Biomedical Design and Manufacturing I
APPL 210 - Sophomore Year

INSTRUCTORS:
Professor Bob Dennis <bob@unc.edu>
TA: Jason Winnike <winnike@med.unc.edu >
114 Phillips Hall

INTRODUCTION:
This is the first in a series of three courses in Biomedical Design. The objectives for this course are (1) for you to develop skill with solid modeling (SolidWorks) software and (2) to transform one of your solid models into a physical object using a modern rapid manufacturing system. The skills you learn this year will be used throughout the BME design sequence.

COURSE STRUCTURE:
This is a self-paced course. There are no lectures and there is no text book. The posted meeting room and time are simply required by the University, but we will never meet as a class. You need to follow this syllabus closely throughout the term, and you need to gain access to SolidWorks software (see below). Each week you are required to do several online tutorials using SolidWorks. Later in the term you will also design a small object that we will build using a fusion deposition modeler (FDM).

SolidWorks (SW) Design Software
SolidWorks is now available for check-out and installation on your laptop:
Follow these detailed instructions:
http://www.bme.unc.edu/~bob/classes/soph-design/how-to-install-solidworks.pdf

If you have questions, please ask the TA for assistance:
Jason Winnike <winnike@med.unc.edu >

SUBMISSION OF HOMEWORKS:
The process for submitting your homework is simple.
1- Do each tutorial as listed below.
2- When finished, take a screen shot of your part
3- Use an application such as MS Paint to save the screen shot as a *.jpg image (not a BMP)
4- Name this image as follows:
yourONYEN-assignment code.jpg
EXAMPLE: Bob's first homework would be:
bobden-t1.jpg
5- Send your homework (the screen shot) each week to: Jason Winnike <winnike@med.unc.edu >

GRADING:
75% - SW homework assignments (due each week.)
Late assignments = 10% reduction per day late
25% - Rapid Manufacturing Project

HOMEWORK ASSIGNMENTS:
Week 1 is the first week of the term, even if it is just a fractional week. Each homework assignment is due by 5:00pm on Wednesday of the following week EXCEPT AS NOTED BELOW, 10% off per day late. For summer half terms you need to double your pace to complete the course on time.

Week #	Assignment	[assignment code]
1-	Tutorial 1-Parts	[t1]
	Tutorial 2-Assemblies	[t2]
	Tutorial 3-Drawings	[t3]
2-	30-Minute Lesson	[30min]
	Lofts	[lofts]
	Fillets	[fillets]
3-	Advanced Design	[advdesign]
	Advanced Drawings	[advdraw]
4-	Pattern Features	[pattern]
	Assembly Mates	[mates]
	Multibody Parts	[multibody]
5-	MEASURE & MODEL ASSIGNMENT #1	
6-	Blocks	[blocks]
	Toolbox	[toolbox]
7-	Revolves & Sweeps	[revsweep]
	eDrawings	[edraw]
8-	Design Tables	[tables]
	COSMOS Express	[cosmos]
9-	Sheet Metal	[sheetmetal]
	Surfaces	[surfaces]
10-	MEASURE & MODEL ASSIGNMENT #2	
11-	3-D Sketching	[3D]
12-	Mold Design	[mold]
13-	SolidWorks Animator	[animator]
	Customizing SolidWorks	[custom]
14-	FDM: Rapid Manufacturing Project (see below)	

DUE DATES:

Week	Due on this date and time
1	**September 2, 5:00pm**
2	**September 9, 5:00 pm**
3	**September 16, 5:00 pm**
4	**September 23, 5:00 pm**
5	**September 30, 5:00 pm**
6	**October 7, 5:00 pm**
7	**October 14, 5:00 pm**
--	**Break, no assignments due this week**
8	**October 28, 5:00 pm**
9	**November 4, 5:00 pm**
10	**November 11, 5:00 pm**
11	**November 18, 5:00 pm**
12	**November 24, 5:00 pm (Tuesday before break)**
13	**December 2, 5:00 pm**
14	**December 9, 5:00 pm**

NOTE: Each term we get a new installation of Solid Works. Usually about two or three of the tutorials do not work properly. We try to find "fixes" for this but we are not always successful. If this happens we will try to notify you before you get to that tutorial. If for some reason your computer will not run a specific tutorial, or if we determine it is not working that term and can not be fixed, then you will simply skip that tutorial. No worries.

MEASURE & MODEL ASSIGNMENTS #1 & #2

For these assignments you need to visit our laboratory (room 114 Phillips Hall). You should send an e-mail to Jason Winnike <winnike@med.unc.edu > to find out what times he will be available in the lab (room114 Phillips Hall) before you make your plan to visit.

When you come to the lab you should be prepared to stay there for about two hours. You should bring your laptop with SolidWorks installed on it. Other classes may also be there so you may need to wait a little while before someone can get you started.

One of the BME TAs is usually there during the afternoon each weekday, but is best to verify ahead of time. For the Measure & Model Assignment #1, you can start this early, any time after you have finished the first three tutorials, but you need to get it done by the due date. For Measure & Model Assignment #2 you can also start early if you want to.

You will be given several objects and several measuring devices, and you will be asked to measure and model the objects using SolidWorks. Detailed instructions will be given when you come to the lab. You will learn how to make accurate measurements and how to translate those measurements into features in your solid models.

The SolidWorks model that you make at first will only be a solid model of the object. For these two Measure & Model Assignments you need to turn in two things:

1- A screen shot of the solid model itself

2- A screen shot of a dimensioned drawing of the object

So, you will need to generate a dimensioned drawing of the object. This is basically what you learned from Tutorial 3 – Drawings. If you were to try to make the object using traditional machining processes (this is the most common approach) you would need a detailed dimensioned drawing.

FINAL FDM RAPID MANUFACTURING PROJECT:
Each student will use SolidWorks to design and fabricate one simple object using a fusion deposition modeler (FDM). You can click on the hyperlink to view the technical specifications for our FDM. These are very modern manufacturing machines that generally cost a lot of money to own and operate, so it is quite unusual for undergraduate students to have access to these machines. Our FDM was purchased for Prof. Dennis' research but he also makes it available to students so they can gain some experience with modern manufacturing technologies.

We will use polycarbonate material (PC) and our machine has a T-16 tip, which means that your part will be built in slices that are 0.010" thick, with strips of PC material that are 0.020" wide that fuse together into the final object. So, if your design has thin features the dimensions should be even multiples of these numbers (a multiple of 0.010" in thickness, and 0.020" in width in the X-Y plane).

Your assignment:

1-Design an object. This can be anything you like, so long as the total solid volume does not exceed 1 cubic inch (to save costs on FDM materials). Please do not design something trivial (such as a cube or a simple cylinder). Be creative.

2-Verify that the total volume of material does to exceed 1 in^3 (~16 cm^3). You can do this easily within SolidWorks by going to the SolidWorks menu and selecting Tools → Mass Properties. One of the output results will be the total volume of the part you have designed. You may need to convert from mm to inches.

3-Name the object as you would for your other tutorials (as instructed above).

4-Save the solid part as an *.stl file (it must be in *.stl format), and send as an attachment to: bob@unc.edu

5-Students can visit the instructor's lab to see how these parts are built. In a company you would do something very similar to this: generate a solid model and send it out to have it built by a rapid manufacturing facility.

PLEASE do not design a trivial object such as a solid cube or simple cylinder. Use your SolidWorks skills to take maximum advantage of this opportunity to use a modern manufacturing process.