EML 4905 Senior Design Project (Core) SPRING 2020 Syllabus

Catalog Description: Project statement, in-depth survey, conceptual and structural design, analysis, statistical and cost analyses, ethical, societal and environmental impact, evaluation and revision of design for the global multicultural and multi-national perspective, prototype construction, testing, final presentation. (3 credits).

This is Global Learning Discipline Specific course that counts towards your FIU Global Learning graduation requirement and is a required requisite to obtain the Mechanical Engineering Degree at FIU.

Prerequisites: EML 4551 and permission of the advisor. Corequisites: EML 4501

Textbook: No formal text. A course booklet is made available on the website.

Course Objectives:
Student teams will continue the design project progress initiated during the prior semester through EML 4551.

The senior design capstone project is broken into two courses: EML 4551, Ethics and Design Organization, a one-credit course, and EML 4905, Senior Design. In the first course on Design Organization, students will organize into design teams and select a design project, and then complete the preliminary design for your project. In Senior Design, detail and final design work will be completed on the project, with either a prototype (full scale, miniature, functional, or possibly a mock-up) with a set of design drawings, or a set of engineering drawings only, if a large system is designed such as an HVAC system.

In Design Organization, the instructor, who is also the Faculty Coordinator for Senior Design Projects, will organize the students into design teams and then assist the students in selecting acceptable project concepts. Lecture and classroom exercises will present the students with good design practice methods, which will then be employed to assist the design teams in developing successful preliminary designs. Global learning, multinational manufacturing processes and professional ethics are covered in the course. Students may use one or more professors as consultants in developing successful designs. Once the project is determined, the professor serves as the advisor for the Senior Design course, the second part of the project.

In Senior Design, the students will report to a Faculty Advisor, who advises students on the senior design activities during the semester and ensure that design documentation is complete and consistent with department policy. Additionally, the Faculty Advisor is to monitor the team’s progress as well as the participation of individual students. All the progress reports and final reports, after signed by the faculty advisor, will be submitted to the Faculty Coordinator for Senior Design Projects for record keeping and milestone checking. All the projects will be presented in a department-wide conference at the end of the semester and evaluated by the Industrial Advisory Board and faculty.

Development of Senior Design Projects in Relation to Global Learning. As senior design project problems and solutions are developed, student teams will employ a global perspective. For this purpose, relevance of engineering problems and situations will be researched and evaluated in terms of different regions, ethnic or cultural settings. For instance, major regional samplings will include the USA, South America, Eastern Asia, Middle East, Europe, and Africa. Each team will also be able to target different regions, ethnic or cultural groups as appropriate to the specific project.

Student teams will analyze and evaluate their proposed solutions for multiple markets and cultures. If necessary, modification strategies will be developed for targeted cultural, ethnic or geographical settings to approach the “global design” concept. Student teams will also analyze design alternatives relative to the (1) available technology in different parts of the world, and (2) economic development of regions; select the best concept for each targeted region; and then evaluate whether a globally-unified design or a regionally-adjustable design offers the most viable solution.

Each design team will identify its contributions in solving the targeted engineering problem in terms of the global issues addressed and the possible global impacts. Hence, this is a global learning course that counts towards the global learning graduation requirement.
Global Learning outcomes

1. Students will be able to identify, analyze and integrate ethics similarities and differences in multiple markets and cultures.
2. Students will be able to conduct an analysis of an engineering problem and its multicultural and/or international impact by identifying different factors such as technology, economics and society, and their contributions to the problem and/or solution.
3. Students will work in teams to develop solutions and action plans to address local, global and/or international engineering problems.

Each of the three Global Learning Course Outcomes (Global Awareness, Global Perspective, and Global Engagement) will be assessed in the assessment form “EML 4905 Senior Design Presentation Evaluation Form” by the faculty and IAB members.

Course Objectives:

• Completion of structural design, system analysis, and design optimization

• Integration of global design components defined in EML 4551 into the senior design project

While taking EML 4551 in the previous semester, each team will develop a specific plan for global design components that will be studied in its senior design project. These plans will be approved by the departmental faculty and Industrial Advisory Board in the previous semester. These approved GL plans will be executed in EML 4905 and evaluated by the faculty and IAB at the end of the semester.

• Economic analysis of the design, global and environmental implications

Economic analysis of the developed design and its global and environmental implications – as defined in the previous course EML 4551 – will be completed, documented in the final report and final presentation. Faculty and IAB members will assess the economic analysis, global and environmental content in the assessment form, which uses a 5-point rubric.

• Prototype construction

• Design of experiments, and testing

• Comparison of theoretical results against experimental data

• Design improvement

• Completion of final senior design report

• Team presentation to the Industrial Advisory Board and departmental faculty

Assessment: Faculty and IAB members will assess the above content in an assessment form that uses a 5-point rubric: Expert=5, Proficient= 4, Apprentice=3, Novice =2, Nonresponsive=1. Minimum criteria for success will be to maintain an average score of 3.00 or better on a 5-point rubric. (EML 4905 Senior Design Presentation Evaluation Form is attached.)
Global Readings and Presented Information to Students

- Case study of what would happen if a flood happened in Miami and what the consequences are
- Case study reading and watching video of what happened to the Spider Lunar Module
- TED talk by Simon Anholt – Which country does the most good to the world?
- Other examples given for groups specifically such as:
  - Design for manufacturability in different parts of the world
  - Cost analysis for different regions and in different currencies
  - Preparation of multi-lingual user’s manuals; graphics-based user’s manuals
  - Use of universal units - US/SI
  - Provision of universal power adapters in design (110 volt/220 volt)
  - Maintenance schedules for different parts of the world considering different climates, practices, available resources
  - Warning labels in different languages or use of graphical warnings
  - Survey of UN and international charters to comply with all existing international standards
  - Survey of related patents and identification of similar previous work (Check the United States Patent and Trademark Office)
  - Contacting students, faculty or engineers in different parts of the world to discuss the design problem at hand, identify similarities and differences, and develop design concepts that address global needs

Organization of the Course:

As stated above, each team meets with its faculty advisor at least once a week. Departmental Undergraduate Program Director (UPD) organizes the class to collect 50%, 75% and 100% Senior Project Reports. UPD also organizes team rehearsal presentations and final presentations made to the departmental faculty and IAB members. 50% and 75% reports are reviewed by the UPD and returned to teams to provide feedback to students for further improvement. A template with proposed general table of content of report is provided to the students.

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<thead>
<tr>
<th>SENIOR DESIGN ACTION ITEM</th>
<th>GENERAL DEADLINE</th>
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<tbody>
<tr>
<td>Final Report (50% completed): Includes Final Design (100% completed) GL content (50% completed) Prototype Assembly (50% completed)</td>
<td>Week 4 of Semester</td>
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<tr>
<td>Final Report (75% completed): GL content (100% completed) Includes Prototype Assembly (100% completed) Testing of Prototype (50% completed)</td>
<td>Week 9 of semester</td>
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<tr>
<td>Final Report (100% completed): Final Report (PDF file and 1 hard copy) Draft Final Presentation (PowerPoint file)</td>
<td>Week 12 of semester</td>
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<td>Presentation Rehearsals to MME Faculty: Senior Design and Senior Design Organization are required to attend Presentation Rehearsals and Fill Out Team Presentation Evaluations</td>
<td>Week 13 of semester</td>
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<tr>
<td>Senior Design Organization Project Feasibility and Senior Design Final Presentations to IAB and MME Faculty - Formal Attire Required</td>
<td>Friday Week 14 of semester</td>
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Class Schedule: 3 hrs/wk equivalent. Teams interact with individual faculty advisors on a weekly basis, and conduct work on projects according the project schedule.
Course Contribution:
Engineering design 100%

Relationship of the course to student outcomes:

(a) Ability to apply knowledge of mathematics including statistics, multivariable calculus and differential equations, science including physics, and engineering (√)
(b) Ability to design and conduct experiments, as well as to analyze and interpret Data (√)
(c) Ability to design a system, component, or process to meet desired needs (√)
(d) Ability to function on multi-disciplinary teams (√)
(e) Ability to identify, formulate, and solve engineering problems (√)
(f) Understanding of professional and ethical responsibility (√)
(g) Ability to communicate effectively (√)
(h) Broad education necessary to understand the impact of engineering solutions in a global and social context (√)
(i) Recognition of the need for, and an ability to engage in, lifelong learning (√)
(j) Knowledge of contemporary issues (√)
(k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice (√)

Lectures:

There are no formal lectures for this course. Each team meets with its Senior Design Project Advisor at least once a week to review progress and receive guidance from the advisor. The day and time of the meetings are determined by each team and faculty advisor as their schedules allow.

Person(s) who prepared this description and date of preparation:
Dr. I.N. Tansel, Professor, Mechanical and Materials Engineering, February 26, 2014. Modified by Dr. Benjamin Boesl, Dr. Carmen Muller-Karger, Dr. Boutsen, March 2020.