**ECE 457 DESIGN PROJECT I**

**FALL 2019**

# **Class Meetings:** SENG- 222 Tuesdays and Thursdays 2:00 to 3:15 PM.

# The schedule for the Fall semester is attached at the end of this document. It may be necessary to occasionally reschedule classes to accommodate work schedules, travel, etc. This will be planned in advance so as to accommodate everyone’s schedules.

# **Instructor:** Dr. Paul Fortier - Professor UMass Dartmouth

Senior Systems Engineer- NUWC (1978-1994)

Engineer Intern R&D Laboratory– (Entrex, Seimens, 1975-1978)

Phone: 508-999-8544

Email: pfortier@umassd.edu

Office Hours: M & F (9-11am) or by appointment- Office is SENG 211A

# **Course Description and Learning Objectives**

This course is the first in the Senior Capstone Design sequence. It provides the experience of executing an engineering design project from start to finish. This includes dealing with standards and constraints, solving open-ended problems, and defining and assessing design options. It also provides an introduction to the methodologies and soft skills required to plan and execute an engineering design project. These skills include forming a design project group and developing group skills required to successfully complete the project, preparing a project plan and schedule, and interacting with their faculty advisor and customer. The specific learning objectives of this course are a subset of learning outcomes of the ECE Department for the ELE and CpE programs. These outcomes are listed below- the numbers in parentheses refer to the ECE department outcomes.

1. Learn and successfully apply methodologies to conceive and design a system or product involving both hardware and software to meet objectives. **(1a) (US 5.B.2)**
2. Learn and implement methodologies for successfully planning and executing an engineering design project. **(2) (US 5.B.2)**
3. Understand the importance of making tradeoffs involving reliability, practicality, cost, specifications and schedule. **(8a) (US 5.B.2)**
4. Learn to work effectively in a multidisciplinary team. **(5a, 5b, 5c)**
5. Develop an understanding of their professional and ethical responsibility in engineering. **(4a, 4b)**
6. Develop writing and oral presentation skills in the context of conducting design reviews and developing project plans. **(10a, b)**

The course also satisfies learning outcomes at the university studies level. These outcomes are derived from the university studies requirement 5:

1. Identify the needs and resources of the communities to which they belong.

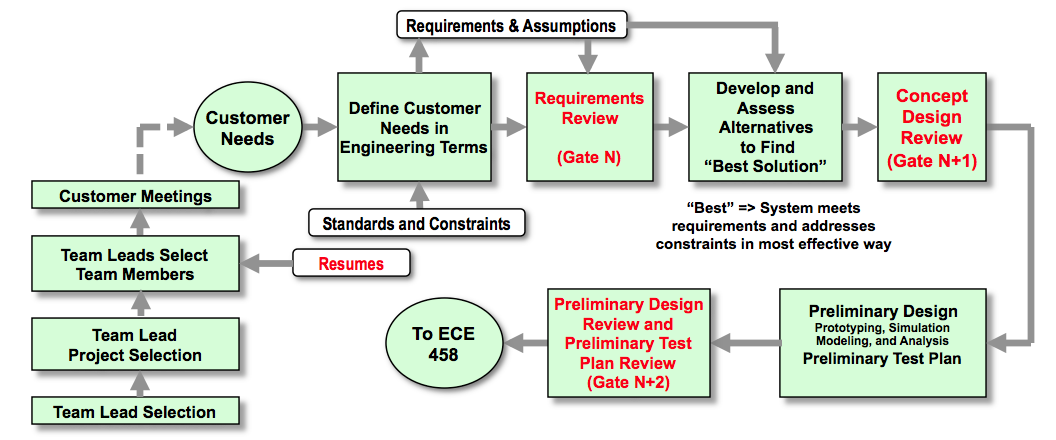
2. Apply knowledge and skills gained through academic study to real problems and/or opportunities within their communities.

3. Describe the connections between learning on campus and the issues and needs of broader academic, professional or civic communities.

4. Articulate the value of engagement to other members of their communities.

**Course Content and General Information**

Figure 1 below shows the major events in the course for this semester. The schedule contains additional detail.

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**Figure 1 ECE 457 Engineering Design Process Overview**

**Text-** Design for Electrical and Computer Engineers: Theory, Concepts, and Practice, by Ralph M. Ford and Chris S. Coulston, published by McGraw-Hill, ISBN 978-0-07-338035-3

**Assignments-** The class has three written reports and three oral presentations.

Students are required to keep a design notebook and to meet with their faculty advisors at a minimum biweekly and provide evidence of this with signatures in their design notebooks.

At the beginning of the course students prepare a resume for use at the Project Fair.

**Computer Literacy**- It is expected that students are familiar with standard word processing, presentation, and spreadsheet programs. Familiarity with database and scheduling applications may be useful but is not required.

**Projects-** Students will select from projects sponsored by college of engineering faculty, local industries, and other campus organizations. Projects are typically interdisciplinary. Historically there have been projects requiring combinations of Mechanical, Electrical, Computer, and Biological engineering students. If a CPE or ELE student selects a project that has high technical content from another discipline they may attend that discipline’s classes and will be graded by the course coordinator from that discipline. PARTICIPATION IN INTERDISCIPLINARY PROJECTS ARE ENCOURAGED AND WILL NOT AFFECT YOUR GRADE POSITIVELY OR NEGATIVELY. The course coordinators from all departments work closely to ensure consistent and fair evaluation of all students.

STUDENTS MAY TO PROPOSE THEIR OWN PROJECTS. These may be based on their personal interests, their intern or coop experiences, or summer employment. Students who propose their own projects will be the Team Leads for those projects. They are responsible for finding a customer (must have) and faculty advisor.

**Team Formation, Roles, and Responsibilities--** The ECE faculty has nominated students as candidates for team leads. That list will be presented at the first class. Students may decline roles as team leads. Any student proposing their own project will be added to the team lead list and pre-assigned to their project.

The number of team leads will depend on the overall class size and the characteristics of projects. Team leads will select projects from the set of projects for this year.

ALL students (including team leads) should review the project proposals on the m: drive and prepare a brief “resume”: The resume should include a list of the projects of interest (in order of most- to – least interest).

It should also include a BRIEF statement of your technical skills and interests.

Team leads will meet to select teams using the information you have provided in the resumes. Attempts will be made to match students to the projects of most interest to them. However an important part of this process is to ensure that teams have members whose expertise/ interests span the range of technical skills needed to successfully execute the project.

After team selection teams should begin regularly meeting to define roles and responsibilities. The course coordinators will provide information and guidance for this process.

# **Class Attendance-** This is an upper level course, so there are no explicit attendance requirements. However, advance notice of absences is appreciated. Students are responsible for material covered in all class sessions.

# **Ethics and Academic Standards-** Students and teams are expected to do their own original work, appropriately cite and recognize external inputs and to conform to the university academic standards policy which is available in the undergraduate catalogue and the student handbook and the following link: http://www.umassd.edu/studentaffairs/studenthandbook/academicregulationsandprocedures/

# **Intellectual Property-** Certain projects may also have intellectual property, proprietary information, or other confidentiality requirements. Students will be familiarized with their responsibilities with respect to these items in class sessions. Students must sign a waiver of Intellectual Property (IP) Rights in order to work on projects sponsored by outside organizations or those having an expectation of IP. This is consistent with industry practice- details will be described in class.

**Course Structure, Roles, and Operation-** The majority of work in the course will be performed by the STUDENT TEAMS. These teams will interact with their CUSTOMER/SPONSOR to define the requirements, scope, constraints, budgets, schedules and key design parameters for their project. TEAM interaction with the CUSTOMER should be as frequent as necessary to successfully execute the project.

The teams must also interact at the minimum biweekly with their FACULTY ADVISOR for technical guidance, mentoring, and review/signing of engineering notebooks. The FACULTY ADVISOR may also be helpful in working with the CUSTOMER to resolve resource and other problems.

The COURSE COORDINATOR will facilitate weekly (Tues/ Thurs) lectures and discussions on the topic shown in the schedule. The intent of the weekly class sessions is to provide students with background and information on topics key to successfully completing their projects. The COURSE COORDINATOR is also available to assist with personnel issues, disconnects between the TEAM and CUSTOMER or TEAM and FACULTY ADVISOR

**Shared Drive**- There is a folder named ECE457 on the m:drive. The ECE457 folder contains sub-folders for each student, each project , class assignments, and class lectures. Student and Project folders that are read/ write- enabled for each student and project team member as appropriate. Other folders are read-only.

**Grading**

The table below shows the class assignment that will be graded and the percentage of the total grade for each class activity. Grading rubrics will be provided with each activity. Weights are: Customer/ Course Coordinator

|  |  |  |
| --- | --- | --- |
| **Class Assignment** | **Weighting** | **Percentage of Grade** |
| Resume and IP Waiver | 0/100 | 5 |
| System Requirements Review | 40/ 60 | 20 |
| Concept Design Review | 40/ 60 | 20 |
| Preliminary Design Review | 40/ 60 | 35 |
| Project Notebooks | 0/100 | 10 |
| Project Contribution and Team Participation | Team, Advisor, Coordinator | 10 |

Grading will be on a 0 to 100 point scale for each assignment. Grades will be scaled as required based on class overall performance. Grades will be lowered by 10% for assignments submitted late.

**Students With Disabilities**

Academic support is available at the Academic Resource Center. Accommodations will be made for students with disabilities documented with the University Center for Access and Success. An example statement can be found at: http://www.umassd.edu/nfi/teachingandadvising/coursesyllabus/sampledisabilitystatement/

**Incomplete Policy**

At the student's request, and no more than 48 hours after the final exam or class, an incomplete grade may be given only in exceptional circumstances at the discretion of the instructor. The student must be passing the course at the time of the request or be sufficiently close to passing that the instructor believes that upon completion of the work, the student will pass the course. If the work is not completed within one year of recording the I, the grade will become an F(I).

**Detailed Descriptions of Course Assignments**

**Resume**

You will write a resume for use in the first two weeks of the course for project assignment. ALL students, including Team Leads must submit a resume. Details are provided in the resume assignment file on the m: drive

**Project Notebooks**

**Project notebooks must be maintained in ink by each student.** Notebooks must be bound (no spiral or ring-type binders) with the front of each page numbered in ink. There should be no erasures (cross out unwanted entries) and all entries (or pages) should be dated. Your name and project title must be on the cover.

The notebook is a tool for documenting ALL your engineering work (see important note below) including problems, analysis, design consideration and problem resolution or approach, results of builds, test plans. Include all requirements, design decisions (with rationale for each) all calculations, preliminary designs, test set-ups, and test results. NEATNESS IS NOT IMPORTANT- THIS IS A WORKING DOCUMENT.

It is recognized that much of your work may be performed and/or documented on-line. Examples include MatLab and CAD programs and data, software, and data/ specs/ information downloaded from the Web. This information does not have to be included in your notebook but should be referenced in it. The reference should be specific enough that a reader of the notebook could find the information. You are responsible for maintaining your online documentation and programs. This is especially important for software- make sure you can identify the latest versions of your software (and retain earlier versions in case they are needed!)

Work that represents group effort should be documented as such, with a clear accountability of who was responsible for each piece**. Notebooks must be signed and dated at least every two weeks by your advisor.**

**Notebooks will be reviewed and graded at the end of the semester.**

**System Requirements Review**

The System Requirements Review consists of a presentation and a short written report.

It documents the customer requirements, the engineering requirements derived from them, constraints, and applicable standards that you and your customer have agreed upon for your project. This is important because it helps ensure that you and you customer have a common and reasonably detailed understanding of what is to be done. The Engineering Requirements should be as quantitative as possible. The engineering requirements form the “Criteria for Success” for your project. If your projects meet these requirements then your project, by definition, will be “successful” (and you will get a good grade!).

**Requirements Review Presentation**

Presentations will be scheduled every 12 minutes. Plan your presentation to take no more than 10 minutes with approximately 2 minutes for questions. The format for your presentation is as follows:

|  |  |
| --- | --- |
| **Slide Number** | **Contents** |
| 1 | Title, Sponsor, Team Members & responsibilities |
| 2 | System Diagram (May be functional diagram, block diagram, UML construct, or pictorial representation. The intent is to convey an overall picture of project.) |
| 3 | Technical Requirements, Mapping to Customer Requirements, and Justification. Use formats shown below in Figures 1A and 1B |
| 5 | Constraints and Applicable Standards |
| 6 | Initial Estimate of equipment, software, and supplies required |

|  |  |
| --- | --- |
| **Customer Requirement Number** | **Requirement Description** |
| 1 |  |
| 2 |  |
| --- |  |
| N |  |

**Figure 1A- Template for Customer Requirements**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Customer Rqmt No.** | **Engineering Requirement Number** | **Engineering Requirement(s) Description** | **Justification and /or Comments** | **Test Method**  **(IADT)** |
| 1 | 1 |  |  |  |
|  | 1.1 |  |  |  |
|  | 1.2 |  |  |  |
| 1 | 2 |  |  |  |
|  | 2.1 |  |  |  |
| 2 | 3 |  |  |  |
| 3 | 4 |  |  |  |

**Figure 1B- Template for Engineering Requirements and Initial Test Methods**

**Requirements Review Report**

The format for the System Requirements Review report is shown below

|  |  |  |
| --- | --- | --- |
| Section | Content | No of Pages |
| NA | Title Page with Project Title; Sponsor; Team Members & responsibilities | 1 |
| 1 | System Diagram(s) and Brief Discussion | 1-3 |
| 2 | Engineering Requirements and Relationship to Customer Requirements  Use formats shown above in Figures 1A and 1B | 1-3 |
| 3 | Constraints and Applicable Standards | 1 |
| 4 | Initial Estimate of equipment, software, and supplies required | 1 |
| 5 | Initial Plan and Schedule | 1 |

The report should expand on the PowerPoint slides with short narratives. F**eel free to reuse the contents of the Powerpoint slides in the report (typically tables and/or figures)- this saves work and ensures consistency.**

Presentations and Reports must be placed in your project’s folder on the ECE457 folder on the m: drive. Each project folder is write-enabled for students working on that project. Presentations should be submitted as Powerpoint files. Reports should be submitted in Word to the extent possible. Files which are not easily incorporated into Word should be submitted as PDF’s, clearly identified and referenced in the body of the report.

**Presentations and Reports must be placed in your project folder by 4 PM on Tues Oct 1**

**Concept Design Review**

The objectives of the Concept Design Review are:

* Show any Updated Customer Requirements, Constraints
* Present Updated Engineering Requirements and Constraints- (Additional detail and changes from Rqmts Review)
* Present Updated Functional Description(s) of Project
  + Diagrams, Drawings, Schematics, Illustrations as Appropriate
  + UML, Flow Charts, Data Flow and Control Flow
* Describe Alternative Solutions Being Considered
  + Select Two Functions, Subsystems, or Components
  + Show what alternatives were considered for them
* Present Analysis of Alternative Solutions
  + Show analysis of Alternatives Using SW, Decision Matrix, or Pugh as appropriate
* Discuss Selected Alternative and Justification for How it Best Meet Requirements

**Concept Design Review Presentation**

Presentations will be scheduled every 12 minutes. Plan your presentation to take no more than 10 minutes with approximately 2 minutes for questions. The format for your presentation is as follows:

|  |  |
| --- | --- |
| **Slide Number** | **Contents** |
| 1 | Title; Sponsor; Team Members & responsibilities |
| 2 | Present Updated Customer Requirements and Engineering Requirements and Constraints  Use same format as in Requirements Review |
| 3 | Updated Functional Description of Project- Use block diagrams, architecture diagrams, UML constructs as appropriate |
| 4 | Overview of the Two Alternatives Being Considered (see descriptions above) |
| 5 | Overview of the Analysis of Alternative Solutions (see descriptions above) |
| 6 | Selected Alternative and Justification for How it Meets Requirements |

**Concept Design Review Report**

The report is not to be a bulleted version of the PowerPoint slides, but rather a short narrative that explains and expands on the material presented in the PowerPoint presentation. **However, feel free to reuse the contents of the Powerpoint slides in the report (typically tables and/or figures)- it will save work and ensure consistency.**

|  |  |  |
| --- | --- | --- |
| **Section Number** | **Contents** | **No of pages** |
|  | Title; Sponsor; Team Members & responsibilities | - |
| 1 | Present Updated Customer Requirements and Engineering Requirements and Constraints  Use same format as in Requirements Review | 1 |
| 2 | Updated Functional Description of Project- Use block diagrams, architecture diagrams, UML constructs as appropriate | 1-2 |
| 3 | Overview of Alternative Solutions Being Considered | 1-2 |
| 4 | Overview of Analysis of Alternative Solutions | 2 |
| 5 | Selected Alternative- Describe How it Meets Requirements | 3 |
| 6 | Updates to Plan and Schedule and Status | 1 |

Presentations and Reports must be placed in your project’s folder on the ECE457 folder on the m: drive. Each project folder is write-enabled for students working on that project. Presentations should be submitted as Powerpoint files. Reports should be submitted in Word to the extent possible. Files which are not easily incorporated into Word should be submitted as PDF’s, clearly identified and referenced in the body of the report.

**Presentations and Reports must be placed in your project folder by 4 PM on Nov 5**

**Preliminary Design Review (PDR)**

The objectives of the Preliminary Design Review are to:

* Verify that you have developed a solution to your customer’s problem and verified (through analysis, prototyping, simulation and modeling) that the design can address all requirements and constraints
* Ensure that risks to implementing the design are understood and that you have a plan to address them.
* Present your preliminary test plan that you will to verify/ demonstrate that requirements are met
* Discuss needed supplies and resources and your plan(s) to obtain them.

Presentations will be scheduled every 12 minutes. Plan your presentation to take no more than 10 minutes with approximately 2 minutes for questions. The formats for the presentation and report are shown below.

**Preliminary Design Review Presentation**

|  |  |
| --- | --- |
| Slide Number(s) | Content |
| 1 | Intro Slide- Project Name, Customer, Advisor, and Team Members & responsibilities |
| 2-3 | Finalized Requirements and Constraints and Test Method to Verify Requirement  (Use same format as for earlier reviews and update earlier requirements tables) |
| 3-6 | Description of Preliminary Design- This must include a Summary of Analysis, Prototyping, and Simulation & Modeling Efforts to Date. (As appropriate to project)  Overview showing how the results from the above efforts show that your design can meet the requirements |
| 7 | Resources and Risk/ Problem Discussion (Risks and How will you Address Them) |

**Preliminary Design Review Written Report**

|  |  |  |
| --- | --- | --- |
| Section | Content | Number of Pages |
| NA | Intro Page- Project Name, Customer, Advisor, and Team Members & responsibilities | 1 |
| 1 | Finalized Requirements and Constraints with brief discussions. Present requirements using same format as earlier reviews. Update test approach | 2-3 |
| 2 | Description of Preliminary Design Including Summary of Analysis, Prototyping, and Simulation/ Modeling Efforts to Date. (As appropriate to project) | 2-4 |
| 3 | Discussion of How Preliminary Design Meets Requirements and What Test Methods will be Used to Verify Requirements. Specifically describe how the results from the above efforts show that your design can meet the requirements | 2-3 |
| 4 | Resource Summary and Risk Discussion (Risks and How will you Address Them) | 1 |
| 5 | Update and Status of Plan and Schedule | 1 |

The report is not to be a bulleted version of the PowerPoint slides, but rather a short narrative that explains and expands on the material presented in the PowerPoint presentation. **However, feel free to reuse the contents of the Powerpoint slides in the report (typically tables and/or figures)- it will save work and ensure consistency.**

Presentations and Reports must be placed in your project’s folder on the ECE457 folder on the m: drive. Each project folder is write-enabled for students working on that project. Presentations should be submitted as Powerpoint files. Reports should be submitted in Word to the extent possible. Files which are not easily incorporated into Word should be submitted as PDF’s, clearly identified and referenced in the body of the report.

**Presentations and Reports must be placed in your project folder by 4 PM on Dec 3**

**Schedule**

The schedule below shows the general topics to be addressed and references. We will modify this schedule if needed based on student performance and interest.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Week | Date | Subject | Notes/ References | Text Chapter |
| 1 | 5-Sep | Introduction and Course Overview; Selection of Team Leads  Introduction to Projects Resume Instructions and Team Formation Process | SENG 222 | 1 |
| 2 | 10-Sep | **Resumes Due on m drive (ALL students)**  Project Selection Process | SENG 222 | - |
| 2 | 12-Sep | Project Team formation | SENG 222 | - |
| 3 | 17-Sep | Requirements, Assumptions, Constraints, Standards, and Codes | SENG 222 | 2,3 |
| 3 | 19-Sep | Customer requirements & Engineering requirements | SENG 222 | 2,3 |
| 4 | 24-Sep | Project Team Meetings & Working Sessions | SENG 221/ 222 |  |
| 4 | 26-Sep | Customer requirements & Engineering requirements  Overview of System Requirements Review | SENG 222 | 2,3 |
| 5 | 1-Oct | **System Requirements Review** | SENG 222 |  |
| 5 | 3-Oct | **System Requirements Review** | SENG 222 |  |
| 6 | 8-Oct | Developing functional and architectural descriptions of systems | SENG 222 | 3 |
| 6 | 10-Oct | Allocation of functions to HW/ SW and system components | SENG 222 | Notes |
| 7 | 15-Oct | Project Team Meetings & Working Sessions | SENG 221/ 222 |  |
| 7 | 17-Oct | Project Team Meetings & Working Sessions | SENG 221/ 222 |  |
| 8 | 22-Oct | Assessment of alternative system architectures | SENG 222 | 4, 5, 6 |
| 8 | 24-Oct | Project Planning and Scheduling and Risk | SENG 222 | Notes,10 |
| 9 | 29-Oct | Assessment of IP, Legal, and Ethical Issues and applicable Codes and Standards | SENG 222 | Notes |
| 9 | 31-Oct | Concept Design Review Instructions and Examples | SENG 222 | Notes |
| 10 | 5-Nov | **Concept Design Review Presentation and Report** | SENG 222 | 12 |
| 10 | 7-Nov | **Concept Design Review Presentation and Report** | SENG 222 | 12 |
| 11 | 12-Nov | Interfaces, Performance Margins, and Risk | SENG 222 | 4 |
| 11 | 14-Nov | Preliminary Design- Modeling, Simulation, Analysis | SENG 222 | 4 |
| 12 | 19-Nov | Test Plans- Requirements Verification and Validation | SENG 222 | 7 |
|  | 21-Nov | NO CLASS- HOLIDAY |  |  |
| 13 | 26-Nov | Overview/ Instructions Preliminary Design Review |  |  |
| 13 | 28-Nov | Project Team Meetings & Working Sessions | SENG 221/ 222 |  |
| 14 | 3-Dec | **Preliminary Design Review  Project Notebooks Due** |  | 12 |
| 14 | 5-Dec | **Preliminary Design Review  Project Notebooks Due** |  | 12 |