of C and Undergraduate Semester level [ECE 3020*](#) Minimum Grade of C and Undergraduate Semester level [ECE 3030*](#) Minimum Grade of C and Undergraduate Semester level [ECE 3005*](#) Minimum Grade of C

EE Majors: Undergraduate Semester level [ECE 3040](#) Minimum Grade of C and Undergraduate Semester level [ECE 3043](#) Minimum Grade of C and Undergraduate Semester level [ECE 3072*](#) Minimum Grade of C and Undergraduate Semester level [ECE 3084*](#) Minimum Grade of C and Undergraduate Semester level [ECE 3005*](#) Minimum Grade of C

Optional Text: Hyman, *Fundamentals of Engineering Design*, Prentice-Hall, 2nd ed., 2003

ECE 4871 Grading:

Teamwork/Professionalism/Meeting Attendance	10 %
Team Skills Matrix	5 %
Technical Review Paper	10%
Design Notebook	10 %
Team Assignments	8%
Surveys	2 %
Req.Advisor/Sponsor Meetings/Meeting Attendance	10 %
Project Summary Form	10 %
Project Proposal	35 %

* An acceptable Technical Review Paper and Project Proposal MUST be submitted on-line to receive a passing grade in ECE 4871.

Course Structure and Studio Attendance:

The course is taught one day a week. The weekly studios will consist of “How To” studio lectures and breakout team meetings (after team formation). The “How To” studio lectures will be immediately followed by team project meetings throughout the semester as part of the studio experience. Students are required to attend ALL course dates live through BlueJeans video sessions. Attendance will be taken each day. Students are responsible for all announcements made in class, including changes to the schedule and to project deliverable due dates.

Materials:

Course materials and announcements may be distributed in lecture, via email, posted online, by other methods. Students are expected to check the course website for course announcements and

read email daily. You are responsible for all announcements or materials, regardless of the official manner of distribution.

Assignments:

Assignment instructions should be read carefully and followed exactly; points may be deducted for failure to follow instructions. All submitted assignments must include a cover page with your name(s), course number, instructor, submission date, and assignment title.

Teamwork/Professionalism:

This grade component is based on your individual participation with course and team activities, team's Project Proposal, Project Summary Forms, and individual students' professional behavior during ECE 4871. Points may be deducted for unprofessional behavior by a student during the semester, including:

- missing scheduled meetings with your project advisor or other team members
- unprofessional behavior as noted by the instructors or as reported by other team members, the project advisor, or industrial sponsors
- failure to function properly as a member of the design team
- lack of professionalism in submitted assignments, e.g., chronic failure to follow required format

Late Policy:

All items are expected to be turned in by the specified due date and time. Late submissions, if accepted, may be subject to a penalty.

Academic Honesty:

Students are expected to behave in conformance with the Georgia Tech Honor Code and are expected to work individually on all tests and assignments, unless explicitly instructed otherwise. Incidents of academic dishonesty will be referred in writing to the Office of the Dean of Student Affairs.

Technical Review Paper:

The Technical Review Paper is a technical review of a specific technology component associated with your team's proposed project. It should be a concise, fact-based summary of current knowledge and state-of-the-art options for the key elements required for implementation of the selected technology component (hardware or software). It is to be completed INDIVIDUALLY, with no assistance from other team members or your project advisor.

Project Proposal

The Project Proposal is a TEAM-written, formal document that accurately describes the proposed project, including the following sections. Detailed instructions will be provided later.

- Executive summary
- Introduction
- Project description and goals
- Technical specifications
- Design Approach and Details
- Consideration of alternate design approaches
- Consideration of contemporary issues

- Schedule, tasks, and milestones
- Budget & Cost analysis
- Leadership Roles
- Current status
- References
- Appendices.

Design Notebook

An INDIVIDUAL design notebook MUST be maintained starting when the Technical Review Paper is submitted in ECE 4871 and continuing throughout ECE 4872 or ECE 4873. Your design notebook must be usable to follow-on projects or other people who need to refer to it at a later time. Usability will be judged from adherence to standards, overall organization, legibility, intelligibility of technical content, and meeting / notebook maintenance. Detailed instructions are provided on the course website.

NOTE: In past semesters of ECE4871/ECE4872 or ECE4873, students have maintained a physical, bound notebook. You are allowed to use online journal apps for keeping individual student electronic notebooks, which would affect some of the requirements listed below.

Notebook Format

- Bound notebook (i.e., no removable pages) or specified electronic format
- Numbered pages
- Your name, your project's name, your contact information and your team members' contact information recorded on the cover or inside the cover

Action Items

- Separate section in the front of the notebook, allocate pages for this section
- Maintain check-boxes for items for which you are responsible
- Check off and date items when completed

Technical Notes in a Chronological Format

- Detailed design notes consisting of design ideas and decisions, record of important websites
- Team meeting notes
- Copies of, or pointers to, code that you wrote
- Do not skip blank pages

Course Outcomes – Upon successful completion of this course, students should be able to:

1. describe factors and constraints associated with product development and life cycles;
2. apply statistics to analysis of engineering problems, including component and manufacturing variation, project scheduling, and product reliability;
3. solve basic problems in engineering economy, including use of time-value-of-money principles for decision making;
4. describe considerations in professional engineering practice, including licensure, ethics, standards, intellectual property, and liability;
5. perform a literature search on a specific technical subject and prepare a summary report;

6. form and effectively function as a team to define, plan, and develop a design project of appropriate scope, depth, and breadth;
7. as part of a team, describe qualitative design goals and determine quantitative design specifications to meet the goals;
8. as part of a team, prepare a project timeline in an appropriate format that includes tasks, critical paths, and milestones;
9. as part of a team, prepare a project budget that includes, as appropriate, development costs, manufacturing costs, and profit;
10. as part of a design team, prepare a design project proposal that effectively communicates information in written and graphical form.

Student Outcomes - In the parentheses for each Student Outcome, "P" for primary indicates the outcome is a major focus of the entire course, "M" for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.

1. (P) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (P) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (P) an ability to communicate effectively with a range of audiences
4. (P) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (P) 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
6. () an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (P) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

1. Overview of ECE 4871/ ECE4872 or ECE4873; Choosing a culminating design project, project selection / team formation process, ECE facilities & training,
2. The Engineering Design Process, Problem Formulation, Design Vocabulary
3. Engineering measurement fundamentals; Understanding and determining project specifications
4. Project documentation instructions: Technical Review Paper instructions, Design Notebook instructions, Project Summary Form, the Team Skill Matrix, Project Proposal
5. Project topics Overview
6. Design team assignments, In-class First Team Meeting Agenda – Team Skills Matrix leading to TRP, Design Notebook first entries, Draft Project Summary
7. Quality Function Deployment
8. Project Planning and Management Tools
9. Job Costing and Budgeting
10. Design Standards and Standards Organizations
11. Intellectual Property
12. Ethics & Professionalism in Engineering Design
13. Looking ahead to ECE 4873 or ECE 4873
 - a. Course overview and deliverables
 - b. Safety issues with culminating design projects

- c. Senior design laboratory rules and ordering parts
- d. Laboratory notebook requirements and reporting timeline