

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

1 Course Details

INSTRUCTOR:	Dustin Rand, PE, Votey 233, email: dustin.rand@uvm.edu, dustinrand74@gmail.com Office Hours: W 12-1PM or by appointment via meeting invite only
Teaching Assistant:	TBD Office Hours: TBD
CLASS TIME:	M/W/F 1:10-2:00 Votey 105
PREREQUISITES:	Senior Standing for ME185/EE187 and ME185, EE187 for ME186, EE188
CREDITS:	3 each semester
REQUIRED TEXT:	None
BLACKBOARD:	Grades and announcements posted here.
EDUSOURCED:	All assignments and due dates posted here. All deliverables and weekly updates submitted here.

2 Course Objectives

COURSE OBJECTIVES [ABET outcomes]:

1. Experience with framing open-ended need-driven design problems, generating and evaluating large numbers of conceptual designs, applying formal design methodologies, and negotiating constraints. [c, e]
2. Experience with estimation, analysis and experimentation to test feasibility and predict performance of a design concept. [a, b, c, k]
3. Experience with working in design teams, management of time and resources, and interacting with faculty and engineers in industry. [d, g, i, k]
4. Experience integrating core engineering and mathematical knowledge from the SoE curriculum with everyday experience in the physical and technological world. [a, e, g, i]
5. Practice with written verbal and graphical communication and project documentation, including maintaining a design notebook, and giving formal oral presentations. [g]
6. Appreciation of non-technical of design considerations including intellectual property law, entrepreneurship [f, i, j]

3 Course Outline

This course is divided into three design phases similar to what you might find in industry. Each phase is outlined below with a brief description of each milestone or deliverable within that phase.

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

3.1 Pre-Project Selection Assignments

3.1.1 Resume and Personal Statement

Prior to selecting a project, each student is required to upload a resume and personal statement to EduSourced. The resume should contain your education and work experience to date. Your personal statement should include a summary of your skills, interests, experiences and qualities you will bring to a project. This statement should not be tailored to any specific project.

3.1.2 Project Bidding

Projects are released for bid to all students in the class. You are required to rank your top 7 projects in order of preference and answer a few questions about why you want to be on these projects. Your ranking, answers, resume and personal statement will be used to assign projects. There is no guarantee you will get your selected projects.

3.2 Preliminary Design Phase

This phase is designed to introduce you to the design process, explore your own particular problem statement and propose a creative design to solve the problem. There is a lot of work needed to demonstrate you really understand your problem and all of the possible ways it might be solved. You will also be required to build a prototype of your proposed solution.

3.2.1 Intro Video*

- Block out 2 hours of time to do a group activity that builds trust, get to know your teammates and shoot video.
- Create a short 2 minute video introducing your team, client and the problem you are trying to solve during this excursion. Have fun.

3.2.2 Group Code of Conduct and Roles*

- Create a group code of conduct that outlines how you plan to work with each other as a team.
- The conduct should include items such as communication, member interactions, conflict resolution, decision making
- Identify the roles and responsibilities of each member on the team.

3.2.3 Intellectual Property Documentation

- Review the Student IP assignment form with your client and have both parties sign.
- Review the UVM Non-Disclosure Agreement with your client and have both parties sign.
- This task may require consultation with legal counsel prior signing and working on your project.

3.2.4 Project Scope Statement*

- Meet as a team to brainstorm your problem statement and formulate questions for client and users.
- Meet your client and understand their problem statement and their objectives.
- Rewrite the problem statement and remove any biases, errors or implied solutions.

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

- The Scope Statement will contain: Major Deliverables, Basic Strategy, Problem Statement, Constraints, External Dependencies, Assumptions and Exclusions.

3.2.5 Schedule and Resources

- Create a schedule for the Preliminary Design Phase of the project and put in the form of a Gantt chart.
- Estimate the number of hours to complete the Preliminary Design Phase of the project.
- After this assignment, you are required to track your time applied to the project.

3.2.6 Engineering Specifications*

- Use the Quality Functional Development (QFD) process to create a House of Quality to determine your customers' needs and how to make sure you meet them.
- Develop a list of specifications that your project will need to meet.

3.2.7 Concept Generation*

- Reverse engineer an existing product and understand it's functionality.
- Define all of the functions required by your design.
- Identify methods for how the functions could be implemented.
- Generate and document multiple concepts for solutions to your design problem.

3.2.8 Hazard Assessment

- Review project and complete Hazard Assessment forms
- Meet with Environmental, Health and Safety Coordinate to evaluate hazards and identify required training.

3.2.9 Hazard Training

- Based on the results of your Hazard Assessment you will be required to complete training.
- Complete the required training for all necessary team members and mark milestone complete.
- The Safety Officer assigned to the SEED program audits this assignment.

3.2.10 Prior Art Review*

- Complete interactive tutorials online.
- Meet with Engineering Librarian to learn about technical search practices
- Conduct a thorough search on technical papers, patents, standards and existing products related to your problem.

3.2.11 Preliminary Design Review Presentation and Demonstration

- Present an overview of your design selection results and working design concept.
- Present critical analysis that validate portions of your design.

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

- Present your specifications and outline your deliverables to your client.
- Present an update on the Budget, Schedule and Resources for the PDR and the upcoming CDR phase of the project.
- Demonstrate your prototype. Each team is allotted up to \$200 to build a prototype prior to the PDR.

3.2.12 Preliminary Design Review Report*

- Summary report of design selection results, working design concept, analysis, budget, schedule, resources, deliverables, etc.

3.2.13 Group Meetings

- Attend two 30-minute meetings with the instructor and two 30 min meetings with the TA prior to the PDR Presentation.
- The meetings will review previous tasks, upcoming tasks, schedule, resources and budget each time.
- Meetings should be approximately evenly spaced during the semester.

3.2.14 Weekly Updates

- Create a folder for Weekly Updates on EduSourced and post all weekly updates to this folder.
- Communicate the content of the weekly update to your client via their preferred method.
- Weekly updates include Accomplished Tasks, Planned Tasks, Ongoing Risks, Needs/Discussions.
- Weekly updates should also include information about hours spent and resources.

3.3 Critical Design Phase

This design phase is where you really get into the details of the design. You are expected to analyze, design, build and test your design to your current requirements and metrics. At the end of this design phase you will have a working prototype that has been tested and demonstrates your solution.

3.3.1 Schedule and Resources

- Create a schedule for the CDR Phase of the project and put in the form of a Gantt chart.
- Estimate the number of hours to complete the CDR Phase of the project.

3.3.2 End of Semester Witness Test

- Demonstrate approximately 30% of a functioning project.
- Demonstrate several tests that prove you meet your requirements and objectives.
- Be prepared with a test plan and results for the test performed.
- Be prepared with up to date Engineering Specification documents.

3.3.3 Failure Modes Effects Analysis (FMEA)*

- Evaluate your design for failure modes and their effects on the user, service personnel and general public.
- Create a list of actions that mitigate the severity, occurrence or detection methods for your design.

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

3.3.4 Test Plan and Results*

- Consider how each specification will be validated by testing, measurement, simulation, inspections, etc.
- Create a step-by-step verification plan for each specification.

3.3.5 Engineering Specifications

- Update the House of Quality and Engineering Specification based on feedback from client and instructor over the course

3.3.6 Critical Design Review Presentation and Demonstrations

- Present in detail your working design concept.
- Present critical analysis that validate portions of your design.
- Present your latest Specification and Test Results.
- Present an update on the Budget, Schedule and Resources for the CDR and the upcoming FDR phase of the project.
- Demonstrate your functioning project.

3.3.7 Group Meetings

- Attend two 30-minute meetings with the instructor and two 30 min meetings with the TA prior to the CDR Presentation.
- The meetings will review previous tasks, upcoming tasks, schedule, resources and budget each time.
- Meetings should be evenly spaced.

3.3.8 Weekly Updates

- Post weekly updates to EduSourced and make available to your client.

3.4 Final Design Phase

This design phase is where you refine your product so that it meets all of your requirements and satisfies your clients' objectives. This is also where you document your design and test results to give to your client.

3.4.1 100% Witness Test

- Demonstrate your functioning project.
- Demonstrate several tests that prove your project meets your requirements and metrics.

3.4.2 Poster

- Create a poster that highlights your problem statement, working design concept and test results.
- Present your poster at Design Night.

3.4.3 Video

- Create a video that highlights your project from start to finish in a fun and informative way.

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

3.4.4 Final Design Review Presentation

- Present in detail your working design concept.
- Present critical analysis that validate portions of your design.
- Present your final SRD and Metrics and validation results.
- Present an update on the Budget, Schedule and Resources for all phases of the project.
- Present your lessons learned and open items.

3.4.5 Final Design Review Report

- Summary report of your working design, analysis, SRD, Metrics, Budget, Schedule Resources etc.

3.4.6 Technical Documentation Package

- Create a mechanical drawing package for all parts, assemblies, manufacturing processes, etc.
- Create an electrical design package for all printed circuit boards, wiring, source code
- Generate a User's Manual for interfacing with your product.
- Transfer all IP related to the project to your client.

3.4.7 Group Meetings

- Attend one 30-minute meeting with the instructor and one meeting with the TA prior to the 100% Demonstration.
- The meetings will review previous tasks, upcoming tasks, schedule, resources and budget each time.
- Meetings should be evenly spaced.

3.4.8 Weekly Updates

- Post weekly updates to EduSourced and make available to your client.

4 Course Expectations

4.1 Safety

Keeping students safe is high priority for myself as an instructor and UVM. Everyone is responsible for keeping themselves and their fellow students safe. Hazard assessments are conducted midway through the semester for each project that identifies the potential hazards, mitigation plans and training requirements. Each team will nominate a Safety Officer responsible for making sure all training is completed and the team works safely. The

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

5 Course Tools

5.1 EduSourced (<https://uvmseed.edusourcedapp.com/login>)

This is the web based platform that is used for most of the course. You will use your UVM NetID to log on and work with your team and your client. All assignments and due dates will be posted here in the form of milestones. Each milestone will have a due date and a document attached that explains the assignment. All assignment feedback will be posted to EduSourced, with grades being posted to Blackboard. You will be required to fill out 360 Peer and Client evaluations throughout the semester on EduSourced as well. It has Microsoft Office Online integrated that allows for group collaboration and discussions. You will find links to course templates, examples, presentation signup polls, lectures, etc. through the global files section.

5.2 Blackboard

All grades and assignment rubric evaluations are posted on Blackboard. All course announcements are sent through blackboard. You should not require any other interfacing with this platform.

5.3 TeamGantt (<https://www.teamgantt.com/>)

TeamGantt is a web based project schedule/time management software. You will be given access to this software to develop a project plan and keep track of your time spent on this project. Each design phase will require a detailed schedule and time tracking.

6 Client Interactions

6.1 Meetings

It is expected that you will interact with your client on a regular basis and have several in person meetings when possible. I encourage you to visit their site to better understand them, their facility and the problem you are trying to solve. In addition, it is required to setup a weekly or bi-weekly meeting with them to discuss project progress. These regular meetings can be via phone, skype, in person or other media that facilitates dynamic and real time interactions.

6.2 Travel

Clients are geographically spaced around the world. Clients not on EST will required adjustments to your schedule to accommodate real-time communications.

For clients in Vermont, it is expected that you will travel to their site at some point during the course. It may be necessary to travel to their site several times over the two semesters if possible. Keep this in mind as you choose a client.

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

6.3 Communications

Communications with your client should be professional and be matched to their preferred medium. Inquire about the best way to communicate with them for weekly updates and urgent requests. Remember they are not students and likely hold different hours, have families, take vacations and work on other projects. Plan accordingly.

7 Group Work

8 Course Grading

8.1 Resubmission

Resubmission of assignments is allowed and encouraged and must follow these guidelines.

- Assignments are graded if resubmitted up to 1 week after the grade/feedback is given to the team.
- Resubmissions are only be graded if the re-submitted assignment contains a revision history and details of what changed. All resubmission should include the “Track Changes” feature enables so the grader can see the exact changes performed.
- Resubmissions are only allowed for deliverables with an * next to the name in the syllabus.
- The maximum re-grade for any criteria on the rubric will be a “3”.

8.2 Modification of deliverable dates

Due to the nature of the course, it can be challenging to match course and client schedules. Some projects are very expensive, complex or take significant time to manufacture. In the event you anticipate needing an extension on any assignment, you need to notify the instructor or TA as soon as you anticipate a schedule slip. We will use our judgment about whether the slip is justified or not. Best practice is to keep us informed of potential issues so we can help mitigate the problem. This course does have an end date that is nonnegotiable, so there are limits to what can be accommodated.

8.3 Rubrics

Each assignment has a rubric. Your grades is based exclusively on each rubric. As you prepare each assignment, please take a look at how the assignment will be graded. A copy of the completed rubric for your assignment is posted on Blackboard so you can see the rationale for your grade. If you have questions or issues about the grading, please first communicate with the TA.

8.4 360 Peer Evaluations

Due to the group work nature of this course, it is imperative that everyone contributes evenly to the project. One of the methods for assessing your personal contribution is by 360 Peer Evaluations. These evaluations are an opportunity to review the contribution and performance of

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

each of your teammates and yourself. You will be able to see the numerical results of your performance as perceived by your teammates. You are also able to comment all team member performances. These comments are only visible to the instructor.

Your final grade each semester is adjusted based on your reviews as compared to your peers. Adjustments are only made if your contributions are +/-10% of the team average. Any grade showing in Blackboard does not take this adjustment into account. Be wary of relying on the visible grade.

8.5 Client Evaluations

As students, you are typically only held accountable to the instructor and their course requirements. In this course you are also being held accountable to your client and their expectations. At the end of each semester the client is asked to evaluate each team based on their perceptions of the quality, effectiveness, effort and methods used to find a solution to their problem. Keep this in mind as you interact with your client.

8.6 Late Work Policy

Each assignment is due at midnight of the milestone due date. Late assignments will be reduced 10% / day late unless prior approval is given.

8.7 Grading Methods

The grading method for this class will use a sliding scale from Exceeds Expectations to Did Not Complete, ranging from a number grade of 4 to 0 as seen below. Do not expect to receive 4's on everything unless you EXCEED my expectations.

Qualitative Description	Score	Equivalent %
Did Not Complete	0	50.0
Well Below Expectations	1	62.5
Below Expectations	2	75.0
Meets Expectations	3	87.5
Exceeds Expectations	4	100.0

ME185/ME186/EE187/EE188 Capstone I/II

Syllabus

8.8 Grade Breakdowns

The % for each assignment is listed below, but may change over the course of the semester.

Assignment Name - Fall	Weight
Intro Video	4.0%
Code of Conduct	1.0%
Roles and Responsibilities	1.0%
IP Documents	1.0%
Project Scope Statement	2.0%
Schedule and Resources - Preliminary	2.0%
Engineering Specifications	5.0%
Concept Generation	10.0%
Prior art review	5.0%
PDR Presentation	10.0%
PDR Demonstration	5.0%
Hazard Assessment	1.0%
Hazard Training	1.0%
PDR Report	20.0%
Group Meetings	5.0%
Weekly Progress Status Reports - 12 per semester	5.0%
Client Evaluation	10.0%
Schedule and Resources	2.0%
50% Witness Test	10.0%

Assignment Name - Spring	Weight
Failure Modes Effects Analysis	5.0%
Engineering Specifications	3.0%
Test Plan	5.0%
Critical Design Review Presentation	5.0%
CDR Demo	10.0%
Final Design Review Presentation	8.0%
Poster	3.0%
Design Night Slide	1.0%
Project Video	5.0%
100% Witness Test	15.0%
Final Design Review Report	15.0%
Technical Documentation Package	5.0%
Group Meetings	5.0%
Weekly Progress Status Reports - 12 per semester	5.0%
Client Evaluation - end of semester	10.0%