ENES 489P: Hands-On Systems Engineering Projects

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ENES 489P: Hands-On Systems Engineering Projects

**Goals.** This hands-on design projects course will expose senior-level undergraduate and graduate-level 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 working with a real-world customer to define 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. Areas of applications for team projects are many and varied including: smart manufacturing, smart robotics, health care and IT management systems, mobile wireless networks, sensor networks, smart transportation, energy efficient buildings, satellites and satellite communication networks, vision systems, biomedical engineering, systems biology, MEMS, micro- and nano-systems, microfluidics, human-robot interactions and teams, health care management in ICU and hospitals, electronic medical records, mobile devices security, network security, sensor fusion, process control.
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Course Contents. The course will consist of lectures and hands-on project development in the laboratory. The lecture topics to be covered include:

1. Systems Engineering in Mainstream US Industry
2. Models of Systems Engineering Development
3. Economics of System Development
4. Strategies of Systems Engineering Development
5. Foundations of Model-Based Systems Engineering
6. Modeling abstractions for System Behavior and System Structure
8. Requirements Gathering and Organization
9. Requirements Allocation and Flowdown
10. Requirements Traceability
11. Functional Allocation to Create the System-Level Design
12. Simplified Approaches to Tradeoff Analysis
13. System Implementation, Testing, Validation and Verification
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Guest lectures will also be given by Systems Engineering Professionals from industry and government labs. The laboratory work will include working with a real-world customer (industry and government experts) to define the project operational concepts and requirements, formulation of visual models, and formulation of design alternatives suitable for tradeoff analysis.