ISAT 430: MATERIALS IN MANUFACTURING & PRODUCTION (SEC 1) - Fall 2016

COURSE AND INSTRUCTOR INFORMATION

Meeting Times: **Thursday** 5:30pm-7:30pm in the JMU X-Labs (Lakeview Hall)

Instructors: Nicole Radziwill, Ph.D., MBA - http://radziwill.cc
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NATURE OF COURSE CONTENT

COURSE DESCRIPTION

The course covers the engineering materials and processes used in fabrication of products including metals, polymer, ceramics, and composites from the perspective of structured, systematic product design to achieve quality objectives. The course provides a basic understanding of traditional (grown) materials, new materials, and smart materials. The properties of materials and elements of strength of materials will be covered. At the end of the course you will be able to:

- Define and understand basic terminology surrounding mechanical and physical properties of materials
- Describe the common manufacturing processes and the determination of its parameters
- Understand the relationship between process parameters, properties of materials, and product shape

COURSE STYLE & DELIVERY

This course implements the 10 Principles of the Burning Mind Project as its core value system. (http://www.burningmindproject.org/the-ten-principles/) As a result, the course is somewhat self-directed, blended (integrating online and in-class components), and gift-oriented. In many classes, you may ask "what can I get out of taking this class?" However, in this course, we want you to ask the question "what can I give to others as a result of my participation in this class?" Individual gifts are an important component. As you explore the topics, we request that you identify things you are good at and can contribute to a larger, team project. Help your classmates find you if they need your skills to build out a particular solution.

The course consists of one two-hour meeting per week. We will talk about concepts, watch and discuss videos, and do hand-on explorations that will help you and your team construct your product case study.

COURSE SCHEDULE *Subject to Minor Adjustments*

Date	Topic/Activity	Who
9/1	*Intro & Product Case Studies* Quick Intro - https://www.youtube.com/watch?v=g1BpNasM-os ISU Intro -- https://www.youtube.com/watch?v=YqctZa01f4g (50 min) **Read**: Farag Chapter 1	*Radziwill/Benton*
9/8	*The Role of Design Processes in Production* Ashby Diagrams - https://www.youtube.com/watch?v=KfZ44zfZh6I	*Radziwill/Benton*
9/15	**Product Descriptions & Requirements (Sections 1 & 2)** (*) **Teams** bring first full draft of product description & product requirements; we will present ideas and work on them in class Strange Materials -- https://www.youtube.com/watch?v=GEWFJiMK6CE (60 min)	**Students**
9/22	*Sustainable Product Design*	*Zhang*
9/29	*3D Modeling & 3D Printing*	*Benton*
10/6	*3D Modeling & 3D Printing (con'td)*	*Benton*
10/13	*Testing Physical Prototypes – **IN ROOM ISAT/CS 146 (Mfg Lab)***	*Showalter*
10/20	*Traditional Materials & Processes* • *Plastics* • *Metal (incl. Steel)* • *Glass & Ceramics* • *Wood* • *Textiles* • *Rubber & Composites*	*Student teams present 10-15 minutes on manufacturing processes for each class of materials* *(*Bring presentation!)*
10/27	*New Materials & Processes* • *MEMS, Nanotechnology, Piezoelectric materials, Biomimetic materials, synthetic spider thread, polymagnets, hempcrete/self-healing concrete, perovskites, Kevlar, silicone sponge, Hy-Fi, vantablack, electroluminescent skin, carbon fiber, wood-skin and flexible stone, electrochromic glass, bioplastics, Filterpave, Vireo, Enguard, Struxure, Enviroboards*	*Students present 5-10 minutes on manufacturing processes for each class of materials* *(*Bring presentation!)*
11/3	*Smart Materials and Cyber-Physical Systems* • *pH-sensitive polymers, programmable matter, artificial muscle, electroactive polymers, electronic skin, electrorheological fluid, ferrofluid, forisomes, nitinol, self-healing material, shape-memory alloys, smart film, smart fluid, smart glass, smart dust, topological insulators*	*Students and/or teams present 5-10 minutes on manufacturing processes for each class of materials*
11/10	**Materials Selection (Section 3) -** (*) Bring **individual** design concept write-ups to class and work with team to flesh them out **Read Before Class**: Farag Ch. 7 & 9	**Open Lab**
11/17	**Individual Design Concepts (Section 4) -** (*) Bring **individual** design concept write-ups to class and work with team to flesh them out	**Open Lab**
12/1	**Production Concepts (Section 5) -** (*) Bring **individual** production concept write-ups to class and work with team to flesh them out	**Open Lab**
12/8	*Evaluating Design Alternatives: Ashby, MCDM (AHP, TOPSIS)*	*Radziwill*
Finals	**Product Case Study Presentations**	**Students**

GOALS OF THE COURSE

Course Objectives: You will…

- Understand basic terminology associated with product design and materials science in manufacturing
- Learn about traditional materials, new materials, and smart materials
- Use structured design processes to describe design concepts for a product and (if applicable) its packaging
- Use qualitative and quantitative methods to select design alternatives
- Gain experience with equipment found in the makerspace environment (e.g. laser cutters, 3D printers, CNC machines) for prototyping

METHODS OF EVALUATION

GRADING

The goal of this course is to *produce artifacts* that demonstrate your understanding of materials, processing, and assembly in the context of a structured, systematic approach to product design. This course will follow the CHOOSE YOUR OWN GRADE policy:

Your grade will be based on:

- 50% Showing up, actively participation, bringing drafts on time!
- 50% Product case study & presentation

Grading Guidelines: 90-100 is an A, 80-89 is a B, 70-79 is a C, 60-69 is a D, below 60 is F. To receive a passing grade in this course, you must successfully conduct and complete the product case study with your team (and have your team acknowledge your contribution).

REQUIREMENTS & POLICIES

Textbooks:

Ilse van Kesteren, **Selecting Materials in Product Design.** PDF Provided.

Textbooks ON RESERVE in Product Design Collaboratory to help with your final projects include:

- Rob Thompson (2015), **Manufacturing Processes for Design Professionals**
- DeGarmo, Black, & Kohser (1997), **Materials & Processes in Manufacturing (8th Ed)**

Other:
MIT Open Courseware:

- **Week 1 - https://www.youtube.com/watch?v=KfZ44zfZh6I**
- Ashby charts for natural fiber composites: http://www.academia.edu/7040260/Natural_fibre_composites_Comprehensive_Ashby-type_materials_selection_charts

Facebook:
Join our class Facebook group at https://www.facebook.com/groups/262216220608559/
Note: Classes NOT at JMU will also be sharing our group. It is a great way to meet other students in stats!

Statistical Software:
R - Free, Open Source!

1. Download it onto your computer from http://www.r-project.org (instructions are in "Intro to R" in Course Materials as well as first chapter of your textbook) 2. Or use it in the ISAT labs.

Attendance Policy and Final Exam: The way to succeed in this class is to SHOW UP AND ACTIVELY PARTICIPATE during EACH of our scheduled class sessions. If you need additional help *beyond regular class sessions*, just ask. But you need to show up for the regular class sessions first.

> Question: **WHAT DO I DO IF I MISS A CLASS?** Answer: Check with **classmates**, or post your questions to Facebook. Do not ask instructors what you missed, or if you can make a class up.
>
> Question: **SHOULD I EMAIL/TEXT/STOP YOU BEFORE/ AFTER CLASS TO LET YOU KNOW IF I WILL MISS A LECTURE?** Answer: **No, unless you expect to be out more than once**. It's your responsibility to leverage *online resources and your classmates* to figure out what went on during the session, if you must miss it.

Incompletes: We do NOT give incompletes in this class.

Honor Code: You are expected to read, understand, and abide by the JMU Honor Code (http://www.jmu.edu/honor/code.shtml) at all times.

Special Needs: If you are a student who is registered with the Office of Disabilities, I need to be given written documentation to support your situation in order to provide you with any accommodations (this is required by law). **Plans for any accommodations MUST be made within the first week of this course**.

Contacting the Instructor: You can contact the instructor any time (24/7) via email or SMS to 703.835.6336. If you text, PLEASE say who you are, and from what class. I really honestly don't mind being contacted at any time of day because I am often awake very late, so there's as good a chance of your question getting answered at 3am as there is at 3pm. If I'm really busy or asleep, I'll turn my ringer off. If you don't hear from me within 24 hours, contact me again. WE ARE ALWAYS HAPPY TO HELP YOU OUT.