CHEME 4630
PRACTICE OF CHEMICAL ENGINEERING PRODUCT DESIGN
SPRING 2015

Schedule:

Lecture   Tues./Thur. : 1.25 pm – 2.40 pm   Olin Hall 216
Meetings / Presentations: TBD

Instructor: Tobias Hanrath   350 Olin Hall; th358@cornell.edu
Office Hours   by appointment*

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Course Content and Educational Objectives:

Students prepare a stage-gate feasibility study of a chemical product including market and economic analysis, patent search, environmental, regulatory, and safety issues. Students will work in design teams to: (i) capture the voice of the customer, (ii) create a house of quality to establish target specifications, (iii) generate and select product concepts, and (iv) perform a design of experiments to guide prototype development and testing. Other key topics and deliverables include intellectual property and patent search, environmental impact assessment, and financial and business analysis.

Students will apply basic concepts of Chemical Product Design to develop new food products. Student teams will work with Cornell's Food Processing Development Laboratory. Key topics of product design and development will be reviewed in lectures in the form of a case study review.

This is a project-based course in which you will improve team work, communication and project management skills. Development teams will meet with their managers weekly in to present key development milestones. Students develop presentation and teamwork skills through weekly presentations of their work to date followed by a final presentation to a panel of internal and external appraisers.

Textbook and other resources :
- *Product Design and Development* (Ullrich & Eppinger)
- *Chemical Product Design* (Cussler and Moggridge; available online at CU library)
- *Taguchi Techniques for Quality Engineering*, (Ross, ChemE4610 text)
- Other resources posted on course website

Prerequisite:
ChemE 4610 – Concepts of Chemical Engineering Product Design. This course is designed to be a practical project-based course building on key concepts established in the prerequisite course.

Website: Important course information, additional reading materials and lecture slides will be made available on the blackboard course website.

Academic Integrity: Each student is expected to abide by the Cornell University Code of Academic Integrity.
[see: http://www.policy.cornell.edu/Code_of_Academic_Integrity.cfm and http://www.theuniversityfaculty.cornell.edu/AcadInteg/]. In accordance with this policy, it is the instructor's understanding and expectation that the student's signature on any assignment means that the student neither gave, nor received unauthorized aid Authorized aid includes: (1) discussing the interpretation of the problem statement, (2) sharing ideas or approaches for solving the problem, and (3) explaining concepts involved in the problem. All cases of academic misconduct will be forwarded to the Academic Integrity Hearing Board. The consequences for an academic misconduct conviction range from academic probation to suspension or expulsion from the University.

Class Preparation and Participation

Reading assignments for course sessions are given in the class schedule of the syllabus. You are expected to come to class prepared to discuss the readings and suggested questions. Your individual class participation grade will be based upon your in-class remarks during discussions.

Grading

The performance of the team in weekly meetings and presentations will be graded by the project manager.
- 60% quality of your team's work on weekly deliverables (presentations and meetings)
- 12% quality of your team's work on the final presentation and report
- 16% quality of your in-class contributions and individual assignments
- 12% quality of your peer evaluation ratings given by your team members

Projects

A key part of this project-based course will be to design a new product and to develop a functional prototype. The goal of this project is to learn principles and methods of product design and development in a realistic context (i.e., hypothetical setting of a company).
Projects will focus on food-based products; product prototyping will be performed in Cornell's Food Processing and Development Laboratory:
[https://foodscience.cals.cornell.edu/about-us/facilities/ithaca-facilities/food-processing-and-development-laboratory]
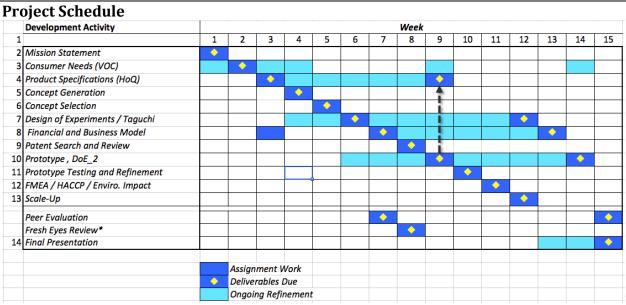
The project development follows a schedule of weekly deliverables detailed in the Gantt chart below. The assignments are intended to pace the development process if the schedule. In light of the fact that this is an accelerated (14 week) development schedule, there is no slack and weekly deliverables should be completed during the scheduled week to keep the product development on schedule. Each team member is expected to contribute substantially to the development team. Peer evaluations will be used to provide feedback to each other and to indicate to the managers how the team is functioning.
We have limited funds to reimburse expenses of the project team related to the course. Each team will be allocated a budget of $1500 to cover prototyping expenses.

Intellectual Property Rights

The student teams will be able to retain the rights to any inventions they develop in this course. If a team should decide to pursue a patent, they may do this on their own. Alternatively, the team can "disclose" their invention with the CCTEC, which may be interested in patenting it, in exchange for a portion of any licensing royalties. Feel free to speak with the course faculty about these and other options. Teams should spend some time during an early meeting agreeing in advance on how to distribute any economic rewards arising from the intellectual property you create. Be sure to keep dated records showing the evolution of your ideas.

*"I hear and I forget. I see and I remember. **I do and I understand**."*

<div align="right">孔子 – Confucius</div>

Project Schedule

Development Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mission Statement	♦														
Consumer Needs (VOC)		♦													
Product Specifications (HoQ)			♦						♦						
Concept Generation				♦											
Concept Selection					♦										
Design of Experiments / Taguchi							♦					♦			
Financial and Business Model								♦					♦		
Patent Search and Review								♦							
Prototype , DoE_2									♦					♦	
Prototype Testing and Refinement											♦				
FMEA / HACCP / Enviro. Impact												♦			
Scale-Up													♦		
Peer Evaluation							♦								♦
Fresh Eyes Review*								♦							
Final Presentation															♦

■ (dark blue)	Assignment Work
♦	Deliverables Due
■ (light blue)	Ongoing Refinement

Course Schedule

Week	Tuesday	Thursday (Lecture Topics)	Development Activity	
1 (1.19)		[1] Introduction development processes {UE1,2}		
2 (1.26)	[2] Customer needs {UE5}	[3] Customer Needs {UE5}	Mission Statement	M
3 (2.2)	[4] HOQ_1 {BB}	[5] HoQ_2 food {BB}	Consumer Needs (VOC)	P
4 (2.9)	[6] Concept Generation {UE7}	[7] Concept selection and testing {UE8}	HOQ and Target Specifications	M
5 (2.16)		[8] DoE planning {UE15,BB,R}	-	
6 (2.23)	[9] DoE analysis {UE15,BB,R}	[10] DoE, fresh eyes review	Concept Generation and Selection	P
7 (3.2)	[11] Economics2; lean launchpad {UE17,BB}	[12] IP and patents {UE16}	Design of Experiments / Taguchi	M
8 (3.9)	[13] Prototyping {UE12,BB}	[14] Risk Management {BB}	Financial and Business Model	P
9 (3.16)	[15] Product Planning {UE4}	[16] FMEA / HACCP {BB}	Patent Search and Review	M
10 (3.23)	[17] scale-up and manufacturing {CM}	[18] scale-up and manufacturing {CM}	DoE_2 analysis / risk mgmt.	P
11 (4.6)	[19] LCA (packaging) {BB}	[20] Case Studies {BB}	Prototype Testing and Refinement	M
12 (4.13)	[21] Case Studies {BB}	[22] Case Studies {BB}	FMEA / HAACP / enviro. impact	P
13 (4.20)	[23] entrepreneurship / VC pitch	[20] entrepreneurship, business model {BB}	Scale-up	M
14 (4.27)	[24] final presentation	[25] TBA	Final Presentation	P

M- meeting; P-presentation
Reading assignments: {UE}–Ullrich Eppinger, {BB} blackboard course website; {CM} - Cussler Moggridge, {R} Ross

Mission Statement → **Identify Customer Needs** → **Establish Target Specifications** → **Generate Product Concepts** → **Select Product Concept(s)** → **Test Product Concept(s)** → **Set Final Specifications** → **Plan Downstream Development** → *Development Plan*

Perform Economic Analysis

Benchmark Competitive Products

Build and Test Models and Prototypes