Degree Applicable

Glendale Community College
September 2013

COURSE OUTLINE

Engineering 299
Undergraduate Research in Engineering II

I. Catalog Statement

Engineering 299 is the second of a two-course series intended to simulate a real-world design experience via an interdisciplinary project in a team-based environment. It introduces the student to the fabrication and testing phase of an in-depth engineering design process requiring integration of multiple systems. Students from a variety of disciplines carry out the design project initiated in Engineering 298. Emphasis is placed on written and oral communication skills as students implement, test, and analyze the product designed in Engineering 298.

Total Lecture Units: 1.0
Total Laboratory Units: 2.0
Total Course Units: 3.0

Total Lecture Hours: 16.0
Total Laboratory Hours: 96.0
Total Faculty Contact Hours: 112.0

Prerequisite: ENGR 298 or equivalent, or consent of instructor.

II. Course Entry Expectations

Skill Level Ranges: Reading 6; Writing 6; Listening/Speaking 6; Math 6.

Prior to enrolling in the course, the student should be able to:

1. communicate effectively in an interdisciplinary, team-based environment;
2. interface with interdisciplinary sub-teams with varying specialties;
3. develop innovative design concepts to solve a problem or task;
4. create and test a prototype to test the viability of a design concept;
5. create and present a design proposal to an audience of peers, professors, and industry professionals;
6. create and present a technical design plan to an audience of peers, professors, and industry professionals;
7. simulate the performance of designs with computer software before a physical product is available for testing;

8. evaluate, analyze, and critique the designs of peers and apply those insights to the creation of his or her own designs
9. read and analyze technical documentation and specification sheets;
10. utilize proper laboratory safety protocols;
11. design a system to complete a specific task, and produce design data necessary to manufacture that system;
12. demonstrate an understanding of the design process, inter-team communication, proper documentation, and revision control practices.

III. Course Exit Standards

Upon successful completion of the required coursework, the student will be able to:

1. interface with interdisciplinary sub-teams with varying specialties;
2. demonstrate an understanding of the fabrication and testing phase of the design process;
3. fabricate models, working prototypes, and final assemblies of a system;
4. test the performance of designs and systems, and resolve any design flaws;
5. analyze the performance of designs and systems in a controlled environment;
6. effectively communicate the design process undertaken and the results of the project, both orally and in a technical report.

IV. Course Content — Total Faculty Contact Hours = 112

A. System Component Fabrication — Lecture 6 hours / Lab 40 hours
   1. Delivering according to design specifications
   2. Tracking progress against project schedule
   3. Maintenance of team workflow
   4. Reporting on progress
   5. Evaluation and critique
   6. Fabrication techniques and corresponding pros/cons

B. Component Testing, Analysis, and Integration — Lecture 4 hours / Lab 40 hours
   1. Quality assurance and verification
   2. Resolution of flaws
   3. Integration of components and delivery to system level
   4. Analysis vs. test (cost, schedule, and feasibility)
   5. Proper test methods
   6. Interpreting test data

C. Final Presentation and Documentation — Lecture 6 hours / Lab 16 hours
   1. Product documentation
   2. Technical report
   3. Technical presentation
   4. Product demonstration
   5. Verification of requirements (product built as designed)
   6. Validation of product design (product meets objectives)

V. Methods of Instruction

The following instructional methodologies may be used in the course:
1. presentation and demonstration;
2. instructor analysis of student work;
3. laboratory practice;
4. individual instructor-to-student assistance in the class;
5. discussion;
6. collaborative learning;
7. field activities/trips;
8. guest speakers
9. online discussions and multimedia.

VI. Out of Class Assignments

The following out of class assignments may be used in the course:
1. technical paper (e.g. design report detailing project undertaken in course);
2. technical poster (e.g. large-format poster detailing project undertaken in course);
3. group projects (e.g. group project on design of a system (e.g. a mechanical, electrical, software, or integrated system), including documentation);
4. analysis (e.g. analysis of a system's design or implementation);
5. portfolios (e.g. a portfolio of design work in mechanical, electrical, software, or other systems);
6. fabrication of deliverables (e.g. constructing and delivering the designed product).

VII. Methods of Evaluation

The following methods of evaluation may be used in the course:
1. practical examinations;
2. midterm examinations;
3. instructor evaluation of in-class presentations;
4. effective participation in team assignments;
5. final examination.

VIII. Textbook

Blanchard, Benjamin S., and Wolter J. Fabrycky. *Systems Engineering and Analysis*. Fifth Edition. Upper Saddle River, NJ: Prentice Hall, 2010. Print.
14th Grade Textbook Reading Level. ISBN-13: 978-0-13-221735-4.

Siegwart, Roland, Illah Nourbakhsh, and Davide Scaramuzza. *Introduction to Autonomous Mobile Robots*. Second Edition. Cambridge, MA: MIT Press, 2011. Print.
13th Grade Textbook Reading Level. ISBN-13: 978-0-262-01535-6.

IX. Student Learning Outcomes

Upon successful completion of the required coursework, students will be able to:

1. identify design flaws during the testing phase and collaborate on solutions with their peers;
2. demonstrate successful aspects of their designs;
3. assess the performance of their peers' designs and evaluate the contributing factors to the designs' successes and/or failures;
4. clearly and carefully document and present their designs and products.