ENES489P
Special Topics in Engineering: Hands-on Systems Engineering Projects
Fall 2016 Syllabus

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Office: 2147 AV Williams
Office hours: Wed 10:30-11:00am, 1:00-2:30pm
Lecture: Tues 5:00-6:15pm CSI 3120
Laboratory: Thurs 3:30-6:30pm AVW 1442
TA’s: Adeola Awowale, adeola1994@gmail.com
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Quick links
University policies: www.ugst.umd.edu/courserelatedpolicies.html
Academic calendar: www.provost.umd.edu/calendar/16.cfm
ELMS: www.elms.umd.edu
VCL: eit.umd.edu/vcl

General description
This hands-on design projects course will expose senior-level undergraduates and graduate students from all areas of engineering to exciting career opportunities in the systems engineering field. Students will be introduced to the technical aspects of systems engineering practice through team-based project development and a systematic step-by-step procedure for product development that includes defining operations concepts, requirements gathering and organization, synthesis of models of system behavior and system structure, functional allocation to create system design alternatives, formal assessment of design alternatives through tradeoff analysis, and established approaches to testing and validation/verification. The students will be introduced to modern methods in Model-Based Systems Engineering, and industrial strength tools and environments for complex systems synthesis. Team projects may address problems from a wide variety of disciplines or cross-disciplines.

Course textbooks and additional reading

- Systems Engineering, Principles and Practice, by A. Kossiakoff and W. N. Sweet (2003) available as an eBook through the UMCP library. Required
- INCOSE Guide to Writing Requirements - see above. Required
- SysML Distilled, by L. Delligatta, Addison-Wesley, 2014. Optional
Lecture sessions

The Tuesday class periods will consist of a lecture on the material indicated in the Course schedule (below) followed by meetings between each group and the class instructor to report on project progress. Meetings between teams and their mentors must be arranged by the teams and must not take place during lecture or lab hours.

Lab sessions

This is an engineering design class and so significant laboratory time is dedicated each week to learning to use the class systems engineering software and for teams to work together on their projects. Because the computer lab cannot accommodate the full class, teams will be designated as A or B; A teams will meet in the lab from 3:30-4:55pm and B teams from 5:05-6:30pm.

Note that when one set of teams (A or B) is meeting for a laboratory tutorial, the other teams (in B or A) may want to meet to work on their projects.

Individual laboratory exercises must be turned in by 3:30pm of the next week for both A and B teams.

Grading

Grade scale: A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%

The overall grade will be determined from a combination of individual laboratory assignments (40%), team project final report/presentation (40%), and two team presentations (10% each). Team grades generally will be the same for all team members unless an imbalance in project contributions is identified during the semester.

Expectations

Students are expected to attend each class lecture and laboratory period, to participate in class discussions, turn in all homework assignments, and attend all quizzes and exams.

Potential class project ideas

1. Systems engineering analysis of a capstone design problem from another engineering disciple, e.g., the senior Bioengineering design project
2. Single family home carbon management system - food, fuel, compost, and waste
3. Software for staffing a hospital emergency room
4. A campus/neighborhood micro electrical power grid resistant to natural and human-made disasters
5. A campus/neighborhood PV farm power distribution and management system
6. A home/campus/neighborhood water management system featuring greywater treatment and re-use
7. A food inventory and supply chain management system for a neighborhood food bank
8. A smart Metrorail passenger information/navigation system for transfer stations
9. Software for management of voter canvassing and registration
10. Wind, wave, and solar energy harvesting to power a robotic exploration of Titan’s liquid methane oceans

Course schedule

<table>
<thead>
<tr>
<th>DATE</th>
<th>#</th>
<th>LECTURE</th>
<th>DATE</th>
<th>LABORATORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/30</td>
<td>0</td>
<td>Course overview; discuss potential projects</td>
<td>9/01</td>
<td>Initial team formation;</td>
</tr>
<tr>
<td>9/06</td>
<td>1</td>
<td>Life cycle models; org structure; modeling</td>
<td>9/08</td>
<td>SysML intro; pkg diag</td>
</tr>
<tr>
<td>9/13</td>
<td>2</td>
<td>Stakeholders; stakeholder requirements; use cases</td>
<td>9/15</td>
<td>UCD; UCN</td>
</tr>
<tr>
<td>9/20</td>
<td>3</td>
<td>System arch: Structure and conceptual elements</td>
<td>9/22</td>
<td>BDD; IBD</td>
</tr>
<tr>
<td>9/27</td>
<td>4</td>
<td>System arch: Behavior - AD, SD, more</td>
<td>9/29</td>
<td>Project work period</td>
</tr>
<tr>
<td>10/04</td>
<td>5</td>
<td>Team Presentation 1: System concept, context</td>
<td>10/06</td>
<td>Activity, seq, state diag</td>
</tr>
<tr>
<td>10/11</td>
<td>6</td>
<td>Risk management*</td>
<td>10/13</td>
<td>Project work period</td>
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<tr>
<td>10/18</td>
<td>7</td>
<td>System requirements*</td>
<td>10/20</td>
<td>RAM; RTM</td>
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<tr>
<td>10/25</td>
<td>8</td>
<td>Element architecture, design</td>
<td>10/27</td>
<td>Element-level design</td>
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<tr>
<td>11/01</td>
<td>9</td>
<td>Design optimization</td>
<td>11/03</td>
<td>Linear programming</td>
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<tr>
<td>11/08</td>
<td>10</td>
<td>Team Presentation 2: Element-level design</td>
<td>11/10</td>
<td>TBD</td>
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<tr>
<td>11/15</td>
<td>11</td>
<td>Design alternatives, tradeoff analysis*</td>
<td>11/17</td>
<td>Tradeoff analysis*</td>
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<tr>
<td>11/22</td>
<td>12</td>
<td>Verification and validation</td>
<td>11/24</td>
<td>No lab - Thanksgiving</td>
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<tr>
<td>11/29</td>
<td>13</td>
<td>Specialty engineering</td>
<td>12/01</td>
<td>RVM; proj work period</td>
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<tr>
<td>12/06</td>
<td>14</td>
<td>Practice presentation, project feedback</td>
<td>12/08</td>
<td>Design Conference</td>
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* indicates travel dates for RAA