FORT LEWIS COLLEGE
Department of Physics and Engineering

Course: ENGR 215 – Engineering Fundamentals 3
Term: Fall 2015
Instructor: Dr. Laurie Williams, room 632 BH, 970-247-7160, williams_l@fortlewis.edu – sections 1
Instructor: Dr. Don May, room 601 BH, 970-247-7545, may_d@fortlewis.edu – section 3

Textbook:

David F. Beer, David McMurrey, 2009, *A Guide to Writing As an Engineer / Edition 3*, 3rd Edition
ISBN:0470417013, Wiley, John & Sons
Other cost: You are required to purchase materials needed for design projects. Expect to spend $50 to $100.

COURSE INFORMATION

Catalog Description

A course in engineering problem solving including the study of engineering fundamentals using a formal design process. This is a project centered course where students learn to plan, design, and manage a project; to construct and test prototypes; to analyze results and communicate findings using a variety of methods. The engineering profession and professional ethics are discussed.

Required Course: 3 credit hours (lecture)
Prerequisite: ENGR 103 (Engineering Fundamentals I)
Pre or Co-requisite: ENGR 104 (Engineering Fundamentals II)

ABET Criterion-3 lists 11 learning outcomes titled a-k. This course addresses the following subset of these outcomes.

COURSE OUTCOMES: (with corresponding ABET outcomes)

1. Learn to use a formal design process (Outcome c)
2. Use engineering science, research, analysis, and modeling as part of the design process (Outcome b, j)
3. Develop and use plans, specifications, and standards (Outcome c, h)
4. Introduce prototyping, testing, and safety (Outcome k)
5. Introduce engineering project management and teamwork (Outcome d)
6. Improve technical communication through writing, graphics, and presentation skills (Outcome g)
7. Explore engineering ethics (Outcome f)
8. Introduce the principles of sustainable design (Outcome c, h)

RELEVANT ABET OUTCOMES:

(b) An ability to design and conduct experiments, as well as analyze and interpret data.
(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
(d) An ability to function on multidisciplinary teams.
(f) An understanding of professional and ethical responsibility.
(g) An ability to communicate effectively.
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
(j) A knowledge of contemporary issues.
(k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

TOPICS

- The design process
- Project management
- Problem definition
- Working as a team
- Research and engineering requirements
- Generating options
- Detailed design
- Prototyping
- Documentation and communication
- Design for sustainability
- Professional engineering
- Ethics
- Safety in engineering

Attendance: Attendance in class is expected. If a class is missed, the student is responsible for the material covered and any announcements including changes in the schedule.

Grading:

1. Projects (~70%) – Based on the understanding and effective implementation of the design process and the elements of good design as evidenced in the ongoing process and the final products of design projects.
2. Assignments (~10%) – Assignments not assessed in item 1.
3. Exams (~10%)
4. Participation, Peer Review, professionalism, leadership (~10%) – Based on attendance, participation in discussions, ability to work in design teams, ability to meet schedules, willingness to take a fair share of leadership roles, peer review results, appropriate use of the shop and work days, and other similar items.
5. Assessment rubrics are used in evaluating performance in this class. You will find them posted on the course Canvas page prior to assignment submittal dates.

Grades:

Grades will be no worse than:
>90 - A
>80 - B
>75 - C
>60 - D
<60 - F

Assignments:

- All assignments are due at the beginning of the listed class period
- Most assignments are completed as group work and thus one assignment is submitted for the group.
- Show the course section, assignment title, the full name of all group members and date on the first page.
- No late work will be accepted unless prearranged with the instructor.

All assignments are typed or electronic submission unless specifically stated. Submit electronic documents in pdf format. Use Google Drawing© (or similar) to create flowcharts and diagrams. Sketches can be scanned (check resolution and contrast for legibility before submitting).

Special Needs Accommodations: "Students with disabilities who require reasonable accommodations to fully participate in course activities or meet course requirements must contact the Disability Services Office by contacting, Dian Jenkins, the Director of Disability Services, 280 Noble Hall, 970-247-7383, and/or jenkins_d@fortlewis.edu, for an appointment as soon as possible."

DEPARTMENT POLICIES: For policies on grading, syllabus changes, disputes with instructor, academic dishonesty, and other important issues see course Canvas.

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Course Schedule and Assignments, Engr 215, Fall 2015

Wk	Period	Topics	Assignments / Due Date
1	1, M, 8/30 2, W, 9/2 3, F, 9/4	**Project 1 –** Introduction, form teams The design process **1.Problem definition** Problem formulation Needs assessment Objectives (tree) Objective metrics Constraints	**All wk 1 assignments due 9/9:** Objectives tree Objective metrics Constraint list Revised problem statement
2	4, M, 9/7 5, W, 9/9 6, F, 9/11	**2.Research and requirements** Research Design functions Engineering requirements **3.Generating alternatives** Design space and the morphological chart Precedent Design selection	**All wk 2 assignments due 9/16:** Engineering requirements list Morph chart
3	7, M, 9/14 8, W, 9/16 9, F, 9/18	**4. Document and communicate** Writing standards Technical sketching/ Engineering drawings CAD Presentations	**All wk 3 assignments due per 9/23:** Project 1 design review Codes and standards assignment Project work
4	10, M, 9/21 11, W, 9/23 12, F, 9/25	**Learning Styles** **Project management** Work breakdown structure Linear responsibility chart Scheduling	**Project 1 Concept Design Report due 9/23** **Project 1 presentations, 9/25**
5	13, M, 9/28 14, W, 9/30 15, F, 10/2	**Project 2** – Introduction, form teams Team Charter **1.Problem definition** Review previous problem formulation Objectives – pairwise comparison **2.Research and requirements** Review -- problem research Review -- design requirements **3.Generating options** Review - Design space Concept Map	**All wk 5 assignments due per 10/5:** Team charter Work breakdown structure Gantt chart Objectives - pairwise comparison chart and objective metrics Constraints Table Revised problem statement
6	16, M, 10/5 17, W, 10/7 18. F, 10/9	**Project management - review** **4.Detailed design** Analysis and modeling Prototyping and testing **Engineering economics**	**All wk 6 assignments due per 10/12:** Linear responsibility chart Engineering requirements Morph chart Concept map (hand) Engineering economics
7	19. M, 10/12 20. W, 10/14 21. F, 10/16	**Engineering Economics** **5.Document and communicate** Design report format	**All wk 7 assignments due per 10/19:** Engineering economics
8	22. M, 10/19 23. W, 10/21 24. F, 10/23	**Project Management -** Percent compl. matrix	**Project 2 Design Report due 10/21** **Project 2 Demo 10/22**

Wk	Period	Topics	Assignments / Due Date
9	25. M, 10/26 26. W, 10/28 27. F, 10/30	**Project 3 –** Introduction, form teams **Step 1.Problem definition** - review prob stmt, objectives tree, pair-wise comparison chart and objective metrics **Step 2.Research and establish requirements** Engineering standards Design requirements (review) Quantifying requirements – requirement table	**All week 9 assignments due per 11/2:** Team charter (P/F) Revised problem statement with objectives list, objective metrics and constraints list WBS, LRC (P/F), Gantt chart
10	28. M, 11/2 29. W, 11/4 30. F, 11/6	**3.Generating options** Systematic design Ideas - patents Review morph chart Review Precedence Down selection - review numerical evaluation method	**All wk 10 assignments due on per 11/9:** Pairwise comparison chart (P/F) Percent completion matrix updated weekly Requirements table and written specification
11	31. M, 11/9 32. W, 11/11 33. F, 11/13	**4.Detailed design** Engineering calculations and modeling **5.Document and communicate** How to make a technical presentations Engineering specifications	**All wk 11 assignments due 11/18:** Numerical evaluation matrix System level diagram with interactions Computer model of essential mechanism
12	34. M, 11/16 35. W, 11/18 36. F, 11/20	Exam 1 PDR presentations Design for sustainability	Test plans and data analysis
Thanksgiving Break 11/23-27			
13	37. M, 11/30 38. W, 12/2 39. F, 12/4	Total life cycle analysis Ethics and the engineering profession	Demonstrate working prototype 11/30
14	40. M, 12/7 41. W, 12/9 42. F, 12/11	Ethics and safety in engineering	To be added **Project 3 Design Report due 12/11**
15	Final Exam	Section 1: T, 12/15, 9:45-11:45 Section 3: T, 12/15, 7:30-9:30	**Exam and Project 3 presentations**

Requirements on Assignments and other course work. Calculations, spreadsheet and written material must use the proper engineering format and/or meets the engineering program writing quality expectations (see program writing text book).