TO: The Faculty of the College of Engineering

FROM: The School of Engineering Education

RE: New Undergraduate Course: IDE 38500: Design Methodologies for Diverse Stakeholders

The faculty of the School of Engineering Education have approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

IDE 38500 Design Methodologies for Diverse Stakeholders
Terms offered 1, 2, Lecture 3, Cr. 3.
Requisites, Restrictions, and Attributes: none

Description: This course focuses on engineering design methodologies with a concern for the needs of diverse stakeholders. The course brings together topics drawn from a variety of disciplines (including anthropology, education, psychology, human-computer interaction and engineering) to introduce interdisciplinary engineering approaches to: (1) design tools, systems, and/or environments to support cognitive processes and (2) engage in human-centered and learner-centered design. The semester design project provides a context for students to apply these methods.

Reason: This course will be offered in the Multidisciplinary Engineering and Interdisciplinary Engineering Studies (MDE and IDES) programs, and will serve as an important part of design instruction prior to the major senior design project. ABET visitors have suggested that more ENE faculty should be actively involved in MDE course offering and this course would help achieve this goal. It will also be open to students in all other engineering programs, and to students across campus with interests in design focused on stakeholder needs (including education and psychology).

There are three primary learning outcomes associated with the course:

- Students will learn about cognitive processes (including learning processes), how to design products, processes and environments to support cognition
- Students also learn methodologies and develop skills to be able to apply human-centered principles in the design of interfaces, every-day products and learning environments, whether in industrial or academic settings.
- Students will engage in reflective practices to connect the course material to previous learning experiences as well as personal learning goals, with a goal of furthering their life-long learning skills.

Donna Riley, Kamyar Haghighi Head
School of Engineering Education

IDE 38500: Design Methodologies for Diverse Stakeholders

Course instructor: Monica Cardella

Full course description:

This course focuses on engineering design methodologies with a concern for the needs of diverse stakeholders. The course brings together topics drawn from a variety of disciplines (including anthropology, psychology, human-computer interaction and engineering) to introduce students to interdisciplinary engineering approaches to: (1) design tools, systems, and/or environments to support cognitive processes and (2) engage in human-centered and learner-centered design. The semester design project provides a context for students to apply these methods.

A fundamental premise of this course is that engineering design work exists within a social context, where engineers work in teams to meet the needs of people. To create an innovative and compelling solution, then, it is critical to understand the needs and "pain points" of the people we are designing for and to account for their needs, their wants, their cognitive abilities, and their ability to learn to use the products and processes we design. In this course, students receive an introduction to human cognition and information processing and insight on cognitive and socio-cognitive theories of how people learn. The course takes an experiential (experience yourself) and pragmatist (learning by doing) approach to connecting theory to practice. Students will learn a variety of methodologies that can be used to better understand the primary users of designed artifacts and other stakeholders associated with the design context. In-class exercises provide opportunities for students to practice data collection, data synthesis and generative design techniques and the semester design project provides a context for students to apply these methods. While the primary focus of the course is on the products and processes that engineers design, the same principles and approaches can be used in other design contexts, including product design and instructional design.

Course Performance Objectives

At the end of this course, learners will be able to:

- Describe and evaluate different methods for understanding stakeholder needs (e.g. literature review, expert interviews, user observations, interviews, focus groups, verbal protocol analysis, and task analysis)
- Appropriately apply different techniques in order to learn more about how people think and learn
- Analyze data collected about stakeholders and interpret the collected data to inform design decisions
- Apply and translate a systematic design process and the knowledge of how people think and learn in the design of user-centered products and/or experiences
- Create prototypes of design solutions that can be tested with users
- Design and carry-out user tests that help validate/refine design solutions

- Synthesize different user-centered design approaches into a reflection of one self and a user-centered design philosophy.
- Reflect on themselves and other users in regards to how learning occurs and how people cognitively interact with designed artifacts.

Grading: The final grade will be based on the following:

Assignment	Individual/Group	Points
Participation (in-class activities and discussion)	Individual	**5**
Needfinding Assignment	Both	**10**
Reading Reflections (Reflection on Weekly Readings)	Individual	**10**
Resource Sharing	Group	**5**
Design Journal	Individual	**15**
Self-reflection and Design Philosophy Paper	Individual	**15**
Group Design Project • **9 Interim Reports** • **1 Final Report** • **1 Project Presentation**	Group	**40**
Total	**50/50**	**100**

The scale for course grades will be A (90-100); B (80-89); C (70-79), etc.

Texts: No Required textbook: Readings will be provided via Blackboard.

Sample course schedule (from Fall 2017)

This course will evolve with your interests, with questions you will have and with progress and directions you want to pursue. The following plan is subject to change (see Blackboard for the latest version):

Week	Class # Date	In Class Activity	Reading before class	Individual Assignment	Group Assignment
1	Class 1 Aug 21	Introduction to the course, review of the syllabus			
1	Class 2 Aug 23	User Experience and Models of Design	Designing Waits that Work Set Phasars on Stun Ch 1	Reading Reflection	
2	Class 3 Aug 28	Conceptual models, mappings, affordances, visibility and feedback	Ch1: Design of Everyday Things	Reading Reflection	

Week	Class # Date	In Class Activity	Reading before class	Individual Assignment	Group Assignment
2	Class 4 Aug 30	Needfinding & Methods for collecting information on users' experiences			
3	Class 5 Sept 5	Needfinding & Methods for collecting information on users' experiences, cont'd Discuss the group project	TBD	Reading Reflection	Needfinding Plan Due by end of class
3	Class 6 Sept 7	Data Collection			
4	Class 7 Sept 12	Analyzing Data		Needfinding Data due	
4	Class 8 Sept 14	M1 Project workday			
5	Class 9 Sept 19	Information processing and methods for studying cognitive processes Discuss "Resource Sharing"			Needfinding Data Analysis/final report due M 1: project prospectus
5	Class 10 Sept 21	Memory, Expertise and Learning	How People Learn; Learning Science in Informal Environments	Reading Reflection	** proposal for Resource Sharing**
6	Class 11 Sept 26	Problem solving, design	Jonassen 2011; design handout	Reading Reflection	M 2: Initial data
6	Class 12 Sept 28	"Resource Sharing" presentations		"Resource Sharing" presentations	
7	Class 13 Oct 3	Culture	Set Phasers on Stun	Reading Reflection	
7	Class 14 Oct 5	Creating Persona, Scenarios and Storyboards			M 3: background review and identify design issues and specifications
8	Class 15 Oct 10	Fall Break			
8	Class 16 Oc 12	Guided project work: creating persona, scenarios and storyboards	Ch from Interaction Design	Reading Reflection	

Week	Class # Date	In Class Activity	Reading before class	Individual Assignment	Group Assignment
9	Class 17 Oct 17	User-centered design principles and design guidelines	Ch 7 – DOET	Reading Reflection	M 4: generate user persona, scenarios & storyboards
9	Class 18 Oct 19	Creating Magical User Experiences			
10	Class 19 Oct 24	Guided project work: initial prototypes			
10	Class 20 Oct 26	Cognitive Task Analysis	1-2 Readings, TBD	Reading Reflection	M 5: prototype
11	Class 21 Oct 31	Finding out if a product/process fulfills the user's need? – Usability testing	Interaction Design chapter 14	Reading Reflection	
11	Class 22 Nov 2	Strategies for usability testing – observations, think-alouds and eye-tracking			M 6: Task Analysis
12	Class 23 Nov 7	Peer Reviews			
12	Class 24 Nov 9	Limitations of user-centered design	Norman 2005	Reading Reflection	M 7: field trials-1 with prototype (submit findings)
13	Class 25 Nov 14	NO CLASS - Project Work Time			
13	Class 26 Nov 16	TBD	TBD	Reading Reflection	
14	Class 27 Nov 21	Presenting your work: tips from graphic design			M 8: Prototype revisions & field trials 2
14	Class 28 Nov 23	Thanksgiving			
15	Class 29 Nov 28	Guided project work: project presentations			M 9: assessment & define improvements for milestone 10 (Status Report due)
15	Class 30 Nov 30	Project Presentations		Self-Reflection Paper due	Project Presentations
16	Class 31 Dec 5	Reflection I		Self-Reflection handout due	
16	Class 32 Dec 7	Reflection II			

Week	Class # Date	In Class Activity	Reading before class	Individual Assignment	Group Assignment
Finals	Dec 13	No Final Exam			Turn in final project paper by 5pm Dec 13

Course offering and enrollment history:

The course, or related experimental courses, have been offered five times under the ENE 59500 number. Even though the course has been a 500-level course, the majority of students taking the course have been undergraduates, and we are intending to re-focus the course to serve primarily the undergraduate students in the MDE and IDES programs. An average of 13 students have enrolled with each course offering, but we expect that to go up to 20 as the course integrates fully into the MDE and IDES programs. We plan to offer the course annually.

Semester Offered	Undergrad Enrolled	Grad Enrolled
Spring 2010	11	6
Spring 2012	10	0
Fall 2013	1	6
Fall 2015	18	3
Fall 2016	9	3
Fall 2017	22	0
Average	~12	~4