

Syllabus: Capstone Project I

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I. COURSE DESCRIPTION

This is a 3 credit one-semester course on research and development.

A. Overview

The course teaches the research and development (R&D) cycle, beginning with the conceptual planning and review phases of an engineering project. The students practice project documentation, formal design review presentations, oral defense of the project, and writing a final report. The course introduces technical methods for analyzing, designing, prototyping, synthesizing, troubleshooting, and testing an integrated system (comprising multiple devices and subsystems) to create a scientific experimental device.

The class meets Fridays from 9:00-11:45am (via VTC as needed)

Office Hours: Friday after class and by appointment

Prerequisites: ETRO 315 with grade C, or better. — This prerequisite cannot be waived.

B. Course plan

The course guides the students to build a rocket payload under the NASA RockSat-C program. The RockSat-C program offers an opportunity for the students to build an experimental system payload (within a 9.5" high and 9.3" diameter cylindrical canister) that is launched in a sounding rocket at the NASA Wallops Flight Facility reaching a low Earth orbit altitude (~110km) in space.

The microgravity environment in NASA Cold Atom Laboratory to be installed in the International Space Station allows for exploring the behavior a Bose-Einstein condensate (BEC) in an optical lattice. In this course, a nonlinear optics experiment will be developed (for example laser-stabilization via novel digital PID controllers) that is useful for applications to in-space experiments that require lasers.

This course, the first semester of a year long course, teaches the students using a hands-on and team-oriented approach. The course focuses on the concept development portion of the R&D acquisition cycle that begins with Concept Design Review (CoDR), Preliminary Design Review (PDR) through Critical Design Review (CDR). The students will participate by helping to plan an innovative experiment, including the preparation of a detailed budget of estimated costs for the experiment's subsystems and components as well as an enumerated supply and equipment list for subsequent purchase acquisition of the required subsystem components. Furthermore, the student will participate by developing a timeline and schedule of critical milestones for assembling the payload in the Spring semester—assuming the project is accepted in January 2017 by NASA—for participation in upcoming RockSat-C launch in the summer of 2018.

C. Course philosophy

The overall objective of this course is to give students a simulated design experience that is as close to real life as is practicable in a university setting. Thus, the course involves:

1. Learning how an engineering project works, including its systems, its standards, and its practices.
2. Designing a fairly comprehensive project requiring interfacing of several subsystems.
3. Working as an integral member of a design team, typically a few people (and not greater than a half dozen).
4. Defining the scope of the project, planning and scheduling the collaborative efforts of the team, and documenting the effort via oral and written proposals, design notebooks, design reviews, progress reports and oral and written design reports, including engineering drawings and a poster presentation.
5. Levering and building upon previous experiences and skills of all the team members to accomplish the new design task.

D. Skill set

This course represents the culmination of the engineering and technology program at UH Maui College. The expected proposed UHMC experiment payload for RockSat-C will involve an encapsulated nonlinear optics experiment that draws together the students engineering skills acquired in several prerequisite courses, including Optics, Signals and Systems, Optoelectronics, Digital Signal Processing, Remote Sensing and Control Systems.

II. PROSPECTUS

A. Course activities

This course gives the junior student preparing for graduation an insight into and first experience of the engineering environment in a real scientific and engineering design project. The textbook covers teamwork, project management, planning, scheduling, engineering paperwork, etc. Guest lecturers may cover specialty areas such as intellectual property, personnel issues, job opportunities in the engineering field, and the like.

Activities include learning teamwork skills, project management skills, maintaining a design notebook, preparing a proposal to do the work needed to provide a design specification, a construction, installation, or manufacturing schedule, and a equipment cost estimate.

The proposal will include:

- a literature review of the state of the art
- a description of what the sponsoring agency wants
- a timeline of activities to accomplish the project
- a detailed action item list for the first two weeks of the design period
- an organizational chart
- resumes of all the candidate investigators
- an estimated cost for all components required for building a working model.

Teams will deliver their proposals in written and oral format as well as electronically; that is each team will post their written proposal provided in PDF document, their slide presentation, and their end-of-proposal memo on their teams web space.

Activities in the proposals include:

- doing the design work as specified in the proposal
- maintaining individual design notebooks
- using project management tools to control the progress of the project
- producing weekly status reports in the form of an action item list
- conducting one to three design reviews
- producing written and electronically delivered progress reports, and producing oral, poster, and written design reports, including engineering drawings and a working model, if appropriate
- posting in their web space the action item list, design review handouts, progress report documents, written design report, slide-based design presentation, a copy of their poster as a PDF file, and the end-of-project memo.

Projects may be proposed by faculty who would like to be project technical advisors, the course instructors, local industry, or non-profit groups, or student groups.

Criteria for project selection include:

- a work scope suitable for a team of few to a half-dozen students
- feasibility in terms of difficulty and complexity within the time constraint of a design period of 11 to 12 weeks
- the mix of personnel required must match the personnel available in the class, and
- suitability of the project for today's world.

Attendance is mandatory for all classes and absenteeism adversely affects your grade unless your absence is excused by an instructor. To obtain an excused absence, simply email to your professor your name, team number, dates of absence and valid reason(s) for absence. For scheduled events like job interviews, an email is expected ahead of the absence. For unscheduled events like illnesses, an email immediately after the absence is expected.

Each individual student is required to keep a project design notebook covering his/her own design effort. These are to be available for review at any class or team meeting by the faculty project technical advisor or course instructor. Progress will be reviewed weekly in a meeting with the faculty project technical advisor. Design notebooks are bound and have sequential page numbers. In the event of a debate over grade assignments, the design notebooks will be used to determine the quantity, quality and timeliness of the work in question.

Late work is not accepted. You may receive a grade of Incomplete or Failure for the second phase (ETRO 498) unless you submit ALL of the following:

- Any borrowed items (parts, tools, equipment, etc.)
- Any items borrowed from the instructor, faculty technical advisor, faculty or staff member, or any other person on or off campus
- Items purchased by the department have been returned to the person who paid for them
- Your personal design notebook: duplicate pages, original, or photocopy
- Teamwork Evaluation Form and Course Assessment Form has been submitted
- Your team has submitted all the required documents and items.

B. Project Teams

The students, with the instructors guidance, form into teams. The instructor attempts to provide each team with members having the variety of interests and training needed for the project design.

C. Project Documents

At the end of ETRO 497 each team presents a written and an oral proposal to the instructor and faculty or staff member. This proposal outlines the relevant literature, describes the design, and defines the work to be done on the project in the second phase, ETRO 498, and the deliverables to be submitted at the completion of the project. It also contains a list of resources that will be needed and a schedule for accomplishing this work.

The team will also submit an End-of-Proposal memo. This memo will include:

- a project management assessment report that tells what tools were used to manage the project to keep it on schedule and under budget, including any changes they made during the management process as the project proceeded*
- recommendations to engineers undertaking proposals of this type in the future*
- a list of the things that each of the team members had to learn that was not taught in any class s/he had taken*
- if the project will include a working model, a copy of the Resources Needed section from the proposal
- the complete project action item list with all items un-hidden
- the initial timeline with as-bid blocks clearly identified and space for the as-worked blocks
- from each individual, a time log for the proposal preparation phase that shows: Date, Hours worked, and total hours worked
- copies of all the team meeting agendas during the work period since the proposal acceptance. Do not re-type, if they are handwritten or the electronic copy has been deleted, just scan them in from the one you used, handwritten meeting notes on it are okay.

*The only three documents that are not copied from other reports or paperwork.

Each week during both the first (ETRO497) and second (ETRO498) phase, each team presents its status to management in the form of its action item list for the past week and the next two weeks, meetings and/or oral reports.

Two to four weeks into the second phase, each team will schedule a design review. These are formal presentations to outside experts, faculty, and undergraduate students. Formal dress is NOT required; just wear whatever you normally wear to work (school). Emphasis is on content. The team chooses attendees that are willing and able to provide helpful direction to the design work as part of a technical review.

At the end of the second phase, ETRO 498, the team submits the design report on their assigned design project. This report has sections which pertain to the project as a whole: executive summary, introduction, literature review, project description including a block diagram or plot plan, capital cost and schedule to implement the designed project. It also has a section prepared by each team member covering his/her design efforts and backing up the team conclusions presented in the first part of the report. The team makes a formal oral presentation in which each team member is expected to speak for approximately the same amount of time. The team also presents the design as a poster presentation that gives the problem statement, describes each subsystem of the recommended solution, and presents the total capital cost and time required to implement the design presented in the final design report.

D. Project Schedule

WEEK	MILESTONE	DUE DATE
3rd Week	Project Menu/Title	(September 8, 2017)
5th Week	Requests for Proposals (RFP) out	(September 22, 2017)
13th Week	Proposals due	(November 17, 2017)
15th & 16th Weeks	Oral Proposal Presentations	(December 1 & 8, 2017)
16th Week, Friday by 3pm	Final Proposal Submission due	(December 8, 2017)
17th Week	Order specialized parts	

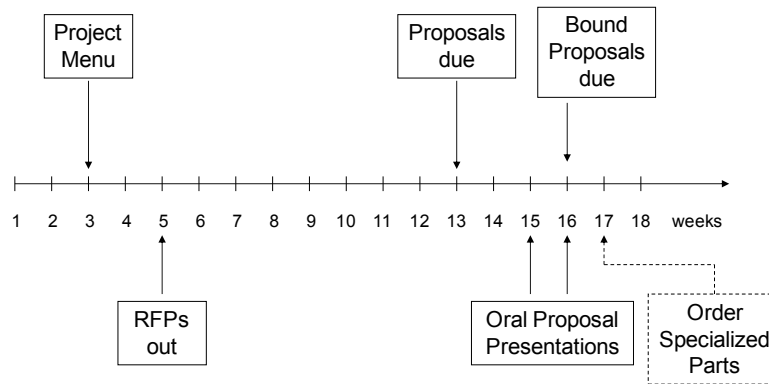


FIG. 1 Weekly schedule for Capstone Project I ETRO 497.

III. COURSE REQUIREMENTS AND EVALUATION

Each student's grade in the course depends in part on the evaluation of his/her performance of assigned individual tasks, but primarily on the evaluation of the teams overall accomplishment.

Any member of the UH Maui College Engineering Technology faculty or staff or participating parties outside the college may witness and review both written and oral reports. However, the course evaluation will be done by the course instructor and the faculty technical advisor.

A. Grading

The grading range for the course is A through F, with weighting as follows:

ACADEMIC MEASUREMENTS	WEIGHT
Written Progress/Final Report	40%
Presenatation I Pre-proposal	15%
Class Activities /Homework	25%
Presentation II Project proposal	20%
	100%

IV. METHOD OF INSTRUCTION

- Class discussions and experiment preparation
- Internet-based video teleconference as needed
- Weekly office hours on Friday at 12pm or otherwise scheduled by e-mail request

V. WIKIPEDIA

Project management material related to Capstone Project I:

- Project managment
- Cost engineering

- Project management software
- Small-scale project management

Engineering and technology related material for Capstone Project I in the Fall 2017 semester:

- Printed circuit board
- Field-programmable gate array
- PID controller
- Nonlinear optics
- Spontaneous parametric down-conversion
- Ultracold atom
- Cold Atom Laboratory

VI. RESOURCES

- Reference text book:
Robert B. Angus, Norman R. Gundersen, Thomas P. Cullinane, “Planning, Performing and Controlling Projects”, 3/E, Prentice Hall, 2003, ISBN-10: 0130416703.
- Additional resources and weekly updates will be provided in class.

VII. DISABILITY STATEMENT

1. If you have a disability and have not voluntarily disclosed the nature of your disability and the support you need, you are invited to contact Lisa Deneen - Disabilities Coordinator at 984-3227 or Telecommunication Device for the Deaf (TDD) 984-3325 or the Text Telephone (TT) replay service at 643-8833.
2. Reasonable accommodations will be provided for students with documented physical, sensory, systemic, cognitive, learning and psychiatric disabilities. If you believe you have a disability requiring accommodations, please notify Lisa Deneen - Disabilities Coordinator at 984-3227 or Telecommunication Device for the Deaf (TDD) 984-3325 or the Text Telephone (TT) replay service at 643-8833. The Disabilities Coordinator will verify your disability and provide the course instructor with recommendations for appropriate accommodations.