

## **Course Syllabus**

### **BBE 3002 Introduction to Engineering Design (3 cr) (Fall)**

**Course Description:** Introduction to identify, formulate, develop and complete open-ended engineering designs in bioproducts and biosystems engineering at the conceptual level; to understand and apply engineering economics principles for the design project; to understand and apply the safety/health considerations and engineering ethics for the design project. Design projects involving written, graphical, and oral presentations.

**Prerequisites** (Math 1271 or Math 1371, Chem 1021) BBE lower division (soph) or upper division (jr) students; fr writing req, or instr consent )

#### **Class Schedule and Locations**

Lecture: MW 01:55 pm - 02:45 pm, 106 BAE Building, St. Paul

Lab: M/W 03:00 pm – 05:00 pm, 105 BAE Building, St. Paul

#### **Grading System:**

Two exams during the semester (Open Book)	40%
Homeworks and Lab Assignments	30%
Design Project including oral presentation and written report	30%

#### **Text:**

Class Notes

#### **References (to be kept in St. Paul campus library)**

Madara Ogot, Gul Okudan-Kremer, Engineering design: a practical guide, Togo Press, LLC. 2004, 544 pages.

Product & Process Design Principles: Synthesis, Analysis and Design, 3th Ed., Warren D. Seider, J. D. Seader, Daniel R. Lewin, Soemantri Widagdo , Wiley; 3 edition (December 22, 2008)

Kangas, P.C., Ecological Engineering, Principles and Practice, Lewis Publishers, 2004

Mitsch, W.J. and S.E. Jorgenson, Ecological Engineering and Restoration Ecology, 2003

van Andel, J. and J. Aronson, Restoration Ecology, Blackwell Publishing, 2006

Cussler E. L. , Moggridge, G. D. (2001) Chemical Product Design, Cambridge University Press

Blank, L.T., Tarquin, A. J. (1989) Engineering Economy, Third Edition, McGraw-Hill Publishing Company.

Felder R.M., Rousseau, R.W. (2000) Elementary Principles of Chemical Processes, Wiley.

Perry, R. H. and Chilton, C. H. (1984) Chemical Engineers' Handbook, 6<sup>th</sup> Edition, McGraw-Hill, New York.

References in Food Engineering?

Martin M. and Schinzinger R. (2009) Introduction to Engineering Ethics, 2nd Edition, McGraw-Hill Higher Education, Boston,

Whitbeck C. and Flowers W. C, (1998), Ethics in Engineering Practice and Research, Cambridge University Press, New York.

### **Course Objectives**

1. Introduce the design process including problem formulation, creativity, alternative solutions, decision criteria, functional and economic evaluation, and implementation.
2. Introduce concepts related to effective teams.
3. Apply the design process to a problem from the field of bioproducts and biosystems engineering in the form of a team design project.
4. Introduce principles of engineering economics for comparing the economic feasibility of alternatives and apply these principles in the design project.
5. Introduce principles of safety analysis applied to design and apply them in the design project.
6. Introduce principles of engineering ethics applied to design and apply them in the design project.
7. Introduce the principles of engineering design tools and their applications in design.
8. Provide opportunities for oral and written presentations of engineering work in the context of the design project.

### **Topics:**

1. Introduction to engineering design principles and design process
2. Design process/teamwork/projects
3. Safety in design
4. Engineering economics principles and applications in design
5. Engineering ethics and applications in design
6. Introduction to engineering design tools and applications
7. Introduction to computational programming tool such as Matlab with applications
8. Presentations/Powerpoint

**Course Structure** (tentative)

Week				
1	Lec	Introduction and Course Overview	Lec	Intro. to engineering design
			Lab	Into to the Lab and overview
2	Lec	Intro. to engineering design	Lec	Design Process, team work and projects
			Lab	Examples for the engineering design
3	Lec	Design process	Lec	Design Process
	Lab		Lab	Project assignments to the students and review of all the projects
4	Lec	Creation of a design	Lec	Environmental considerations
	Lab	Introduction to computational programming tool and applications*	Lab	Introduction to computational programming tool and applications*
5	Lec	Engineering Safety in design	Lec	Engineering Safety in design
	Lab	Introduction to computational programming tool and applications*	Lab	Introduction to computational programming tool and applications*
6	Lec	Engineering Safety in design	Lec	Engineering Safety in design
	Lab	Introduction to computational programming tool and applications*	Lab	Introduction to computational programming tool and applications*
7	Lec	Engineering ethics	Lec	Engineering ethics
	Lab	Introduction to computational programming tool and applications*	Lab	Introduction to computational programming tool and applications*
8	Lec	Mid Term Review of Design Project Progress	Lec	Mid Term Review of Design Project Progress
	Lab	Introduction to	Lab	Introduction to engineering design

		engineering design tools and applications**		tools and applications**
9	Lec	Engineering Economics and Applications	Lec	Engineering Economics and Applications
	Lab	Introduction to engineering design tools and applications**	Lab	Introduction to engineering design tools and applications**
10	Lec	Engineering Economics and Applications	Lec	Engineering Economics and Applications
	Lab	Introduction to engineering design tools and applications**	Lab	Introduction to engineering design tools and applications**
11	Lec	Engineering Economics and Applications	Lec	Engineering Economics and Applications
	Lab	Introduction to engineering design tools and applications**	Lab	Introduction to engineering design tools and applications**
12	Lec	Principles of Statistics and Applications in Design	Lec	Principles of Statistics and Applications in Design
	Lab	Design Project development	Lab	Design Project development
13	Lec	Design Project development	Lec	Design Project development
	Lab	Design Project development	Lab	Design Project development
14	Lec	Design Project development	Lec	Design Project development
	Lab	Design Project development	Lab	Design Project development
15	Lec	Oral presentation	Lec	Oral presentation
	Lab	Oral presentation	Lec	Oral presentation

- \* Due to enrollment and lab capacity this will be taught in two lab sessions
- \*\* Depending on the emphasis area, students can choose to participate in one of the two lab sections dealing with engineering design tool and its applications – process and product (HiSys or other equivalent design tool) or environment and ecology (Geographic Information System (GIS))