Engineering Senior Project 1 & 2 (Computer Engineering)

Fall & Spring 2020/21

A demanding, and perhaps original, Computer Engineering project performed under close faculty supervision. **Computer Engineering students are highly encouraged to work individually, or at most on a team of two**. The scope of the project typically includes problem definition, development of requirements, and preliminary design work & decisions made amongst various options. Progress reports, a final paper *(in IEEE conference-ready formatting)*, and a public seminar *(or poster and video)* are required. Work in other courses may not be double-counted. All projects must have original working hardware and/or software to earn better than a "B" grade, and must have significant complexity. Register by Instructor.

LEARNING OUTCOMES

COMPUTER ENGINEERING Targeted Tasks Rubric

J Wunderlich PhD
Program Coordinator

Yellow / Highlighted = Graded student works collected in Binders for internal & external-ABET review

2018/19 New ABET Learning Outcomes   An ability to:

(ABET-1) Identify, formulate, and **solve** complex engineering problems by applying principles of engineering, science, and mathematics.

(ABET-2) 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.

(ABET-3) **Communicate** effectively with a range of audiences.

(ABET-4) 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.

(ABET-5) Function effectively on a **team** whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

(ABET-6) Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (**LAB's**).

(ABET-7) Acquire and apply new knowledge as needed, using appropriate **learning** strategies.

Pre-2018/19 ABET Learning Outcomes

(ABET-a): An ability to apply knowledge of mathematics, science, and engineering.

(ABET-b): An ability to design and construct experiments, as well as to analyze and interpret data.

(ABET-c): An ability to design a system, component, or process to meet desired needs.

(ABET-d): An ability to function on multi-disciplinary teams *if possible*, or to draw on the talents of others

(ABET-e): Identify, formulate, and solve engineering problems.

(ABET-f): An understanding of professional and ethical responsibility

(ABET-g): Communicate effectively orally and in writing

(ABET-h): A broad education necessary to understand the impact of engineering solutions in a global and societal context

(ABET-i): Recognition of the need for, and an ability to engage in life-long learning

(ABET-j): Knowledge of contemporary issues

(ABET-k): An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

H = High Emphasis in Course
M = Medium Emphasis in Course
L = Low or no Emphasis in Course

	Solve Problems	Design	Communication	Ethics & Impacts	Teamwork	Labs	How to learn	CREDITS	CONTACT HOURS
2018/19 New ABET Learning Outcomes:	1	2	3	4	5	6	7		
Pre-2018/19 ABET Learning Outcomes:	aek	ck	g	fhj	d	bk	i		
CS 121 Computer Science I	H	H	M	L	L	H	H	4	4
CS 122 Computer Science II	H	H	M	L	L	H	H	4	4
EGR 191 Introduction to Engineering I **LECTURE & LAB**	M	M	H	M	M	H	H	4	6
EGR 192 Introduction to Engineering II	H	H	M	H	H	L	M	2	4
EGR 210 Circuit Analysis **LECTURE & LAB**	H	H	M	L	L	H	L	4	6
EGR/CS 222 Systems Programming	H	H	M	L	L	H	H	4	4
EGR/CS 230 Computer Architecture & Hi-Tech Fundamentals	L	M	M	H	L	L	H	4	4
EGR 310 Signals and Systems	H	M	M	L	L	H	L	4	4
EGR 311 Electronics **LECTURE & LAB**	H	M	L	L	M	H	M	4	6
EGR/CS 332 Digital Design I	H	H	M	L	L	L	M	4	4
EGR/CS 333 Digital Design II, Assembly Language, & Interfacing **LECTURE & LAB**	H	H	H	L	H	H	M	4	6
EGR 410 Control Systems **LECTURE & LAB**	H	M	M	M	M	H	L	4	4
EGR/CS 422 Operating Systems	H	H	M	L	L	H	H	4	4
EGR/CS 433 Advanced Computer Engineering **LECTURE & LAB**	H	H	H	L	H	H	M	4	6
Elective: EGR/CS434 Robotics & Machine Intel, CS342 Networking, or EGR315 Communication Theory	Variable							4	4
EGR 401 Senior Project in Engineering I	H	H	H	M	M	H	M	2	
EGR 402 Senior Project in Engineering II	H	H	H	M	M	H	M	2	

PROFESSORS

Joseph T Wunderlich PhD *(primary faculty member this semester – direct all communications to Dr. W)*
Associate Professor of Engineering and Computer Science
Program Coordinator for Computer Engineering and Architecture Programs
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Office Hours: http://users.etown.edu/w/wunderjt/schedules/CALENDAR3_s21_web.htm

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Program Coordinator for Computer Science
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DELIVERABLES and GRADE PERCENTAGES

EGR401

Week 0 to 4 (optional):
- Informal communications about concepts

Week 4: Initial Report (20% of course grade)
- **ABSTRACT** – 200 words max
- **INTRODUCTION --** provide overview of project. If a team project, how is the team work managed. Who is taking the lead on what aspects of the project?
- **BACKGROUND** material on what other people have done and where your project fits in. The state of the art in the field (i.e., where it stands with other research/designs/projects).
- Peer Evaluation of Team Members; Just celebrate each other's contributions

Week 8: Preliminary Design Report (20% of course grade)
- **DESIGN CONSTRAINTS – problem definition.** Who is the customer, what are their requirements? Include Market analysis as appropriate. Include industry standards adhered to (e.g. IEEE, ASME, ASTM, AIA, etc)
- **TIMELINE/SCHEDULE**
- **BUDGET**
- **SOCIAL, ETHICAL, AND ENVIRONMENTAL IMPACTS** (include mitigations)
- Peer Evaluation of Team Members; Just celebrate each other's contributions

Week 12: DESIGN REPORT (40% of course grade)
- Showing design problem, methodology, and results of design analyses
- **What alternatives were considered and why were they eliminated? You should include Pugh-type decision matrices**
- Includes both system level design and detailed design of specific components.
- Peer Evaluation of Team Members; Just celebrate each other's contributions

Week 15: YOUTUBE VIDEO 1 of Preliminary Design and results, including decisions made (20% of course grade)

EGR402

Week 4: IMPLEMENTATION DRAWINGS and/or PRELIMINARY SIMULATIONS and REAL-TIME CODE (10% of course grade)
- Complete Detailed Working Drawings for any Implementation/Fabrication
  - Shop Technician may be asked to approve these
- Peer Evaluation of Team Members; Just celebrate each other's contributions

Week 8: TESTING REPORT (10% of course grade)
- Detailed Methodology, Results, and Analysis
- Peer Evaluation of Team Members; Just celebrate each other's contributions

Week 12: FINAL SIMULATIONS & REAL-TIME CODE and/or **MANUFACTURING PLAN** (if for mass production) (10% of course grade)
- Peer Evaluation of Team Members; Just celebrate each other's contributions

Week 13: POSTER PRESENTED ON SCHOLARSHIP DAY (20% of course grade)

Week 15: YOUTUBE VIDEO 2 (25% of course grade) **and FINAL PAPER** (25% of course grade)

FUNCTIONALITY & COMPLEXITY
All projects must have original working hardware and/or software to earn better than a "B" grade, and must be of sufficient complexity to rival the very best of any semester course projects in any other engineering or computer science course.

VIDEO 1 and 2
YouTube videos must be less than 10 minutes.

POSTER
A poster is required to be presented on Scholarship Day – obtain Poster template from Engineering Department Administrative Assistant Jennifer McFadden; and schedule printing with her at least one week prior to SCAD.

FINAL PAPER

- 10 point, two-column format, single-spaced
- IEEE formatting standards for citations, equations, and paper structure as specified here:
  http://users.etown.edu/w/wunderjt/IEEE_CONF_PAPER_FORMATTING.pdf
- Include sections titled:
1. **ABSTRACT** – a 200 word maximum
2. **INTRODUCTION** -- overview of project. If a team project, how is the teamwork managed. Who is the lead on what aspects of the project?
3. **BACKGROUND** material on what other people have done and where your project fits in. The state of the art in the field (i.e., where it stands with other research/designs/projects).
4. **DESIGN CONSTRAINTS – problem definition.** Who is the customer, what are their requirements? Include Market analysis as appropriate. Include industry standards adhered to (e.g. IEEE, ASME, ASTM, AIA, etc)
5. **TIMELINE/SCHEDULE**
6. **BUDGET**
7. **SOCIAL, ETHICAL, AND ENVIRONMENTAL IMPACTS** (include mitigations)
8. **DESIGN** -- showing design problem, methodology, and results of design analyses. *Must include DESIGN within appropriate constraints (costs, usage, manufacturability, etc).* Design is an iterative process with data driven decisions --your report should demonstrate this process. **What alternatives were considered and why were they eliminated? You should include Pugh type decision matrices.** Includes both system level design and detailed design of specific components. For many projects this section should fill ½ the final report.
9. **IMPLEMENTATION/FABRICATION REPORT** -- Design modifications and adaptations during this process.
10. **TESTING METHODOLOGY, RESULTS, AND ANALYSES** -- How was the prototype tested, and what were the results of those tests?
11. **MANUFACTURING PLAN** if for mass production and/or **SOFTWARE ENGINEERING**
12. **FINAL DISCUSSION AND CONCLUSIONS** – where do we go from here?
13. **BIBLIOGRAPHY** Most referenced material should be scholarly (e.g., peer-reviewed journals, conference publications, or books); or Industry standards (e.g., IEEE, ASME, ASTM, AIA, etc.). Excessive use of wikipedia will be penalized.
14. **APPENDICES** All data spec sheets, code-listings, working drawings, or any other materials requiring multiple pages must be put in appendices immediately following paper – or in another labeled binder if necessary.

   If projects include participation by a student in another major (Computer Science, International Business, etc), report must be expanded to include, for example, more on Software Engineering, an extensive business plan, and/or model including socio-political implications. When multiple sub-teams collaborate on a project, separate reports may be appropriate -- but these reports should work together to tell the complete story. Furthermore, the above template is a guide as to scope; the model will not work for all projects. If one of these topics does not seem to fit your Project, discuss with the professor to find a broader theme or constraint which will include these topics. If your work is unique and significant enough, the professor will help you submit (and possible reformat all of the above) to fit the requirements of a specific publisher.

TEXTBOOK

None, but possibly mandatory assigned readings, depending on the nature of the project

ACADEMIC HONESTY

Elizabethtown College Pledge of Integrity: *"Elizabethtown College is a community engaged in a living and learning experience, the foundation of which is mutual trust and respect. Therefore, we will strive to behave toward one another with respect for the rights of others, and we promise to represent as our work only that which is indeed our own, refraining from all forms of lying, plagiarizing, and cheating."*
See the 2016-17 Elizabethtown College Catalog, "Standards of Academic Integrity"
   (http://catalog.etown.edu/content.php?catoid=10&navoid=507#Academic_Judicial_System)
   or Academic Integrity at Elizabethtown College, 11th ed.
   (https://www.etown.edu/offices/dean-of-students/files/academic-integrity-handbook.pdf)]

DISABILITY SERVICES, RELIGIOUS OBSERVANCES, and COVID-RELATED EXPECTATIONS

https://elizabethtown-my.sharepoint.com/:w:/g/personal/ouimetc_etown_edu/EfZ-QooKt_VPjgwsWJz230wB3Rb6CIHsPvE0xuqWCpr-UA?e=4%3acZzjpW&at=9

DISABILITY SERVICES: Elizabethtown College welcomes otherwise qualified students with disabilities and is committed to providing access for all students to courses, programs, services, and activities. If you have a documented disability such as a learning disability or chronic illness or a new circumstance such as a concussion and would like to request accommodations please contact the Director of Disability Services by phone (717-361-1227) or e-mail (daviesl@etown.edu). The Office of Disability Services can provide resources to you and facilitate communication with faculty about reasonable accommodations. After meeting with the Office of Disability Services, please set up an appointment to meet with me, the instructor, to discuss the accommodations as they pertain to my class.

RELIGIOUS OBSERVANCES: The College is eager to facilitate individual religious beliefs and practices whenever possible while retaining course student learning outcomes. It is your responsibility to meet with the class instructor in advance to request arrangements related to your religious observances that may conflict with this class, and to make appropriate plans to make up any missed work.

COVID-RELATED EXPECTATIONS: All students are expected to adhere to the established community expectations around safety, including: daily digital health reporting, physical distancing, proper wearing of facial coverings within buildings and classrooms and when within six feet of individuals outdoors, frequent handwashing, and participation in cleaning and sanitizing protocols as requested. You will be turned away from class if you do not have a face covering. Students diagnosed with a health condition that precludes mask wearing can contact Lynne Davies in Disability Services (daviesl@etown.edu) to request remote learning as a reasonable accommodation. **If you are exhibiting any symptoms of COVID or fail to pass the daily health screen, do not come to class.** Failure to adhere to the established community expectations around safety will result in notification of Campus Security and application of the student conduct process for failure to comply, endangering the well-being of others, and/or disorderly conduct. The student code of conduct applies also to participation in all virtual activities, including Zoom sessions and discussion boards.