ECE 4810: Electrical/Computer Engineering Design I
Required Course

2006-2007 Catalog Data: First of a two-semester sequence on engineering design in which students work in teams on approved design projects. A preliminary design is expected at the conclusion of this course. This course, along with ECE 482, are approved as writing-intensive courses which may fulfill the baccalaureate-level writing requirement of the student's curriculum.
Credit: 2 hours (lecture) Prerequisite: IME 3160; consent of department chair

Textbook(s) and/or Required Materials:

1. Middendorf, W. H. and Engelmann, R. H., 1998. *Design of Devices and Systems*, (3rd ed). Marcel Dekker.
2. Gesink, J. and Miller, D. A., 2006. *ECE 4810 Handouts*, available from the WMU IEEE student branch.
3. Pfeiffer, W. S., 2003. *Technical Writing: A Practical Approach*, (5th Edition or later). Prentice Hall.

Recommended Materials:

1. Wolf, S. and R. F. M. Smith, 2004. *Student Reference Manual for Electronic Instrumentation Laboratories*, (2nd Edition). Pearson/Prentice Hall.
2. MATLAB® and Simulink® (or similar) mathematics software suite (MATLAB® and Simulink® available in Computer Aided Engineering Center)
3. OrCAD® PSpice® circuit simulation package (available in Computer Aided Engineering Center or free download)

Reference Materials:

1. Wolf, S. and R. F. M. Smith, 2004. *Student Reference Manual for Electronic Instrumentation Laboratories*, (1st or 2nd Edition). Pearson/Prentice Hall.
2. Underwriter Laboratories Inc. *UL 372: Standard for Primary Safety Controls for Gas and Oil Fired Appliances*.
3. Various websites providing information on electronic components and design, engineering ethics, product standards, professional registration, etc.

Other Materials:

1. WBGH Educational Foundation, *Nova®: The Light Stuff*, (video on design of human-powered aircraft), 1988.
2. National Institute for Engineering Ethics, *Gilbane Gold*, (video dramatization of an engineering ethics case from the perspective of an engineer), 1989. National Society of Professional Engineers.

Course Coordinators: Dr. John Gesink, Professor and Chair, ECE
Dr. Damon A. Miller, Associate Professor, ECE

Instructor (Spring 2007): Dr. Damon A. Miller, Associate Professor, ECE

Prerequisites by Topic:

1. Principles of engineering design and analysis as presented in sophomore and junior courses in circuits, electronics, analog and digital systems, digital logic, computing, electromagnetics, and signals
2. Laboratory experience in electrical and/or computer engineering courses
3. Report writing

Course Objectives: (ABET Learning Outcomes)

ABET learning outcome assigned to this course by ECE assessment plan: f, g, and h.

1. an appreciation of the importance of using notebooks to document engineering work (g);
2. an ability to develop a needs analysis (a, c, e, h, j)
3. a working knowledge of sources for engineering design specifications (c, e);
4. an ability to develop a comprehensive set of quantitative and qualitative engineering design specifications based on a needs analysis (a, c, e, h, j);
5. an ability to apply and understand the advantages and disadvantages of the three primary methods of engineering design: synthesis, repeated analysis, and device evolution (a, c, e, k);

6. an ability to conduct a physical and economic feasibility study for a proposed device or system (a, b, c, e, k);
7. an ability to conduct a literature and patent search to support an engineering design project (a, b, c, e, k);
8. an ability to design a device or system to meet a specified need using knowledge of mathematics, science, and engineering, while considering (as listed by ABET Engineering Criteria 2000) "economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political" issues (a, b, c, e, h, j, k);
9. an ability to effectively function as a member of a design team (c, d, g);
10. an ability to develop a strategy for designing a device or system based on a precedence matrix (a, b, c, e, k);
11. an ability to use physical and/or mathematical models to verify that a designed device or system satisfies design specifications (a, b, c, e, k);
12. an ability to provide effective documentation for an engineering design project (g);
13. an ability to estimate time needed to complete an engineering project using the critical path method and the program evaluation and review technique (c, k);
14. a knowledge of the role that human factors engineering has in engineering design (a, c);
15. an ability to determine the tolerance on a device or system based on the tolerances of the individual components comprising that device or system (a, c, e, k);
16. a basic understanding of mechanisms to protect intellectual property, including patents, copyrights, trademarks, semiconductor masks, and trade secrets (c, e, k);
17. an understanding and appreciation of engineering ethics, including an ability to cite examples where engineering ethics were compromised with disastrous consequences (f);
18. a knowledge of the IEEE and the NSPE Code of Ethics (f);
19. an understanding of the importance of, and how to obtain, a professional engineering license (f);
20. an appreciation for the role engineers play in society (f, h, i, j);
21. an awareness of basic electronic system prototyping techniques (k); and
22. an ability to correctly and effectively communicate via the written word (d, g, k).

Topics: (items 12 and 13 contribute to ECE Department undergraduate learning outcomes as indicated)

1. Design team formation
2. Senior design project identification and selection methods and guidelines
3. Needs analysis and design specifications
4. Engineering design methodologies
5. Feasibility studies
6. Project planning and the critical path method
7. Human factors engineering
8. Formal engineering proposal preparation
9. Intellectual property including patents and copyrights
10. Engineering ethics, professionalism, and engineering registration
11. Basic electronic system prototyping techniques
12. Attend ECE department seminar(s) and Conference on Senior Engineering Design Projects (f, h, i, j)
13. Students are encouraged to utilize a variety of software packages (available in the Computer Aided Engineering Center) for project scheduling, design and analysis of analog and digital circuits and systems, physical drawings, mathematics, etc., in their homework and proposal preparation activities (k)

Course/Laboratory Schedule: Two 50 minute lectures

Evaluation:

1. Examinations (45%) 2. Senior capstone design project proposal (40%) 3. Homework (15%)

Contribution to Professional Component:

ABET professional component content as estimated by faculty member who prepared this course description:

Engineering Design: 2 credits or 100% Engineering Science: 0 credits or 0%

Relation of Course to Program Outcomes:

This course provides significant support for:

EE and CE program objectives: Depth, Breath, and Professionalism

ECE expected learning outcomes: f, g, and h.

Person who prepared this description and date of preparation:

1. Prepared by: Damon A. Miller Date: 12 September 2007