GEORGE MASON UNIVERSITY

VOLGENEAU SCHOOL OF INFORMATION TECHNOLOGY AND ENGINEERING

SYST 490/495 Senior System Design Project (2009/2010)

8/26/09

Instructor: Dr. George L. Donohue
Office: Rm. 2212 Engineering Bld.
Lecture: Rm. 2211 Engineering Bld.
Lab: Rm. 2211 Engineering Bld.
Time: TTh 12:00 – 13:15
Office Hours: Tuesday/Thursday 14:15 to 15:45, (lunch mtgs 13:15-14:15 by apt.)

Suggested Reading:

Thomas L. Friedman***, The World is Flat: A Brief History of the Twenty-First Century,*** Farrar, Straus and Giroux Publishers, 2006;

William J. Palm III, ***System Dynamics***, McGraw Hill, 2005;

Norman R. Augustine, ***Augustine's Laws: A Top Executive Looks at the Complexities and Conundrums of Today's Business Management – and Offers Solutions***, American Institute of Aeronautics and Astronautics, 1997;

FE Review Manual, Michael Lindeburg, 2002
http://www.ncees.org/exams/study_materials/fe_handbook/ (17.5 Mbyte pdf file)

Objective: These two courses, together, provide the Capstone experience to the Systems Engineering undergraduate program. It provides the students with the opportunity to put all of the course material that you have covered in the last 3 to 4 years into practice. It also provides the faculty with the opportunity to test your ability to have assimilated the course material and certify that you are ready to receive the Bachelor of Science degree in Systems Engineering. In addition to providing you the opportunity to utilize the systems engineering processes (e.g. requirements determination, work-breakdown structures, Pert Charts, test and evaluation, life cycle costing, etc.) it will require you to use your analytical skills in system modeling, simulation and decision making. Emphasis in these courses will also be placed on written and verbal communication skill development and the creative process of engineering design. You now have the basic skills that should allow you to create new systems that are technically sound, affordable, environmentally compatible and safe. You are required to describe your problem definition, scope, value hierarchy, requirements analysis, modeling and simulation approach for your designs in the Program Proposal that you will submit in late November and present to your sponsors and the faculty in early December.

You will be required to manage a complex, unstructured project using the management and teamwork skills that you have developed. The class will be divided into three project teams, each working on a real problem. Each student MUST maintain a personal log of

all design activity, to be inspected upon demand. You MUST submit a weekly time sheet to your team timekeeper to be used in your EVM project control and submitted at all major program reviews. Qualifying teams will be entered into inter-scholastic senior design competitions at the end of the Spring Semester (SIEDS 2010, ~30 April, 2010, USMA TBA May, 2010). Decide which Track you want to compete in this semester.

Each member of the class will give a substantial presentation at some point in the project to faculty and outside project sponsors. Each student will be graded upon his/her presentation ability. The Project Proposal and the final Project Report will be graded for writing style and completeness. The total project grade will represent a sizable portion of each student's final grade. In addition, each student will be ranked by each team member for total contribution to the program outcome.

Competition Tracks:

- Data Mining & Statistics
- Simulation & Stochastic Modeling
- Human Factors & Cognitive Engineering
- Math Modeling & Optimization
- Risk Analysis, Technology Management & Policy
- Life Cycle Analysis
- System Economic Analysis

Semester Schedule:

Sept.1. Introduction to the course, design problems and time-sheet system. Background discussions and data exchange. Three (4 person) teams will be formed based upon my initial core team selection on Tuesday Sept 8. This is a 3 hour Lab course and thus a ***minimum of 10 to 12 hours/week of productive effort is expected***. A review/entrance/placement exam will be given today. Please review the sophomore and junior SE course material. The exam results will be discussed on Thursday, 3 Sept.
September 3. Class Organization and Objectives. Exam results review and team assignments.
September 8. Continued discussion of team projects
September 10. Discussion of Team Projects and Project Scope
September 15. Individual team activity
September 17 Review Value Hierarchy, Requirements Traceability, WBS, PERT and Critical Path and Life Cycle Concepts, Review Modeling and Simulation for design trade-off analysis
September 22. Individual team work
September 24. Teams Present mini discussions of status to date
September 29. Teams Present mini discussions of status to date

> **Submit Problem Definition, Statement of Need (SON) and Preliminary Requirements Document, Proposed SOW, Project Labor Cost Estimate for EVM tracking**. **Present Initial Level 3 Work Breakdown Structure,**

Estimated Project Time Schedule and Gantt/PERT/CP Charts. (Last Day to Drop class)

October 1. Team A and B Presentation *
October 6. Team C Presentation *
October 8. Prelim Report Pass Back and MTE Review
October 13. Individual team work
October 15. Mid Term Exam
October 20. Discuss Project Investment Decision Report Format and Modeling and Simulation Plan requirement
October 22. Pass Back Exam and Discussion *mid term team self evaluation*
October 27. Meet with individual team SPONSORS for progress discussions
October 29. Meet with individual team SPONSORS for progress discussions
Nov. 3 & 5 Meet with individual teams for discussion by appointment
Nov. 10. Formal Team Progress Presentations*
Nov. 12. Formal Team Progress Presentations
Nov. 17. individual team work
Nov. 19. Present details of System Model
Nov. 24. Present details of System Model
Nov. 25. Thanksgiving
Dec 1,3 & 8 Dry Run Presentations; Final Proposals submitted for Faculty and Sponsor evaluation
Dec 10. Final Proposal Presentations to Faculty and Project Sponsors
Dec 15. Present first semester ***team self evaluation*** and Plan for second semester. Revised Project Milestones

* Actual presentation order will be determined by random draw

Grading: Each student's final grade will be determined as follows:

30% Mid-Term Exam
25% Project Proposal and Final Project report (written)
25% Faculty / Sponsor Evaluation of Team Presentation
10% Team Project productivity self evaluation
5% Individual presentations
5% Timesheets/Notebooks

Team Assignments:

Team composition decided Sept. 8

Project Descriptions:

A) West/Rhode River Water Quality Improvement Program
Sponsor: West/Rhode River-keeper, Chris Trubauer;
Faculty Advisor: Dr. George Donohue

The West and Rhode Rivers are major rivers feeding the Chesapeake Bay. They are located approximately 20 miles south of Annapolis Maryland. The River-keeper is responsible for monitoring the water quality of these rivers in cooperation with the Maryland Department of Natural Resources (DNR). The Smithsonian Environmental Research Center is located on the Rhode River and has a continuous water quality monitoring system. The DNR maintains a historical data base and the River-keeper updates spatial-temporal data on a semi-periodic basis. It is desired to conduct projects that will enhance the water quality of these rivers and thus eventually the entire Bay. It is desired that a system-dynamic model be developed that would allow the river-keeper to predict the effects that a collection of proposed water quality improvement projects would produce. A complete design, including cost, Value Hierarchy, water quality transfer functions, systems dynamic model in matlab and projected performance must be developed.

Ref.: Mueller, J.A. and R.V. Thomann, ***Principles of Surface Water Quality Modeling and Control***, Harper Collins, 1987.

West and Rhode River Water Quality Assessment Plans, 2008,2009, TBD

B) Lighter than Air Unmanned Air Vehicle system Design
Sponsor: Lockheed Martin
Faculty Advisor: Dr. Lance Sherry

TBD

C) TBD
Sponsor: either Boeing or UPS

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