

Junior BME Design and Manufacturing Syllabus

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INTRODUCTION:

In this course you will be introduced to the concepts of modern design practice and manufacturing processes. If you have not taken a BME design class yet, and have not done the SolidWorks tutorials, you need to do this in addition to the other material in this class (contact the instructor). There are no meetings for lectures. Course material is available on-line, and you will meet several times in the lab with the instructor at an arranged time.

DESIGN & MANUFACTURING LABORATORY:

Due to the large number of students this term, labs will be arranged for specific groups each week.

TOPICS:

- Lab 1: Safety and Reverse Engineering Introduction
- Lab 2: Reverse Engineering: Detailed study
- Lab 3: Biomedical Manufacturing Project
Rotating cylindrical bioreactor (NASA)

This term you will build a small rotating bioreactor vessel.

You will learn about a range of manufacturing processes and equipment. These will include:

- (1) Hand and power tools, belt sanders, grinders
- (2) Fusion Deposition Modeler (FDM)
- (3) Laser Cutter
- (4) Lathe: manual or CNC
- (5) Mill: manual or CNC
- (6) Welding (TIG, MIG, Gas, Ultrasonic, Solvent)
- (7) Heat treatment, surface finishing, anodizing hardness testing.
- (8) Gages and measuring instruments

MANUFACTURING PROCESS RESEARCH:

Individual students will select a common, simple biomedical product and will research the processes and materials used in the manufacture of that product. The students will then write a brief report. Things that should be included in the report are:

- Your name
 - What is the product and what are its uses
 - A brief history of the product (invented when/where)
 - Who manufactures the product?
 - What is the approximate cost?
 - What materials are used?
 - What manufacturing process are used?
 - What is done to ensure safety?
 - What variations or options are available?
 - References or sources of information
 - Examples; syringe, hypodermic needle, IV bag, scalpel.
 - Format: 12-point font, single spaced with images
 - Limit: 3 pages
- SUBMIT BY E-MAIL IN PDF FILE FORMAT

REVERSE ENGINEERING REPORT:

Students will work in groups of 7-8 (approximately) to disassemble and analyze a piece of equipment. A detailed report will be generated to attempt to describe the device in enough detail that it could be reproduced.

LECTURES (provided on web page and CD-ROM):

Each lecture will be divided into two core topic areas:

- 1- Modern Design Practices
- 2- Manufacturing Processes

Lectures can be downloaded from my web page at:

<http://www.bme.unc.edu/~bob/classes/junior-design/>

also available on CD-ROM if needed. At the end of each lecture is a brief design assignment which should be turned in the week the lecture is assigned. Assignments begin the first full week of classes (no assignment due over break).

LECTURE TOPICS:

- (1) Introduction; Overview of SolidWorks skills
Modern Design: The Process of Modern Design, Reverse Engineering
Manufacturing: Overview of Manufacturing
Assignment: simple modern object: first use
- (2) Modern Design: Problem Definition & Design Spec.
Manufacturing: FDM (Fusion Deposition Modeling)
Assignment: Write a simple design specification
- (3) Modern Design: Concept Generation & Selection
Manufacturing: Laser machining
Assignment: "Better Mousetrap": generate 5 concepts
- (4) Modern Design: Functional decomposition
Manufacturing: Machining processes: mill & lathe, hand tools
Assignment: design a component; functional decomp.
- (5) Modern Design: Benchmarking
Manufacturing: Welding, brazing, soldering
Assignment: SW component design, milling machine
- (6) Modern Design: Gantt charts
Manufacturing: Casting and Molding, Forming
Assignment: component design, forming processes
- (7) Modern Design: Detailed Design, Design Reviews
Manufacturing: Heat treatment & surface finishing.
Assignment: "detailed design" and tolerances
- (8) Modern Design: α - β Prototype, Evaluation, Engineering Change Notices (ECN)
Manufacturing: Water-jet, EDM, DMF
Assignment: biomed design: water-jet & Solid Works
- (9) Manufacturing: Materials Selection in Design
Assignment: none
- (10) Manufacturing: Biomedical Sterilization
Assignment: selection of sterilization processes
- (11++) Wrap-up of laboratory projects & reports

GRADING:

- 25% - Reverse Engineering Report (large team grade)
- 25% - Biomedical Manufacturing Project (individual)
- 25% - Manufacturing Process Research (individual)
- 25% - Individual assignments for each lecture