ES 101 – INTRODUCTION TO ENGINEERING
MODULE 2 – Engineering Design – Why Structures Stand Up and Fall Down
FALL 2014

ES 101 Course Description:
This course teaches the fundamentals of engineering design methodology. Students will use engineering design processes to aid them in: recognizing the need for an engineering solution, defining constraints, specifying requirements, and modeling an engineering solution, among other aspects of engineering design. Instructors integrate societal contexts of engineering practice into the projects and examine the ethical implications of engineering solutions.

Engineering Design Module 1 Description:
Engineers are faced with the challenge of designing taller buildings, longer bridges and larger dams that can safely endure extreme earthquakes without collapsing. These engineered designs must provide an acceptable level of safety, while also being cost-effective and functional, and ideally, sustainable and aesthetically pleasing. This module will introduce students to the engineering concepts (material behavior, force analysis and dynamic response) that are at the heart of designing structures, machines and products. In project work, students will first use computer models to investigate the performance of a wide range of proposed design alternatives. Students will then build a physical model of their final design and load test it to failure. Students will also learn how to use Excel to predict dynamic behavior and how to use information collected from physical experiments, computer simulations and their new knowledge of materials and forces to create designs that "stand up and stand out".

Prerequisite: None

Professor: Anne Raich, Ph.D. 322 ACE 330-5590 raicha@lafayette.edu http://sites.lafayette.edu/raicha

ES101 Calendar Link: https://webmail.lafayette.edu/home/engineering@lafayette.edu/Calendar.html

Lecture: MWF 8:00 am – 9:15 am, AEC 200
Office Hours: M & W 9:30 am – 10:30 am; W & F 2:00 pm - 3:00 pm; and T & R 3:00 pm- 4:30 pm
Other times, if the door to my office is open, feel free to stop by and ask questions

Textbook: For Module 2: None - Course Readings & Papers will be handed out as needed in class
For Graphics: Sexton, T. (2010) A Concise Introduction to Engineering Graphics: With Workbook, 4th Ed., ISBN-13: 9781585035847, Schroff Development Corporation

ES 101 Course Grade Components and Descriptions

ES 101 Course Distribution :	Module 1 Grade:	40%	Graphics Grade:	10%
Will Use Percents Earned (e.g. 87% earned or 70% earned)	Module 2 Grade:	40%	Co-curricular Grade:	10%

VERY IMPORTANT NOTE ON THE ES 101 COURSE GRADING
Students must successfully complete each of the four listed components of the course (Module 1, Module 2, Graphics, and Co-curricular) in order to pass the ES 101 course for the semester. If you fail any of the components, you will fail the ES 101 class. In other words, you can't fail the Co-curricular component and loose just 10% of your grade. If you fail the Co-curricular component, you will also fail ES 101.

Graphics Component:
Graphics (CAD, Visio, and Sketch-Up) will be taught through four, 30-minute instruction sessions along with a series of online tutorials. The four instruction periods are scheduled during the semester and will be held during our regularly scheduled class time. Students are required to attend the Graphics instruction sessions. Formal tutoring sessions will be scheduled to support students who need help in addition to the tutorials and instruction sessions.

"Strive for perfection in everything you do. Take the best that exists and make it better. When it does not exist, design it" – Sir Henry Royce

Co-curricular Component and Grading Scale:
You must attend eight (8) co-curricular events this fall semester, including each of the five (5) department plenary sessions, the Resnik lecture (1) and two (2) brown bag lunch events of your choice. Attendance will be taken at each event in order to facilitate assigning grades for this component. The days and times for each of these events are provided on the ES 101 Calendar (link provided on the first page of this syllabus). Your Co-curricular grade is tied directly to the number of events you attend in total during the fall semester as shown below:

Attend all 8 events = 100%
Attend 7 events = 80%
Attend 6 events = 60%
Attend 5 events or less = Failing Grade (avoid this one!)

If you cannot attend the Resnik lecture or a plenary session, you must attend 2 additional brown bag events for each missed event.

Department Plenary Sessions:
Each of the plenary sessions will introduce you to a specific engineering discipline and department at Lafayette College. In each plenary session, you will learn more about what you can learn and do as a student in that major here at Lafayette as well as what you can do professionally with that major in the future. The department plenary sessions are currently scheduled on five specific Monday nights from 7 – 9 pm (ME presents on 9/22, ChBE presents on 9/29, EGRS presents on 10/6, ECE presents on 10/20, and CEE presents on 10/27). Any changes to this schedule will be noted on the ES 101 calendar during the semester and announced in class. The department plenary sessions will be finished before registration for spring semester courses begins in November.

Brown Bag Lunch Events:
The schedule for the ES 101 Brown Bag Lunch Events for the fall semester can be viewed on the ES 101 calendar. You are required to select two (2) brown bag lunches to attend during the fall semester. You will reserve a place for your selected brown bag lunches by selecting 'Will Attend' though a choice in Moodle. You need to RSVP because space may be limited in the brown bags. RSVPs will be accepted until a few days before each lunch. By RSVPing you are also ordering lunch for that day. Lunch will be provided by Dining Services and your meal plan will be charged for the lunch. You can attend more than the required 2 brown bags during the semester if you would like to. More information on the weekly brown bag lunch event topics will be provided during the semester on the ES 101 calendar.

Resnik Lecture:
The Resnik Lecture will be scheduled on a Monday night starting at 7 pm and is for all 1st year engineering students.

Engineering Design Module 2 Components and Descriptions:

Engineering Design Grade Distribution: (makes up 40% of your ES 101 grade)
- Class Attendance: 5%
- Class Participation & Group Interaction: 15%
- Individual Homework, Response Writings & In-class Work: 30%
- Group Materials and System ID Lab Reports: 30%
- Truss Design Project & Report: 20%

Letter Grade Scale: A ≥ 92; 92 > A- ≥ 90; 90 > B+ ≥ 87; 87 > B ≥ 82; 82 > B- ≥ 80; 80 > C ≥70; 70 > D ≥ 60; F < 60

Expected Workload:
This course requires what is called "*old-fashioned gumption*", as will many other engineering courses you encounter in your studies. There is a lot of work assigned in the course. The work takes many forms, including reading articles and chapters, writing reading responses, memos and group lab reports, using Excel for graphing and performing numerical calculations, building physical models and solving homework problems involving hand calculations. The main purpose of individual homework is to help you learn the fundamental topics that are covered in class and used in the group labs and design projects. The lab work will provide the opportunity to gain hands-on experience with testing methods, analysis methods and engineering design processes. There is typically a strong correlation between time spent on individual work and the achievements of your group. The amount of out-of-class work required will vary each week, but you should plan to spend between 8 to 10 hours each week solving homework problems, reading course material, and/or working on group lab and design projects. Engineers are known for their intellectual curiosity and their willingness to work and these skills allow engineers to rise to positions of leadership.

Learning Objectives:
Specific learning objectives are defined for each topic to clearly identify the knowledge and skills the student is expected to have learned and mastered. Full understanding of a learning objective is accomplished through in-class and out-of-class work (i.e. notes, discussion, labs, reading assignments, homework, and group projects). Individual assignments will assess the acquisition of the identified knowledge and skills for each student, while group design project work will be used to assess student understanding of how to apply specific knowledge and skills.

Class Attendance: Regular and on-time class attendance *is required.* A portion of your Module 1 grade is tied to on-time attendance even though role is not taken in class. The 5% class attendance grade holds for all students who have not missed any classes during the first seven weeks of the semester. Your class attendance grade will decrease 1% for each class you miss, but only if you provide prior email notification about your planned absence. If no email is sent to the professor before the missed class, your class attendance grade will be decreased by 2% for each missed class. Therefore, if you miss three classes without prior notification you will receive 0% for this component of your module grade. If there are extenuating circumstances that result in unplanned class absences, these will be considered only if the student obtains a Dean's excuse.

Class Participation and Group Interaction: Your learning will take place both during and outside of formal class times. You are expected to participate during class discussions in addition to asking and answering questions and to work effectively with your colleagues on any in-class activities. In addition, you are encouraged to share articles, topics, and stories that you encounter as you dig through and learn about the topics related to extreme building and engineering in general.

Homework, Response writings and In-class work: Homework and in-class assignments require a mix of reading, writing, and calculations. All assignments should be completed in a professional manner and are due at the beginning of class on the due date. Reading and response writing assignments must be completed prior to the class during which they will be used. Unless a prior arrangement is made, late assignments will receive a grade of zero. Do the homework and response writing assignments so that you can come to class and participate.

ES 101 Student Outcomes:
Upon completion of this course, students will:

Recognize that engineering at Lafayette and beyond is innovative and exciting.
Understand the engineering design process

In support of the outcomes listed above, students will:

- Have had an introductory design experience
- Have had experiences using engineering equipment, tools, software, and hardware appropriate to the topic of the course
- Have a working knowledge of engineering graphics and basic CAD skills
- Have an introductory understanding of the societal context of engineering relevant to the topic of the course
- Gain experience in visually and orally conveying engineering information, e.g., create and present a poster
- Gain experience working as a member of a team
- Have an introductory understanding of engineering mechanics topics related to materials, forces, equilibrium and dynamics
- Have an experience applying engineering mechanics topics to model, analyze, predict, build and test a truss structure using a design process
- Have had an introductory experience using numerical methods to provide approximate solutions and to predict system behavior
- Have a basic understanding of how technical and non-technical issues are considered by engineers during design

Students with Disabilities**:** The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation or require assistance with academic concerns/accommodations, please contact the Office of the Dean of the College, 200 Scott Hall (610-330-5080). The college policy regarding student disabilities can be found at this website: http://attic.lafayette.edu/disability-services/ and will be adopted in this course.

Course Topics:
The topics listed below are tentative and may be modified by the instructor during the semester. Students will be advised in a timely manner of assignments, due dates, and required readings. If you have any questions at any time during the semester, please stop by my office or send me an email (raicha@lafayette.edu)

Class		Date	Tentative Topic (Subject to Change)
1	W	10/15	Intro/Syllabus/Motivation
2	F	10/17	Teaming/Design Process & Engineering
3	M	10/20	Structural Forms & Behavior–Force/Stress/Deformation Basics
4	W	10/22	Materials Lab
5	F	10/24	Graphics Session in **AEC 223B**
6	M	10/27	Excel Lab
7	W	10/29	Design Criteria & Constraints/Analysis & Design of Trusses
8	F	10/31	Truss Analysis - Methods of Joints
9	M	11/3	Truss Analysis/ForceEffect in **AEC 302**
10	W	11/5	Graphics Session in **AEC 223B**
10	F	11/7	Truss Design/ForceEffect in **AEC 302**
12	M	11/10	Deployable Structures Lab
13	W	11/12	Truss Build Lab
14	F	11/14	Intro to Dynamics – Bungee Jumping with Drag
15	M	11/17	Intro to Numerical Methods w/ Excel
16	W	11/19	Vibrations – Undamped & Damped SDOF Systems
17	F	11/21	Vibrations – SDOF Systems/Numerical Methods II w/ Excel in **AEC 223B**
18	M	11/24	Dynamic System Identification Lab
19	M	12/1	Seismic Events & Seismic Ground Motions/Numerical Methods III
20	W	12/3	SDOF Systems/Response Spectra/Numerical Methods IV
21	F	12/5	Earthquake Engineering Retrofit Strategies Lab

Course Expectations:
You are expected to:
- Prepare for class by reading the assigned material ahead of time and doing the assigned work for the class. You should be able to answer simple questions about the concepts covered in the readings and assignments.
- Actively participate in class as a problem solver, contributor and group member.
- Cooperate with your group and work with them, not compete against them.
- Meet with your group outside of class time in order to complete assignments.

Academic Integrity Statement**:** "Students are expected to be honorable, ethical, and mature in every regard"
Just as ethical conduct is an essential part of the engineering profession, academic integrity is essential to ensure a fair and positive learning environment. No form of scholastic misconduct will be tolerated. Academic dishonesty includes cheating, fabrication, falsification, plagiarism, copying homework from other students (even with their permission) or from a solution, etc. Violations will be reported to the Dean of the College for disciplinary action. Students should know the *Principles of Intellectual Honesty* (http://www.lafayette.edu/academics/honesty.pdf). The college policy on academic honesty can be found at: http://studentlife.lafayette.edu/files/2011/08/studenthandbook_1112.pdf.

> *"I give you two examinations, one in trigonometry and one in honesty. I hope you pass them both, but if you must fail one, let it be trigonometry for there are many good people in this world today who cannot pass an examination in trigonometry, but there are no good people in the world who cannot pass an examination in honesty"*
> *- Vanderbilt Univ. past-Chancellor Madison Sarratt*

Federal Credit Hour Compliance: The student work in this course is in full compliance with the federal definition of a four credit hour course. Please see the Registrar's Office website for the full policy and practice statement.
http://registrar.lafayette.edu/files/2013/04/Federal-Credit-Hour-Policy-Web-Statement.doc

"We were put on this earth to make things" – W.H. Auden

Assignment Policies:
Assignments will be collected at the beginning of class on the date due. Late work will be accepted **only** by making a **prior** arrangement with the instructor either during office hours or by email, subject to the Lafayette College Dean's Excuse Policy outlined in section 7.3.2 of the Faculty Handbook under the heading Class Attendance.

- Reading Response Assignments and Group Lab Reports will be typed, not handwritten. Unless specific formatting instructions are provided for an assignment or lab report, all typed documents should use 11 point, Times Roman font and be single-spaced text with 1-inch margins all around. Name(s) and the date should be in the top right corner of each page..
- This class emphasizes developing skills in problem solving. All homework involving calculations should be submitted on engineering paper (one side only) in a professional manner, which includes neat handwriting and organization. Therefore, neatness, clarity, and the ease that others have in understanding your work is important and will considered as part of your grade. The following should be provided in the homework:
    - Provide a description of the problem being solved and any assumptions made.
    - Provide clearly drawn sketches that include dimensions and other necessary information and text
    - Clearly identify the design or analysis steps and calculations made. Check your units and assumptions.
    - Provide a summary of your final answers and claim your answers by boxing them.
- Unless otherwise stated, all homework and reading responses in this class are expected to be individual work. Copying the work of others, including homework, is in violation of the College's Principles of Intellectual Honesty, which can be accessed at http://www.lafayette.edu/academics/honesty.pdf. You may discuss the homework assignments with other students. All work submitted, however, must be your own and it is your responsibility to properly acknowledge the source of ideas and facts received from others, including other students. A student who commits academic dishonesty is subject to a range of penalties, including suspension or expulsion. The primary purpose of homework is to facilitate learning the concepts needed to complete the class labs and projects, not just having a solution to turn in.
- Discussions about re-grading of assignments or labs are not conducted in person or by email. If you would like to request re-grading, attach a signed statement to your work that details where you feel you lost points and submit it to the professor within one week after the assignment or lab has been returned.

Group Lab Reports and Design Project Information:
- Students will work in groups to complete the class labs and design project. There will be several in-class labs in this module and groups will perform the lab and then work together to report the lab results in a formal lab report.
- The group design project will involve the design of a truss structure and the testing of a physical model of the design. This design project requires the consideration of stated design criteria and constraints, the evaluation of alternative solutions, and the selection of a final design.
- Groups are made up of 3 or 4 students. Using the information provided on your student information sheet, Prof. Raich will form student teams during the first week of class. Groups will develop a Code of Cooperation and will also complete peer evaluations during the semester. Your Truss Design Project grade will factor in the evaluation provided by your group members. In addition, all group reports must be signed by the group members. Group members not signing a group report submitted will receive a ZERO grade for that report.
- It is generally adhered to that one group may not collaborate with another group on Group Labs and Projects.
- More detailed information concerning the group truss design project criteria, constraints, specifications, and reporting requirements will be presented and discussed in class and will be available on the course website after that time. The due dates for each part of the project also will be posted at that time.

Software Used for this Class:
The CE Lab computers have Microsoft Excel and Microsoft Word, which you can use for homework assignments and group labs/projects. The ForceEffect app can be downloaded from the Chrome store for free and used on any computer that has the Chrome browser installed. We will also have access to lynda.com for additional Excel tutorials as needed.

Resource Conservation: Please observe the following paper conservation policies
Preview your work to correct errors before printing; Return unused sheets to the printer; Place discarded copies in the recycling bins; Print only what you need; no 2nd or 3rd copies; Use color printouts only for critical figures or graphs.