1. Background and Objective

The University of Massachusetts Lowell’s Francis College of Engineering holds an annual Dean’s Cup Challenge for undergraduate students during Engineers Week. The Dean’s Cup consists of competitions in all five (5) departments within the College: chemical engineering; civil and environmental engineering; electrical and computer engineering; mechanical engineering; and plastics engineering.

The UMass Lowell Dean’s Cup has been adapted to the Carrero Cup Challenge for 4th graders at the Lawrence Family Development Charter School (LFDCS). However, instead of doing a different engineering competition a day during Engineers week, these students do an engineering challenge over a 2-4 week period. The students meet for 1½ hours during one day a week after school from 3:30pm to 5pm. Engineering students from various UMass Lowell student professional organization chapters, such as ASCE and Tau Beta Pi, assist the 4th grade LFDCS students in these competitions.

For this course, your team will design an engineering competition for the Carrero Cup Challenge that can be completed by the LFDCS students over the course of 2-4 weekly meetings. Your competition should have a specific learning goal related to engineering (e.g. teach the students how to measure length using a ruler). In addition, your team’s engineering competition should be interesting and exciting to the students that will be learning from it.

Please be CREATIVE!

2. Deliverables

The deliverables for this project are the following:

- **Electronic Document Submittal (40% of your grade) – Due on Wednesday, April 30, 2014 at 10am.**
  - The electronic content for the laboratory. You need to submit these documents via email to Dr. Hajduk (Edward_Hajduk@uml.edu) before the deadline of 10am on Wednesday, April 30, 2014. The subject for this email should be as follows:

  25.108_2014_Project_3_LastName1_LastName2_LastName3

  where the team member last names should be in alphabetical order. Late submissions will **NOT** be accepted. The submitted electronic content should meet the specifications and the templates provided. You will deliver this content as one **MS-Word document** and one **MS-PowerPoint presentation**.
  - The MS-word document (see project_3_template.doc):
    - Relevant background theory for the teacher/instructor in charge of the completion, including a clear description of any safety concerns.
Specifications

- The teacher/instructor instructions for performing the competitions with a class of 15-30 students.
- The materials list for each student group performing the experiment.
- The student instructions for the competition in clear, concise language/pictures.
- References for work cited/used.
  - The MS-PowerPoint file (see project_3_template.ppt):
    - The slides presented at the final project showcase.

- **Competition Demonstration and Presentation (35% of your grade)** – Due Thursday, May 1, 2014 during your scheduled UMass Lowell visit.
  - You will present a **working demonstration** of the engineering competition and a poster comprised of your PowerPoint slides. Your presentation should be no longer than five (5) minutes long. Poster board and competition content, relevance, and implementation will be judged by the community partners as well as guest engineering faculty.

- **Uniqueness & Creativity (15% of your grade)** – Due Thursday, May 1, 2014 during your scheduled UMass Lowell visit.
  - You will be graded on the uniqueness and creativity of your team’s engineering competition.

- **Attendance & Feedback (10% of your grade)** – Due Thursday, May 1, 2014 during your scheduled UMass Lowell visit.
  - This phase consists of you presenting your team’s competition and gaining feedback on it from fellow students and potential customers (i.e. our community partners). Each team will be provided forms to be completed for this deliverable on Thursday, May 1, 2014.

- **Tutorial Video Submission (2.5% Extra Credit) - Due Thursday, May 1, 2014 at 10am.**
  - You need to make and upload a **tutorial video** of the module to a video hosting service online, such as YouTube. You will need to submit the link to the video to Dr. Hajduk (Edward_Hajduk@uml.edu) prior to 10am on Thursday, May 1, 2014.
  - You will be graded on the content and quality of the demo. Your video should contain information about what you are looking to explain, how to build the model, how does it work, and final conclusion.
  - There is no limit on the duration of the tutorial video, but try to be concise.
3. Electronic File Deliverables

Download the **Project_3_Template.doc** and **Project_3_Template.ppt** template files from the course Blackboard site. Read the section descriptions in those documents and then place your text, images, etc. appropriately in the relevant sections.

*Note that these templates are in Microsoft Office 2003 formats for Word (.doc) and PowerPoint (.ppt). You will need to turn in your electronic files in these formats as well. Failure to do so will result in a reduced grade.*

The files should be renamed as follows:

**The MS-Word document you deliver should be named:**

Project_3_LastName1_LastName2_LastName3.doc

and **the MS-PowerPoint document:**

Project_3_LastName1_LastName2_LastName3.ppt

The last names should be in alphabetical order. Example: If the last names of your group members are Arlington, Belmont, and Cambridge, your file names should be:

*Project_3_Arlington_Belmont_Cambridge*.doc or .ppt

Failure to properly name your electronic documents WILL result in a project grade reduction of up 5% per file that is not properly named.

Once you have completed the electronic documents, you will submit them via email as detailed in Section 2.0.

1) **DO NOT PRINT THE DOCUMENTS** and hand the printouts in as an alternative to electronic submission. *Electronic submission is a requirement for this lab!*

4. Presentation Showcase Deliverables

During your scheduled UMass Lowell visit on Thursday, May 1, 2014, you will be expected to have the following deliverables as part of your presentation to the community partner(s):

1) **A working prototype of your engineering competition module:** This should be a working prototype to demonstrate the module that you are proposing teachers use in after-school programs. In other words, be prepared to start the engineering competition.

2) **A posterboard:** You will be expected to have a poster-board, no bigger than 4ft x 5ft that can be used to display 8.5” x 11” printouts of your PowerPoint
5. Requirements

After-school programs look for appropriate, fun, and innovative hands-on engineering experiments that educate and excite young children about science and engineering. Keep in mind the following core requirements as you design your shoebox module:

- **Make it SAFE:** First and foremost – keep your lab module safe. If you are concerned about certain aspects of safety (eg: cutting materials, etc), clearly outline the safety concerns in the lab manual and in the teacher supplement.
  - No combustables other than matches and candles.
  - No allergens – peanuts, latex, etc.
  - No chemicals requiring ventilation – Water based chemistry only
  - No animals
- **Make the module age appropriate:**
  - Make the project something that students in middle school would relate to.
  - Make it FUN – these projects are aimed at attracting students to science and engineering. It needs a WOW factor. EXCITE the students!!
  - Make the project something that students in the target age group will understand. They don’t need to know the subject matter, but they should be able to take some new knowledge away.
- **Keep it inexpensive:**
  - These projects will need to be reproduced at minimal cost.
  - Utilize recycled and easy to obtain materials.
  - Keep the cost for materials below $10.00.

6. Project Topics

The topic of your project should relate directly to engineering and should be relevant to students who are in Grade 4. To assist you in relating to that age group and help you understand some learning standards related to this age group, you can look at the learning standards for Grade 3-8 students within the Massachusetts Science and Technology/Engineering Curriculum Framework. You can download these learning standards via the course Blackboard site and at:

http://www.doe.mass.edu/frameworks/scitech/1006.pdf

You may also the Next Generation Science Standards (NGSS) as a guide for your project. The NGSS can be found at:

http://www.nextgenscience.org
You may choose ANY topic related to engineering. **Remember that you will be graded on originality so do not use the examples that are provided in the provided references!**

### 7.0 SLICE Project: What is SLICE?

This is a Service Learning Integrated throughout the College of Engineering (SLICE) project. The aim of the NSF funded SLICE initiative at UMass Lowell is to integrate *service learning* into a course. In our course, this project strongly leverages *service learning* by providing educational materials to encourage middle school to junior high school students to explore science, technology, engineering, and mathematics (STEM). The community partners and therefore customers for this project will be communities that need assistance teaching students in Grade 4 in these areas. These school programs will use whatever appropriate and meaningful learning modules you come up with to stimulate excitement about engineering fundamentals in the USA and elsewhere.

From the SLICE website ([http://slice.uml.edu](http://slice.uml.edu)):

We define service-learning as a hands-on learning approach in which students achieve academic objectives in a credit-bearing course by meeting real community needs. In engineering the students become better professionals and better citizens while the community benefits.

**SLICE project objectives:**

- **Integrate service-learning into the engineering curriculum at UML so that every student is exposed to service-learning in every semester of their experience in every department at UML.**
- **Study the art and science of service-learning.**
- **Create a formal program to connect faculty to community groups (local and international).**
- **Develop appropriate projects/experiments for integration of S-L into about forty core courses in the undergraduate engineering curriculum at UML.**
- **Develop assessment tools to gauge the impact of this integration on students, faculty, institution, and community.**
- **Become an engaged college—engaged with the students, each other as faculty across departments, and with the community.**