CEE 497: Senior Design Project I

Monday – Wednesday
2:30 – 3:45 PM
BHS 201

CLASS SYLLABUS – Spring 2010

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TBE – B 370
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OFFICE HOURS:

Monday – Wednesday
4:00 – 5:30 PM
COURSE DESCRIPTION

This is a capstone course which objective is to involve students in the design process from project definition through project planning. In addition, concepts involving project management are introduced. Team efforts and oral and written communications are required.

COURSE MATERIAL

The course will be taught using material from various books. Some required reading material will be placed on the course WebCampus website. The primary references contain material directly relevant to the course. The other references contain material of broader interest to the course.

REFERENCES

Primary:

PREREQUISITES

CEE 198, EGG 307, CEE 334, CEE 346, CEE 362, CEE 367, and any two of CEE 413, 450, and CEE 480.

COREQUISITES

One remaining course of CEE 413, CEE 450, CEE 480 if not previously taken.

TOPICS COVERED

Engineering project management topics include: engineer as manager; engineering organization; motivation, leadership, delegation; communications and meetings; project management, planning, scope of work, scheduling, costs, controls; engineers and law, contracts, engineering contracts, liability; and ethics. Most of these will be one or two day topics. Several class sessions will be devoted to requests for proposals (RFPs) presentations by practicing professionals, to team presentations on the case study and management topics, progress on project selection, proposal preparation and presentation, etc.

GOAL

This course intends to introduce civil engineering students to engineering project management and to provide a meaningful design experience. The course includes an introduction to engineering project management and preparation of a Design Proposal in response to one of several (RFPs) presented in class. A project will be selected and worked on and completed during the following semester in the second course – CEE 498, Senior Design Project II.

Specific requirements for this design experience are:
1. Projects must be based on the knowledge and skills related to the design process acquired in earlier course work.
2. Projects must incorporate engineering standards and be responsive to local codes and regulations.
3. Consideration must be given to the recognition of reasonable constraints imposed by economic, environmental, sustainability, manufacturability, constructability, ethical, health, safety, reliability, social,
political, and aesthetic concerns/constraints. Very few projects lend themselves to consideration of each of these concerns but several must be addressed.

4. Students must work in teams.

Students must demonstrate an awareness of engineering practice issues such as:

a. marketing and procurement of work,
b. bidding versus quality based selection processes,
c. interaction of design and construction professionals,
d. importance of professional licensure,
e. importance of continuing education,
f. teamwork, motivation, and leadership,
g. scope, budget, and schedule for a project

**PROJECT PROPOSAL**

Each proposal must be developed considering that the corresponding project must be a design project with the following characteristics:

a. Have a real or virtual client with a need for a civil engineering design project.
b. Have design objectives reflecting client needs.
c. Involve at least two areas of civil engineering specialization – construction, environmental, geotechnical/materials, structures, surveying, transportation, and water resources.
d. Involve safety, economic, social, political, and aesthetic concerns.
e. Be open-ended.
f. Have at least two alternative (in addition to “do-nothing”) solutions which merit examination.

**Technical Advisors:** Each project team will be required to have a departmental faculty member as a technical advisor. Each team will also have a client advisor. The client advisor also serves as a mentor. This individual will normally be the presenter of the RFP (Request for Proposals) to which your team responded. Advisors must be in the dominant technical areas of your proposed project.

**CAD Experience:** You are strongly encouraged to obtain civil engineering CAD experience (preferably Softdesk Civil) since all projects will require the preparation of design drawings. It will be difficult for you to produce a satisfactory final product if you lack CAD design skills. The department offers CEE 301 which is a prerequisite for CEE 498.

**Project Rationale (due 03/10/2010)**
The Project Rationale must contain the following elements, which are two of the six criteria that are used to judge projects during the Design Competition:

1. A discussion of the innovative aspects of your proposed project. What makes the project or technical approach novel or unique?
2. A discussion of the potential for commercialization/implementation. Is there potential for the salability of the project or other applications/spin offs? Does it have an economic future?
Design Proposal (due 05/05/2010)
The Design Proposal will contain all of the following elements that are relevant:

1. Description of project
   - Executive summary
   - A concise statement of the problem and proposed solution, by way of introduction
   - Client
   - Who will benefit from the design
   - Detailed discussion of the problem. Background, history.
   - Significance of the problem (e.g., quantity of people or sites affected, land area, cost, etc.)
   - Design goals, as relevant (what one would use to judge whether the project was successful)
     - Performance
     - Environmental conservation or betterment
     - Contribution to human health, safety
     - Cost
     - Other
   - Innovative aspects of the design
   - Location, if applicable
   - Political jurisdiction(s) that would have responsibility for approving designs
   - Probable funding sources for real-world implementation of design

2. Description of work to be performed during CEE 498
   - Scope of work
     - Explicitly list planned exclusions
   - Alternatives to be considered
   - Engineering disciplines that are involved
     - Explain using specifics
   - Codes that apply or will be followed/consulted
   - Key data or information
     - Describe the data or information that has already been gathered
     - What else is needed? How will it be obtained?
   - Deliverables
     - Competition display (required)
     - Graphics
     - Physical models
     - Written report (required)
     - Other
   - Tasks
     - Research efforts
     - Data collection efforts
     - Laboratory experiments
     - Meetings with individuals to gather information
     - Technical design tasks
     - Construction of prototypes
     - Report preparation
     - Display preparation
     - Presentation preparation
     - Other

3. Schedule of tasks. Include:
   - Start and end dates
   - Critical dates (e.g., having a working prototype)
   - Due dates for progress reports and final products
4. Communications with instructor, UNLV technical advisor(s), and external technical advisor(s)
   • In the form of a task-based checklist. Instructor and advisors to initial and date when milestones are met. Checklist to be turned in upon completion.
5. Budget estimate
   • Person-hours by task
   • Materials and supplies
6. Personnel assignments by task

**Deliverables:**
Both the Project Rationale and the Design Proposal should be written using LaTeX.
1) Hard copies of the Project Rationale and the Design Proposal. Include your name as a header.
2) Soft copies of the Project Rationale and the Design Proposal LaTeX document. Send the copy to: apaz@unlv.edu. The soft copies should be compressed in a single folder including all the required files and named using the following scheme: LastName_FistName_Project Rationale and LastName_FistName_Design Proposal.

**GRADING**
1. Project rationale 20%
2. Presentation of project rationale 10%
3. Preparation of a written project proposal which will be implemented in CEE 498 40%
4. Presentation of the project proposal 20%
5. Homework 10%

**COURSE WEBSITE AND EMAIL**
WebCampus will be highly utilized to post course material. Please see https://webcampus.nevada.edu for instructions on logging into your account. In accordance with UNLV policy, all students are to be contacted using their UNLV email. (user_name@unlv.nevada.edu). This will be the email address that I use. If you don’t know your email address, then go to http://rebelmail.unlv.edu/. Do NOT use the e-mail tool provided in WebCampus, instead use your UNLV e-mail address.

**ACADEMIC ETHICS**
Ethics in this course are very serious:
1. If a student is found cheating on an exam, he/she will receive an F in this course.
2. As I stated earlier, students can work in groups to do the homework, but each student is responsible for his/her own work. Students that hand in nearly identical homework will not receive credit for that assignment.
3. Academic Misconduct – “Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV’s function as an educational institution.” An example of academic misconduct is plagiarism: “Using the words or ideas of another, from the internet or any source, without proper citation of the sources.” See the “Student Academic Misconduct Policy” (approved December 9, 2005, located at <http://studentlife.unlv.edu/judicial/misconductPolicy.html>).
4. Copyright - The University requires all members of the University Community to familiarize themselves and to follow copyright and fair use requirements. YOU ARE INDIVIDUALLY AND SOLELY RESPONSIBLE FOR VIOLATIONS OF COPYRIGHT AND FAIR USE LAWS. THE UNIVERSITY WILL NEITHER PROTECT NOR DEFEND YOU NOR ASSUME ANY RESPONSIBILITY FOR EMPLOYEE OR STUDENT VIOLATIONS OF FAIR USE LAWS. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. To familiarize yourself with copyright and fair use policies, you are encouraged to visit the following website: <http://www.unlv.edu/committees/copyright/>.

CLASS ATTENDANCE

Students’ attendance to class is highly recommended. Some of the lectures and assignments will deal with material that is not in the text. We will also be doing many classroom activities. Please inform the instructor if you intend to miss a lecture for personal reasons.

DISABILITY RESOURCE CENTER:

The Office of the Executive Vice President and Provost and Faculty Senate have endorsed the following statement to be included in all course syllabi. [NOTE: Over two-thirds of the students in the DRC reported that the syllabus statement, often read aloud by the faculty during class, directed them to the DRC office.]

The Disability Resource Center (DRC) coordinates all academic accommodations for students with documented disabilities. The DRC is the official office to review and house disability documentation for students, and to provide them with an official Academic Accommodation Plan to present to the faculty if an accommodation is warranted. Faculty should not provide students accommodations without being in receipt of this plan.

UNLV complies with the provisions set forth in Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, offering reasonable accommodations to qualified students with documented disabilities. If you have a documented disability that may require accommodations, you will need to contact the DRC for the coordination of services. The DRC is located in the Student Services Complex (SSC), Room 137, and the contact numbers are: VOICE (702) 895-0866, TTY (702) 895-0652, FAX (702) 895-0651. For additional information, please visit: <http://studentlife.unlv.edu/disability/>.

SUGGEST STRATEGY

Students must complete and understand the homework. Students should not wait to clarify issues they did not comprehend regarding class or homework. There are no bad questions. Students should take advantage of office hours. If a student has conflict with the suggested hours, the student must contact the instructor (phone or email) to set up an appointment. Do not wait till the last moment to schedule an appointment. Only students requesting appointment in advance (at least one day) will be considered.

UNLV WRITING CENTER

One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 895-3908. The student’s Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at:
LIBRARY STATEMENT

The University Libraries offer free, brief clinics and workshops to help you increase students’ research skills and save time searching. Take your topic to a Research Clinic for in-depth, one-on-one consultation with a research expert, or attend one of the more structured workshops on topics such as finding books or articles, successful research strategies, or Internet research. Check out the schedule at www.library.unlv.edu/inst/events.html or call 895-2123 for more information.
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<thead>
<tr>
<th>Week</th>
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<td>Introduction I &amp; LaTeX I</td>
<td>[Read the syllabus – HW_1 posted]</td>
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<td>Brainstorming, RFP development</td>
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<td>RFP development, team formation (HW_1 due)</td>
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<td>Project Planning, Scheduling and Control [Chapter 7.4]</td>
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<td>Project Planning, Scheduling and Control [Chapter 7.4]</td>
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<td>Project Budgeting and Cost Control [Chapter 7.5] (Scope of Work first draft - due)</td>
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<td>Legal Structures of Business Organizations [Chapter 11]</td>
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<td>Contract Law Principles [Chapter 9]</td>
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<td>Engineering and Construction Contracts [Chapter 10]</td>
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<td>Professional Liability [Chapter 12]</td>
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Design Requirements
CEE 497/498 Fall 2008 and Spring 2009

1. The Grand Prize of the Senior Design competition is $2,500. To win the competition, a high emphasis is placed on developing a project that is innovative and has the potential for commercialization or implementation. In addition, the design must have technical merit, the project must have clarity and soundness, and the oral and poster presentations must be excellent. Unless the project is innovative and has the potential for commercialization or implementation it will not be approved. Routine site development projects or routine structural designs will not be approved.

2. You must demonstrate the existence of real or “virtual” clients for whom you are undertaking a design. You will need to develop a good grasp of the needs and goals of the client in order to effectively articulate your design goals and rationale.

3. Interdisciplinary projects involving more than one department in the college are encouraged.

4. Once you have identified a project and formed a team, you must recruit a mentor from outside UNLV to provide assistance. An engineer with a PE license is preferable, but not necessary. This should be done well before CEE 498 begins.

5. You must identify and recruit at least one mentor within the civil engineering department (faculty member) to provide technical advice and assistance. This should also be done well before CEE 498 begins.

6. The project must involve at least two distinct engineering disciplines (civil plus electrical, mechanical, or computer engineering) or two specializations within civil engineering (construction, environmental, geotechnical, materials, structures, surveying, transportation, water resources, or hydraulics). Emphasis need not be equal in these areas. This is an accreditation requirement for the civil engineering curriculum.

7. The project must address safety, economic, social, political, and aesthetic concerns as appropriate. This is an accreditation requirement for the civil engineering curriculum.

8. There must be an evaluation of at least two alternatives in some aspect of the design. This is an accreditation requirement for the civil engineering curriculum.

9. The design must incorporate engineering standards and be responsive to relevant codes and regulations. This is an accreditation requirement for the civil engineering curriculum.

10. Team members must support their team. A person who creates a burden for his/her team or whose lack of participation or responsibility make it difficult for the team to perform will be dropped administratively from the course by the instructor following consultation with team members.
The College-wide senior design competition is held on the Wednesday of the week before the final examinations of Fall and Spring semesters. The venue for the poster presentation is the Great Hall, in the College of Engineering. The competition typically begins at 9:00 am and ends at 4:00 pm. The event is open to public and is usually well-advertised among the students, staff, faculty, local industry and community. In the last few semesters, several high school students have visited the poster presentation session. Many local companies use the event to identify potential recruits.

The departments of Civil and Environmental Engineering, Electrical Engineering, and Mechanical Engineering are involved. Each department selects a judge from the local industry and/or their Industrial Advisory Board; thus, there are three judges with varying backgrounds. A panel of faculty members and senior design faculty instructors meets with the judges before the competition and briefs the judges on the history, rules, regulations, judging criteria, and the time constraints for judging. Typically, the judges spend up to 20 minutes per project. During this time, the judges listen to the students, watch the project demonstrations and ask questions. The following are the criteria used for judging:

- **Innovation** (Is the project and the technical approach novel or unique?)
- **Potential for commercialization/implementation** (Is it possible to either commercialize or implement the project? Is there potential for salability of the project or other applications / spin-offs? Is an economic analysis included?)
- **Technical merit** (Are there merits in terms of the technical details of the project, constraint analysis, alternative design analysis, testing and quality of test data?)
- **Clarity and soundness of the project** (Are the ideas and implementation of the project clear?)
- **Presentation (oral)** (How well is the project presented orally?)
- **Presentation (poster)** (How well is the project presented in terms of the poster?)

These criteria are dynamic and have evolved over the years to meet the changing circumstances. The first four criteria are evaluated on a scale of 0 to 10 with 10 being the best. The last two are evaluated on a scale of 0 to 5 with 5 being the best. The judges are also given an opportunity to write comments about each project.

The average scores given by the judges to each of the project are computed and used to rank the projects. The winners are chosen in consultation with the instructors and announced. All participants are invited and encouraged to attend the College-wide Senior Design Dinner and Award Ceremony which is usually held on the Friday of the week before final exams of the spring semester, in the Cox Pavilion.

Leaders from local industry, industrial advisory board members, faculty and staff, and senior design students participate in this gala event. Attendance is 300 or more. The event is subsidized by major engineering companies through ticket purchases and sponsorships. Usually, a leader of a major regional technology company is invited to give the keynote speech. This event is not only used as a way to celebrate student success, innovation and design, but also as a way to advertise the programs and the quality of our graduating students to local industry and to garner financial support for the continuing improvement and success of our academic programs.

Fred Cox, a retired local entrepreneur and engineer, philanthropist and a College of Engineering Advisory Board member, became interested in the Senior Design Competition due to its design and entrepreneurship potential in fall 2000. In spring 2001, Harriet and Fred Cox donated $150,000 to the senior design competition with the intent that the interest received from the investments of this money be used as prize money for the competition. Fred Cox, now also a member of the UNLV Foundation Board of Trustees, remains very involved in the competition. He continuously provides valuable guidance to improve the projects and the process of the competition. Mr. and Mrs. Cox invariably visit the poster presentation session and encourage the students.

The program has several salient features including:

- **Synchronization of course times to encourage interdisciplinary projects:**
  The senior design courses in mechanical engineering and CEE are usually scheduled for the same time and day. Instructors do their best to get the students from different departments together to encourage interdisciplinary projects.

- **Judges from the industry:**
  Three judges, one representing each discipline, are invited to judge the projects. This arrangement helps to achieve an objective evaluation of the projects in the competition. In addition, because the senior design course is a culminating
undergraduate course, evaluation of the projects by judges from industry amounts to evaluation of the program outcomes by an external constituency.

- **Commercial potential as a component:**
  While commercial potential is not one of the ABET “outcomes” for Civil Engineering education and accreditation, it is one of the criteria. The idea behind this criterion is to encourage entrepreneurship among students and to provide an opportunity for students to conceive of products which will be of commercial value and be useful to society. One goal of using this criterion is to encourage some of our graduates to become local entrepreneurs, in order to diversify and strengthen the local economy.

- **Interdisciplinary projects encouraged with special prize:**
  Engineers work in interdisciplinary teams with each member having interest and knowledge in one aspect of the product. Students need to be prepared for this aspect of the work force. To encourage interdisciplinary projects, a special prize has been added.

The college has instituted several prizes for the Senior Design competition. The overall winning team receives the grand prize of $2,500 and each team member receives a golden medallion. In every department, first and second place winners are awarded $1,000 and $500, respectively, along with medallions. With a view to encourage interdisciplinary projects, a separate $1,000 award is given to the winner of the Interdisciplinary Projects prize.