ME 5708  RAPID PRODUCT DESIGN AND OPTIMIZATION
FALL 2016

INSTRUCTOR:   Dr. Frank Liou
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OFFICE HOURS:  11:00am-12:00pm on Tuesdays and Thursdays (except as indicted in my
weekly schedule posted outside of my office or http://web.mst.edu/~liou)
or by appointment. E-mail communication is encouraged.

This course is also supported partially through Blackboard Instructional Software at the
following site: http://blackboard.mst.edu

TEXTBOOK:
Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development
(Dekker Mechanical Engineering), Frank W. Liou, CRC Press (September 2007).

COURSE OBJECTIVES:
The aim of this course is to discuss the engineering procedure and practice of applying modern
prototyping technologies, such as RP and VP, to quickly deliver new products in lower cost and
higher quality. The students will gain a thorough understanding of using product prototyping for
product design and development with modern technologies and tools.
- To facilitate learning of current product prototyping processes
- To facilitate learning and innovation of rapid product realization methodologies
- To facilitate learning skills and motivation for life-long learning in engineering product
development

WHAT YOU’LL LEARN:
- What is Rapid Product Realization?
- Examples of Rapid Product Realization tool kits and case studies
- How you can use tool kits to design and prototype new products, processes, systems

WHAT YOU’LL DO:
- Solve a prototyping challenge by asking “what would I do here? what has been done here?
what’s feasible?”
- Brainstorm and work with your classmates on rapid product realization
- Become acquainted with prototyping tool kits and principles
- Learn how to incorporate rapid product design techniques in your product prototyping project

WHAT YOU’LL TAKE HOME:
- A sense of possibility, because models already exist...in the past
- A procedure for bringing various ideas and tools to the rapid product design process
- Several rapid product realization experiences, including your classmates’
GRADING POLICY:

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<td>Semester Project*</td>
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<td>Peer evaluation and Instructor's Judgment **</td>
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Total = 508

* Projects: semester project. Projects could be three students, or four when with a distance student to form a group. Each group only needs to submit one report. At the end of the semester, each team member will submit a peer evaluation regarding to the individual effort.

** The "Peer Evaluation and Instructor's Judgment" score will be based on class attendance, participation in project evaluations, and on peer evaluation from team member.

FINAL GRADE:
Final grade will be based on percentage. If you make 90% overall, I’ll guarantee an A

80%  B
70%  C, etc.

If everyone gets over 90%, everyone will get an A, and I’ll be very pleased if you all do well.

SEMESTER PROJECTS:
One purpose of this course is to provide you with basic product design knowledge so that you can find extra information you need for engineering design during your life-long engineering career. The semester projects are aimed to integrate the knowledge you have learned from this class with any additional knowledge you find to accomplish the prototype design project. Therefore you need to document in detail all the prototyping activities related you used or considered in your design project.

Note: For the sponsored projects, the artifacts and prototypes will be returned to the course instructor by the last day of classes.
COURSE OUTLINES

COURSE INTRODUCTION

1. Introduction
   1.1. Develop a Successful Product

2. Product Prototyping
   2.1. Product Prototyping
   2.2. Prototype Planning and Management
   2.3. Prototype Cost Estimation
   2.4. Prototype Design Methods
   2.5. Prototype Design Tools
   2.6. Prototyping Materials and Tools
   2.7. Metal Alloys and Manufacturing
   2.8. Prototyping Processes
   2.9. Learning from the Past/Learning from Nature

[Exam 1]

Mid-term project presentations

3. Modeling and Virtual Prototyping
   3.1 Modeling and Virtual Prototyping
   3.2 Modeling of Physical Systems
   3.3 Modeling of Geometry, Materials, and Structures
   3.4 Product Modeling
   3.5 Virtual Prototyping/Design for AM

4. Additive Manufacturing (Rapid Prototyping/Rapid Manufacturing)
   4.1 Physical Prototyping
   4.2 Rapid Prototyping Procedure
   4.3 Liquid Based RP
   4.4 Processes Solid Based RP
   4.5 Processes Powder Based RP Processes

5. Prototype assessment and optimization
   5.1 Engineering Optimization
   5.2 Optimization Using Excel
   5.3 Design for Quality

Final Project Presentations

[Exam 2]
REFERENCES

- Crabb, H. C., The Virtual Engineer, SME, 1998
- http://real.uwaterloo.ca/~lars/examples.htm