Design Courses (submitted)

NSF Interdisciplinary
Graduate Design Workshop

d.school, Stanford University
August 28-29, 2009

Leadership By Design – Design By Collaboration
Processes for Illuminating and Expanding the Box
submitted by Bruce Corson, Studio for Pre-Expert Creativity
An exploration of the collaborative, cross-disciplinary design process and the pre-expert leadership skills necessary for its effective engagement. We will develop fundamental sensibilities for perceiving and characterizing problematic situations and practice designing robust responses to the problems we derive from them. The course will provide a critical foundation for students whose future includes responsibility for identifying and responding effectively to novel circumstances.

Designing Day One
Securing a Space for Creative Collaboration
submitted by Bruce Corson, Studio for Pre-Expert Creativity
The potential of collaboration lies in discovering opportunity space beyond the horizons of our individual and collective awareness. Our most important task on the first day of a collaborative undertaking is to design a haven for understanding, receiving and sustaining this creative potential. In this haven, we can transform how we engage problematic situations - how we detect them, how we explore them, how we derive "problems" from them and how we define success in responding to them; in it, we can transform how we engage with each other. When we fail to consciously establish this haven, we default to a dynamic common to most conventional "collaborations" – the tendency to assert expertise and seek and see only familiar problems with familiar solutions. The consequence of this behavior is that "all the serious mistakes are made the first day." In this seminar, we will explore conscious sensibilities and practices that engage collective creativity on Day One and lead to elegant collaborative design.

Rube Goldbergineering
submitted by Shawn Jordan, Purdue University
Do you enjoy building machines and inventing new solutions to problems? Come join a design team to brainstorm and build creative contraptions to solve everyday problems in a complex way. This course will use hands-on learning to emphasize science, technology, and engineering concepts.

ARCH 497c DigiFAB
submitted by David Celento, Pennsylvania State University
This course investigates emergent tools for creative fabrication, including: rapid prototyping, laser-cutting, laser-scanning, CNC milling, and haptic carving devices. Students are asked to explore these tools through unique fabrications.

ARCH 497D X-Disciplinary Creativity: Smart Products for Tomorrow
submitted by David Celento, Pennsylvania State University
Taught in a studio learning environment, students from engineering, design, computation, and business backgrounds will work together to design and develop Innovative Smart Products. Teams will be cross disciplinary in nature and consider all aspects of the design, creation, fabrication, and marketing of products with embedded intelligence.

ARTGR 672 Graphic Design & Human Interaction
submitted by Sun Kang, Iowa State University
The theory and investigation of experience design as it applies to human interactions in contemporary society and culture. Studio problems may involve such areas as: exhibition design, electronic interface design, wayfinding, package design, and publication design. Section A: Usability. The exploration and design of interface/interaction with products, systems, and technologies.

ARTGR 672 (HCI595X) Human Interaction Design: Design for Behavioral Change
submitted by Debra Satterfield, Iowa State University
This course examines the roles of emotion, cognition, behavior, and motivation as a methodology for designing and evaluating the effectiveness of experience design. It also examines the role of experience design as a socially mediating device that can serve as a way of moderating or enhancing social inclusion. In particular educational experiences and technology are examined with respect to their inherent socially mediating properties.
A studio project for the design of an educational game is used to teach audience analysis, creative problem solving, behaviorism, educational strategies and multi-sensory communication to graphic design and engineering students. Students must select a target audience of children with epilepsy, autism, or cerebral palsy between the ages of 2 and 5 years old. Their

solution must incorporate the use of sign language, an age appropriate learning objective, and a game paradigm to socially mediate play-based interactions with typical peers, caregivers or parents. The game must be fun and motivational to the child with disabilities and with typical peers. Students must consider the unique abilities and challenges faced by children with developmental disabilities. Their solutions must make the learning process easier for non-experts and must include a system to reward users for correct responses.

BUS Design and Systems Thinking for MBAs

submitted by Sara Beckman, University of California, Berkeley

This course will explore core elements of different ways of thinking – critical thinking, system thinking, design thinking – and work with the students to develop a toolkit of tools and techniques that MBA students should have that derive from them. We'll also cover visualization, storytelling, scenario planning, and other such methods often used in these "thinking" domains.

BUS Design as a Strategic Business Issue

*submitted by Sara Beckman, University of California, Berkeley**

Companies are increasingly looking to design as a source of competitive advantage. In a world made increasingly competitive through globalization and technological advancement, design is a differentiator that creates customer value and competitive separation. In fact, innovation is the only sustainable form of competitive advantage. Design is the process of systematically creating successful innovations. Many think design is only about form – the creation of beautiful objects - but good design balances form, function, and performance. Further, the kind of design thinking that is applied to products can also be applied to services, processes, customer experiences, and business models. The purpose of this course is to help students learn design thinking – the skill to systematically create innovative solutions to business problems. The course will explore the relationship between business strategy and design.

BUS Innovation, Creativity and Entrepreneurship

*submitted by Sara Beckman, University of California, Berkeley**

Business "innovation" and "creativity" are terms used frequently in today's business world to describe companies or projects that go beyond conventional thinking. Many young job-seekers, like those graduating from UC Berkeley, seek jobs with organizations that are creative in the way that they define their business, run HR practices, and compete in the marketplace. These innovative businesses – whether they be corporate "intrapreneurial" projects or small entrepreneurial startups -- and their inspiring leaders are highly valued in today's market. This course aims to capture the challenge and excitement of these companies and provide students with an opportunity to understand the underpinnings of this innovation.

The Innovative Organization designs, develops, markets, sells and finances its product or service in a way that sets it apart from its competitors. In today's fast-paced Internet- and telephony-driven world, innovation is both a desired trait and a necessity for survival. But how do organizations capture, develop, embrace, and harness innovation? How do employees (often the founders or leaders) bring creative individualism to the organization? Highly differentiated and unique business start-ups are often led by a leader who understands how to harness the power of the innovative organization.

BUS Design Practicum, New Product and Services Lab

*submitted by Jaewoo Joo, Rotman School of Management, University of Toronto**

This course offered to MBA students as an elective in their second year. The student teams are usually comprised of 6 students per group. Each team is multi-disciplinary, incorporating many skill sets including Business, Engineering, Liberal Arts, Science, and Industrial Design. The project or problem requires deep understanding of human factors and calls for new and 'game changing' solutions. In particular, teams will be expected to: a) Develop a deep user understanding by uncovering customer insights in current markets; b) Develop new product/service ideas based on an understanding of unmet needs; c) Translate ideas into concepts; c) Do a complete market analysis, including potential, size, segmentation, and potential adoption profiles; d) Test their concepts using consumer research; and e) Develop a viable business plan. At the end of the practicum, teams will present their plans to faculty and industry representatives. The intent of the program is to complete the innovation cycle from deep user understanding of insights and needs through to innovation prototypes and strategic business design.This course spans terms 3 and 4, and students cannot take the course in one term without taking it in the other term.

BUS Innovation, Foresight, and Business Design
*submitted by Jaewoo Joo, Rotman School of Management, University of Toronto**
This course offered to MBA students as an elective in their second year. It aims to prepare the MBA candidate for the ambiguous challenge of creating and supporting a real culture of innovativeness within the framework of an organization. In content, manner and style, this course has been designed to focus on developing the candidate's ability to inspire discovery and learning within teams as well as increasing the value of their own creativity. Students will work with "pre-design" methods that will help them to identify and validate ideas and transform these results into pre-competitive products, services and systems. Finally, this course will explore how these insights inform strategic decision-making and ultimately create wiser policy options, by realigning the desires of people with the potential of new technology and the capabilities of organizations. Students will work in teams to evaluate global behavior shifts in the context of strategic innovation and define opportunities for new business models. The coursework is designed to: a) Help students to unlearn in order to see from new perspectives, b) Recognize and assign meaning to local and global patterns of emergence in behavior, c) Translate these behavior signals into future opportunities, d) Explore the experiential value of these opportunities, e) Describe the support structures required to deliver on these experiences, and f) Propose models of translating these experiences into corporate wealth

BUS Strategic Product Design for MBA students
submitted by Mark Henderson, Arizona State University
This course teaches methods and tools to link the strategic elements of product and process development with the technical decisions and engineering and other capabilities of the firm. This course involves active learning, discussion, and interactive exercises. Using a broad selection of readings from management, design and technology and several case studies, students learn the development process and practice it by developing a new product starting with customer selection and observations through needs identification, success metrics, concept generation, prototyping and product assessment.

CEE222A: Computer Integrated Architecture/Engineering/Construction (AEC) Global Teamwork
submitted by Renate Fructer, Stanford University
Students from architecture, structural engineering, and construction management engage in a cross-disciplinary, collaborative, geographically distributed and multi-cultural project-based teamwork. Global AEC student teams exercise their domain knowledge in architecture, structural engineering, construction management, and the information technologies in a multidisciplinary context focusing on the design and construction concept development phase of a comprehensive building project. Round table AEC panel discussions, best practice and signature project cases are discussed, direct interaction with industry expert mentor sessions, cyber project critique and presentation sessions with industry mentors, and project team sessions using collaborative technologies provide a global perspective of the AEC industry and cutting edge information and collaboration technologies.

CEE222B: Computer Integrated Architecture/Engineering/Construction (AEC) Global Teamwork.
submitted by Renate Fructer, Stanford University
Global AEC student teams continue their project activity focusing on the most challenging concept developed in Winter Quarter and selected jointly with their client. Comprehensive team project activities focus on design and construction, including project development and documentation, i.e., detailing, 3D and 4D modeling, simulation, sustainable concepts, cost benefit analysis, life cycle cost analysis, and final project presentation of product and process.

DESCI 501 Analytical Product Design
submitted by Panos Papalambros, University of Michigan
Design of artifacts is addressed from a multidisciplinary perspective that includes engineering, art, psychology, marketing, economics, and other disciplines. Using a decision-making framework, emphasis is placed on quantitative methods, building mathematical models, and accounting for interdisciplinary interactions. Students work in team design projects from concept generation to prototyping and design verification. Usually offered in the Fall Term

DESCI 501 Analytical Product Design
submitted by Shanna Daly, University of Michigan
At UM, I will teach Analytical Product Design in the Fall: Analytical Product Design --- The design of artifacts is addressed from the multidisciplinary perspective that includes engineering, art, psychology, marketing, and economics. Using a decision-making framework, emphasis is places on understanding basic

quantitative methods employed by the different disciplines for making design decisions, building mathematical models, and accounting for interdisciplinary interactions throughout the design and development process. Students work in teams to apply the methods on design project from concept generation to prototyping and design verification.

(Design) Exhibition.
submitted by Wendy Ju, California College of Arts
The public show is both an important fundamental of any design practice, and a crucial target for design in and of itself. Through a series of individual and group design projects, we will be examining major historical exhibitions, a wide range of exhibition genres, as well as questioning our established notions of what exhibition is or where they can exist. We will explore initial promotional materials through installation and interaction at the event to culminating archives and artifacts.

(Design) Interaction Design Studio.
submitted by Wendy Ju, California College of Arts
This studio course will focus on techniques and technologies for designing interactions. We will look at interactivity from both a technical and an experiential perspective, and consider its application in a variety of contexts. In this class, you will develop a variety of skills for designing, prototyping and evaluating interactions, and develop a facility for commenting and critiquing interaction design.

(Design) Pulse. Topic studio.
submitted by Wendy Ju, California College of Arts
The ID/IA studio will focus on PULSE--the power of simple bits of information collected, transmitted, transformed and shared. How is the pulse--of a person, of a relationship, of a building or instution--measured, monitored, and interpreted? From this foundation, students will explore the integration of industrial and interaction design, from ideation and field research to form and function prototype development and evaluation. Focused exercises will illuminate methods and processes that students will subsequently apply in concert to individual projects.

DSC 520 Contemporary Design Issues.
submitted by Jacques Giard, Arizona State University
Issues influencing contemporary design, such as sustainability, globalization, gender, collaboration, emotion, etc. The course is based on the premise that designers can have a greater impact on society if their focus moves beyond professional skills, i.e., what do you want to be, to issues that design can address, i.e., what do you want to do. Consequently, the objectives of the course are to provide awareness of some of these issues and to explore how design can make a positive difference.

DSC 580 Practicum: Methods of Teaching Design
submitted by Jacques Giard, Arizona State University
Background and development of design education theories. Concepts of studio teaching methods. Comprehensive student project development and evaluation methods. The course is intended to provide fundamental theoretical and practical knowledge required to design and implement learning experiences within the disciplines of design and beyond. Additionally, students will be introduced to techniques of self-assessment and teacher learning that offer the chance to continually improve studio/classroom methodologies and broaden their repertoire of teaching approaches. The course is designed to promote learning by doing and living and students are encouraged to fully immerse themselves in the discourse of learning and teaching.

DSGN 401-1 Human-Centered Design Studio 1
submitted by Ed Colgate, Northwestern University
This course is part one of a year-long studio course, providing a project-based introduction to the design of products and processes that meet human needs. Students are given a problem area in which to innovate and will be led through the process of investigating cultural, emotional, technological and business factors to develop new concepts, creating and testing prototypes, and iterative design. Principal focus will be placed on understanding the interaction of people and products/services. Teaching methods include lectures, labs, reading, homework assignments and projects.

DSGN 401-2 Human-Centered Design Studio 2
submitted by Ed Colgate, Northwestern University
This course builds upon DSGN 401-1, particularly within the realm of interaction design. Students are challenged to explore novel and multimodal approaches to interaction, and are introduced to the broader concept of experience design. Teaching methods include lectures, labs, reading, homework assignments and projects.

DSGN 401-3: The design of services and products.
submitted by Don Norman, Northwestern University
The course explores the nature of "experience ecologies." Students learn to map and analyze existing services, and to design and evaluate new ones. The course relies on project based learning to

explore the design process in the context of service design. It provides hands-on learning in the context of tackling real challenges in the local community. Outside lecturers plus multiple class projects. In this coming year we will emphasize service blueprinting of front stage and back stage activity along with emotional experience.

DSGN 401-3 Human Centered Service Design
submitted by Liz Gerber, Northwestern University
This is the final course in the year-long sequence. It course builds upon both DSGN 401-1 and 401-2, exploring interaction in the context of experiences and services. Students explore the nature of "service ecologies," which comprise a set of actors (people and interactive products) and the relationships among them. Students learn to map and analyze existing services, and to design new ones. Case studies will be drawn from areas such as retail, health, financial, and consumer services. Teaching methods include lectures, reading, case studies, homework assignments and projects.

DSGN 495-20 Design Research
*submitted by Ed Colgate, Northwestern University**
In this course, students learn the value of field research in the human-centered design process. The class covers an introduction to qualitative research, and provides an overview of existing methods. In addition to homework assignments and labs, students work on a cumulative team-based research and design project that includes generative research, analysis and synthesis, brainstorming, concept generation and concept evaluation.

DSGN 495-05 Differentiation by Design
*submitted by Ed Colgate, Northwestern University**
This course introduces students to a systematic "Differentiation by Design" strategy for enhancing the "customer-getting" experience within the New Product Development process (NPD). The course focuses on those elements of the traditional NPD progression that serve to differentiate a new offering from its competition. Students become aware of the many opportunities for differentiation available, and discover the methods and means of employing these. Successful completion of the course should enhance students' ability to add real innovative value as team members in the NPD "concept through commercialization" customer/product experience. Lectures are supported by case studies, readings, relevant outside experts and real world examples of the Differentiation by Design process, strategy and methodology.

DSGN 495-21 Sustainable Manufacturing
*submitted by Ed Colgate, Northwestern University**
The goal of this course is to explore how to conceive, design and develop a product or production facility using principles of Sustainability. Students start by evaluating the guiding definition and principles of sustainable design, engineering and development and consider a number of examples. Issues related to social equity are explored by looking at the business opportunities related to solving some of the world's most intractable problems (e.g., poverty). Special attention will be paid to the challenges of improving energy efficiency and finding alternatives to oil. Finally, the course tackles the question of what it takes to make human life sustainable –technology or conviction? Why is the approach different in Europe than in the U.S? What is the role of business versus the government in paving this way? Will the change to sustainable practices occur through bottom-up or top-down demand? Will the path to sustainability be guided by a shift in values or will it simply make good economic sense?
The course is primarily discussion based. The first 2/3 of the class meetings focuses upon the readings and "the big picture". The last third of the class is a skills sharing session focusing on practical aspects of environmental best practice, land recycling movement, green building, climate change, renewable energy.

DSGN 495 Innovation Frontiers
*submitted by Ed Colgate, Northwestern University**
Many historians and scientists believe we live in the greatest time of change in the history of our species. In any such transformational time a great skill thoughtful individuals should master is to learn to find patterns in the change. If you can find patterns, you won't be blindsided by change, but instead able to anticipate shifts and then innovate effectively. In this class, students learn the emerging principles of innovation as a science so that they can approach the unfamiliar with a whole new level of curiosity, confidence and courage. The course teaches how to deconstruct anything innovative—from Apple's iPhone to YouTube or Wii—and how to assess the structural causes of innovation success… or failure. Students discover how and why India and China are breeding grounds for entirely new innovation frontiers in order to understand why Lasik eye surgery can be profitable in India at $10 per eye (vs. $1,200 in the U.S.) and how the seventh richest man in China got that way manufacturing solar cell arrays to produce sustainable electricity.
Students in the course also practice applying the principles of innovation in a specific challenge, and

produce defensible, clear proposals at the conclusion of the course. These should be of a nature and quality to merit publication in magazines such as Fast Company or Wired.

DSGN 490: Introduction to Product and Service Design.
submitted by Don Norman, Northwestern University
Taught with Rachel Powers. MMM is a dual-degree MBA / Engineering program with 120 students (60 per year) focused upon design and operations. This one quarter course is required of all 1st year students. It has two components: readings and discussion and a set of design exercises (led by Rachel Powers). The readings mostly come from the business literature, with numerous case studies. The most important component is Design Thinking: spending the time to figure out what the question is. Both MBA and engineering students want to tell you the answer. It is difficult to break them of that habit and have them first figure out what the question is.

DSGN 495: Advanced Reading in Design.
submitted by Don Norman, Northwestern University
Taught with David Blanchard. A reading course for MBA students. Taught like a graduate seminar (which MBAs aren't used to). Each week covers seminal books in design, with special attention toward ones relevant to business and to making effective presentations (The Book by the Heath brothers, "Making it Stick" was especially popular.) A pair of students lead each week's discussion. Co-taught with Dave Blanchard who was a 2nd year MMM student last year, but now works for IDEO (Evanston): he will co-teach it with me again in Spring 2010.

ENE Design Cognition and Learning
submitted by Robin Adams, Purdue University
Design is central to engineering: it is an integral part of the engineering profession, it plays an essential role in how we educate engineers, and it is one way of describing the competency of engineering graduates as practitioners. Efforts to assess design competency and improve design teaching have motivated research that seeks to characterize design knowledge, skills, and strategies associated with successful performance. This research aims to construct a systematic inquiry to uncover structures or patterns underlying design activity and is situated in theories of learning, human cognition, and creativity. As such, the objective of this course is to "unpack" design cognition and learning with an ultimate goal of motivating design research and informing design practice (in education and work settings). The course is organized by four themes: (1) what is design knowledge, (2) how is design a cognitive activity, (3) how do researchers study design, and (4) what are design learning trajectories (what changes and how does it change)? By the end of this course students should be able to: identify examples and trends in empirical approaches to studying design activity, identify quality resources for investigating design cognition and learning, describe and critique variations in the way design is understood, translate research on design into practical implications, and articulate a philosophy of design and become more confident as a designer.

ENE History and Philosophy of Engineering Education
submitted by Robin Adams, Purdue University
History and philosophy are bodies of knowledge and modes of inquiry that both shape and are shaped by their socio-cultural contexts. They are more than a chronology of events or grand statements – they are lenses for illuminating epistemologies of engineering, the principles, ideas, and methods that underlie what it means to know engineering, to be an engineer, practice engineering, and prepare others for engineering practice (e.g., instruction). In this course we examine the history and philosophy of engineering education through various tools and frameworks to guide critical reflection and analysis of philosophical, epistemological, and historical arguments. These tools include: (1) reflective practice and "sitting comfortable with paradox", (2) insider (engineers) and outsider (those who study engineers) perspectives on the nature of engineering, (3) philosophies of education that argue for the aims, purposes, and process of education, (4) archival research and historical documents, and (5) boundary work in terms of what is included and excluded when considering the nature of engineering education and what shapes these boundaries.

ENE Content, Assessment, and Pedagogy
submitted by Shanna Daly (Michigan), Purdue University
At Purdue, I taught within the Engineering Education Graduate program, which was specifically target to help them design engineering courses, but is also relevant in how we think about the design of design courses. Description: Content, Assessment and Pedagogy is a Department of Engineering Education Foundation course that is designed to provide the participants with a working knowledge of these three areas and especially the integration of these three areas for the design of learning modules, lessons, courses, and programs. The course features the state-

of-the-art ideas of our text authors – Janet Donald, James Pellegrino, and Marilla Svinicki – and article authors, as well as the instructor's and participant's ideas. The course features an integrated design approach and a hands-on project that is intended to help the participants learn the key elements and apply them in a real context.

EngE 1114: Exploration of Engineering Design,
submitted by David Richter, Virginia Tech

ENGE 5024: Design in Engineering Education and Practice
***s**ubmitted by David Richter, Virginia Tech*

Engr 231 Transformative Design.
Project-based. How interactive technologies can be designed to encourage behavioral transformation. Topics such as self-efficacy, social support, and mechanism of cultural change in domains such as weight-loss, energy conservation, or safe driving. Lab familiarizes students with hardware and software tools for interaction prototyping. Students teams create functional prototypes for self-selected problem domains.

ENME 600 Engineering Design Methods
submitted by Linda Schmidt, University of Maryland
Course Description: Engineering Design Methods will introduce course participants to a number of contemporary philosophies and methods of performing engineering design. Emphasis will be given to the methods that are becoming "mainstream" in mechanical engineering curricula (e.g., Axiomatic Design, Systematic Design with Functional Decomposition, TIPS/TRIZ). The course will focus on design methods for the earliest stages of the design process, sometimes called conceptual design. Important design methods have both evolved from use and been proposed in an intentional way. Methods in each category will be presented in the course, discussed, and applied to design problems.

ENME608 Engineering Decision Making
*submitted by Linda Schmidt, University of Maryland**
An introduction to structured decision making, including several decision analysis and product design selection methods. The course will cover material on individual and group decision making methods, organization and structure of decision making, and selection under uncertainty. Main topics will include: methods for modeling decisions, uncertainty, and preferences.

EPD 710 Current Research
Submitted by Jacques Giard, Arizona State University
Review and critical evaluation of contemporary literature and method in architecture, building science, interior design, industrial design, and landscape architecture. The seminar offers an overview of the principal themes in current design research and scholarship, the underlying issues and methodology informing the research, and the opportunity to engage in discussions of knowledge production in the design fields. Moreover, this seminar explores contemporary design research as it occurs in the disciplines that comprise the Ph.D. program as well as some of the related fields.

GE598 Optimal Product Design and Development
submitted by Harrison Kim, UIUC
This course is designed to address the fundamental theories for engineering system (product) design and development in a multidisciplinary environment. Product design and development process in a firm is viewed as a combination of decomposed activities that can be modeled as an enterprise product planning model and an engineering product development model, respectively. Product planning involves demand modeling, customers' preference analysis, and profit modeling under uncertainty. Product development involves analytical problem formulation to achieve the performance targets assigned at the enterprise level and multidisciplinary design optimization (MDO) can be utilized to model this problem. This course is composed of two major parts: analytical product planning and analytical product development based on the MDO theory. The treatment of topics is mathematically rigorous but with an emphasis on practical use. Students are required to work on a (group) semester project utilizing available design optimization software, e.g. iSight and Matlab.

HER—V 511 People-Centered Design Research
submitted by Youngbok Hong, Indiana University
This course is designed to lay the foundation in design research and It covers application and in-tegration of theory, methods and skills for initiating people-centered design research activities.

HER—V 521 Method for Design Analysis
submitted by Youngbok Hong, Indiana University
This course covers theory, methods and skills for design analysis in the context of a cross-disci-plinary collaborative process for innovation.

HER—V 531 Methods for Design Synthesis
submitted by Youngbok Hong, Indiana University

**=course taught by others*

This course covers theory, methods and skills for design synthesis in the context of a cross-disci-plinary collaborative process for innovation.

HER—V 541 Methods for Design Evaluation
submitted by Youngbok Hong, Indiana University
This course covers theory, methods and skills for design evaluation, optimization and implemen-tation in the context of a cross-disciplinary collaborative process for innovation.

INFO I541: Interaction Design Practice
submitted by Marty Siegel, Indiana University
The goal of this course is to begin the transformation from non-designer to (interaction) designer. The following topics are listed in approximately the order they will be "uncovered" – from the design of everyday things to the design of software; old and new design models; mockups, sketches, and how they are used; seven themes of good design; group decision protocols; guidelines for critiquing designs; post-mortem analysis; time management challenges; philosophy and ethics of design; thinking like a programmer, architect, instructional designer, graphic designer, composer, playwright, and choreographer. Throughout the course, these topics will be interspersed: case studies (a variety of web and real products); critiques of design projects; life in the "trenches" as an interaction/experience designer; professionalism; and the philosophy of design. These topics will "play out" through the group design of five "wicked" design projects, with the last project culminating as a submission to the CHI International Student Design Competition.

INFO I694: Capstone I & II
submitted by Marty Siegel, Indiana University
The capstone is a two semester culminating activity for the master's degree program in Human-Computer Interaction Design (HCI/d). In the fall semester we focus on: the ideation and framing of a project; finding relevant research and literature; planning a project, project management; presenting and selling a project; designing, planning and documenting user research; and managing teams and real life situations in design projects. In the spring semester we focus on: practical issues in design and research processes; ethical issues and responsibilities; how to abstract and generalize from empirical studies and experiments; how to design user studies; how to transform designs into "real" products and processes; how to write research and design papers; and how to prepare a presentation and a poster. Throughout the two semesters, sensitivities and realities of business practice will be discussed. (co-taught with Erik Stolterman)

(i-school) Qualitative Research Methods
*submitted by Sara Beckman, University of California, Berkeley**
This course will focus on the use of qualitative methods for research on the development, diffusion, and use of information technologies as well as information and management practices. Its core concern is with an epistemological question - how do we arrive at credible knowledge through qualitative research practices? The methods covered will include interviewing, focus groups, participant observation, and ethnography. Along the way we will confront the issues of quality, validity, and rigor.

MAE540 Product Design: Methods & Theory
submitted by Jami Shah, Arizona State University

MAE591D Design Geometry & Kinematics
submitted by Jami Shah, Arizona State University
(co-taught with Swimmer, Davidson)

MAE598/494 Advanced CAE Simulation
submitted by Jami Shah, Arizona State University

MAE-5420 Advanced Mechanical Design.
submitted by Pieere Larochelle, Florida Institute of Technology
Advanced topics in the design of mechanical systems. Various design theories and methodologies are discussed and analyzed including those of Ullman, Petroski, Sandor, Shigley, Sandor, and Taguchi. In addition advanced synthesis and analysis topics are presented: kinematic models of mechanical systems, dynamic models of mechanical systems, mechatronics, dynamic simulation of mechanical systems, and design optimization. Engineering case studies and computer-aided design software are utilized throughout the course.

ME 310A: Project-Based Engineering Design, Innovation, and Development
*submitted by Micah Lande, Stanford University**
Three quarter sequence; for engineering graduate students intending to lead projects related to sustainability, automotive, biomedical devices, communication, and user interaction. Student teams collaborate with academic partners in Europe, Asia, and Latin America on product innovation challenges presented by global corporations to design requirements and construct functional prototypes for consumer testing and technical evaluation. Design loft

format such as found in Silicon Valley consultancies. Typically requires international travel. Prerequisites: undergraduate engineering design project; consent of instructor.

ME 341 Computational Methods for Engineering Design

submitted by Wei Chen, Northwestern University

The course is designed to provide students across all engineering disciplines a view of using computational techniques and the simulation-based design paradigm for engineering decision making, across a wide spectrum of activities in engineering product development, including those in product design, manufacturing, and life cycle engineering. The course will promote project-based learning which encourages students to work on computational design projects. The course will also expose students to the state-of-the art commercial software for computational design.

ME 441 – Engineering Optimization for Product Design and Manufacturing

submitted by Wei Chen, Northwestern University

The course is designed to provide engineering students a view of optimization as a tool for engineering decision making. Students will be given a fundamental introduction to the optimization techniques and an opportunity to learn how to model product design and manufacturing problems and solve them using computer-based (numerical) optimization techniques. Students will be encouraged to learn by doing and relating the course material to their research.

ME 461 Integrated Product Development: Design

submitted by Duke Perreira, Lehigh University

Industry sponsored Integrated Product Development Project (IPD) projects. The student works with an industry sponsor to do a technical and economic feasibility study of new product development. Selection and content of the project is determined by the faculty project advisor in consultation with the industry sponsor. Deliverables include progress and final reports, oral presentations and posters.

ME 462 Integrated Product Development: Manufacturing

submitted by Duke Perreira, Lehigh University

Industry sponsored Integrated Product Development Project (IPD) projects. The student works with an industry sponsor to create detailed design specifications, fabricate and test a prototype new product and plan for production. Selection and content of the project is determined by the faculty project advisor in consultation with the industry sponsor. Deliverables include progress and final reports, oral presentations, posters and a prototype.

ME 495– Advanced Computational & Statistical Methods for Engineering Design

submitted by Wei Chen, Northwestern University

The course is designed for engineering graduate students who are interested in furthering their knowledge in advanced and emerging methods of engineering design, in a broad context of product design, manufacturing process development, and designing for life cycle issues. Students are encouraged to apply the techniques taught in class to the topics related to their thesis work.

PSED510 Predictive Science and Engineering Design Interdisciplinary Cluster Seminar

submitted by Wei Chen, Northwestern University

This is a literature and project combined seminar course focusing on the common principles and techniques underlying Predictive Science and Engineering Design (PS&ED). As an emerging paradigm, PS&ED enables a new level of integration of science and engineering by the deliberate transformation of scientific knowledge from a descriptive to a predictive form. The enrichment of this paradigm is critical to the simulation and design of innovative, complex "engineered" systems in a variety of applications across such diverse domains as microsystems, biological systems, energy generation and consumption systems, to efficient manufacturing. Students will work in teams on interdisciplinary projects related to the current design focus of Predictive Science and Engineering Design (PSED) cluster.

ME 518: Concurrent Design of Product

submitted by Ping Ge, Oregon State University

The class aims at stimulating research interest and nurturing research development capability in the area of collaborative product design through an integrative effort of people, information, and processes. Focus is on the design theory and methodology; accompanying real world examples are provided to demonstrate their use; literature-based, innovative research development is conducted on selected collaborative design topics.

ME 290 Managing the New Product Development Process: Design Theory and Methods

submitted by Sara Beckman

This course is part of the Management of Technology program at the University of California, Berkeley. It is an

operationally focused course, as it aims to develop the interdisciplinary skills required for successful product development in today's competitive marketplace. Engineering, iSchool and Business students from Berkeley and Industrial Design students from California College of the Arts join forces on small product development teams to step through the new product development process in detail, learning about the available tools and techniques to execute each process step along the way. Each student brings his or her own disciplinary perspective to the team effort, and must learn to synthesize that perspective with those of the other students in the group to develop a sound, marketable product. Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice. Although the course focuses on the application of these principles to new product development, they are more broadly applicable to innovation in general – of products, services, organizations, business strategies and governmental policies.

ME 555 / MFG 555 - Design Optimization.
Submitted by Panos Papalambros, University of Michigan
Mathematical modeling of engineering design problems for optimization. Bounded-ness and monotonicity analysis of models. Differential optimization theory and selected numerical algorithms for continuous nonlinear models. Emphasis on the interaction between proper modeling and computation. Students propose design term projects from various disciplines and apply course methodology to optimize designs.

ME 5353 Fundamentals of Transdisciplinary Design and Process
Submitted by Derrick Tate, Texas Tech University
New approaches are needed to change the way products are developed. The fundamental aspects of design must cut across disciplinary boundaries to provide a means for solving complex problems. The purpose of studying design methodology and processes is to understand the features of design and development that are common across all disciplines. This course covers the activities of the design process from conceptual design to analysis and implementation of design solutions and uses examples drawn from a variety of disciplines. This course provides the skills necessary for individuals or groups of engineering designers to apply a variety of state-of-the-art design tools, such as axiomatic design and the theory of inventive problem solving (TRIZ), to projects. Students will learn how to analyze design processes and processes, to select appropriate tools for improving product development, and to work together on group projects.

ME 5355 Complexity Theory for Transdisciplinary Engineering and Science
Submitted by Derrick Tate, Texas Tech University
Complexity is an issue that affects engineering, scientific, and social disciplines. This course introduces the role of complexity in the challenges facing twenty-first century engineers. A theoretical foundation for complexity is presented that enables an engineering system's complexity to be measured against its function and qualitative factors, such as social mores and human values. Multiple types of complexity are distinguished, and several tools for managing and resolving complexity are presented. An integrated mix of theory and process is applied to case studies from several disciplines: electro-mechanical, manufacturing, biological, and socio-technical systems.

ME 53XX Transdisciplinary Discovery and Innovation for Engineers
Submitted by Derrick Tate, Texas Tech University
This course will help students to develop their creativity and critical thinking and aims to develop their background for PhD research related to transdisciplinary design, process, and systems. The focus in following the transdisciplinary approach is to enable the students, working jointly with others representing diverse disciplines, to develop and use shared conceptual frameworks that draw upon discipline-specific concepts, theories, and methods, but address common problems through a new synthesis of a common ontology, theories, models, and methodology. The theme of this course is the means by which engineering and science progress through discovery, adoption, and dissemination of new ideas and technologies. The topics covered include the process of scientific change, integrated tools and processes for engineering innovation that draw upon multiple disciplines, and the theoretical and practical foundations and current transdisciplinary topics in design, process, and systems.

ME 520 Computer-Aided Design and Manufacturing (CAD/CAM)
*submitted by April Bryan, Rose-Hulman Institute of Technology**
Use and management of computer in engineering for drafting, design management, documentation, and manufacturing. Covers drafting methods and

standards, design data management, CNC operations and implementation.

MG 590 Integrated Project
*submitted by April Bryan, Rose-Hulman Institute of Technology**
The integration of business and technical considerations in new product development. The identification of managerial and engineering challenges faced in developing a commercially viable new product within the context of a rapidly changing and highly competitive business environment. Readings, case studies and individual projects dealing with strategic planning, entrepreneurship, new product development, and related topics. The focus is on a major team project. This integrated project must include the identification of a new product including all relevant business and technical issues and the development of a detailed plan for profitably bringing this new product to market. A final report with oral presentations is required.

MG 461 Multidisciplinary, Entrepreneurial Design I: Capture the Vision
*submitted by April Bryan, Rose-Hulman Institute of Technology**
Explores design processes characterized by interdisciplinary activity and focus on commercial success. Includes basic design processes with emphasis on data collection and specification, with special attention to the voice of the customer. Develops at least three creativity techniques and identifies sources of ideas for successful innovation. Demonstrates procedures for assessing markets and establishing conceptual business models and describes the fundamentals of project planning and management. Addresses aspects of professional practice -- -- ethics, communication, contemporary issues, social impacts, global context and team work—in the design process. Uses a team project on reverse engineering to tie together course objectives, and identifies an entrepreneurial or appropriate externally sponsored project topic for later courses. Prerequisite: Junior standing or consent of instructor.

MG 462 Multidisciplinary, Entrepreneurial Design II: Expand the Concept
*submitted by April Bryan, Rose-Hulman Institute of Technology**
Expands on the basic design process issues such as solution identification and selection and the assessment of trade-offs and impacts on health, safety, quality, environment, sustainability, and manufacturability. Applies design disciplines to a specific project by using creativity techniques, identifying sustainable competitive advantages and appropriate intellectual property protection procedures. Uses project planning methods to estimate project size and assess risks, as well as other techniques to facilitate rapid product development. Provides experiences in communication, project retrospectives and design reviews. Completes the early stages of a team selected and conducted project in entrepreneurial design that has the approval of students' home department. Prerequisite: EMGT461 or consent of instructor.

MG 463 Multidisciplinary, Entrepreneurial Design III: Deliver the Product
*submitted by April Bryan, Rose-Hulman Institute of Technology**
Further examines and applies design process disciplines, including techniques such as system modeling, optimization, statistical analysis, design of experiments, FMEA (Failure Modes and Effects Analysis), robust design, simulation and process improvement. Describes key business concepts needed for a business plan and applies them to the team projects. Uses professional project approaches such as metrics, retrospectives, design reviews and proper documentation. Emphasizes team project work with home department approval of specific discipline related design activities and with practical applications of concepts in the realization of functional prototypes or systems. Concludes with written and oral presentations of team project reports. Prerequisite: MG 462 or consent of instructor.

MG 537 Organizational Theory and Management
*submitted by April Bryan, Rose-Hulman Institute of Technology**
Presents theory, examples, and best practices of organizational design for success. Strategies for planning, organizing and controlling organizations in various life cycles stages, technological levels, and international domains are critically important for organizational success. Discusses proper assessment of internal and external organizational environments, managing dynamic processes, and dealing with innovation and change to plan for growth and expansion of organizations considering outsourcing, globalization, communication and information technology changes. Theory is presented to include politics, conflict, and change management as issues organizations must manage.

MG 587 Systems Engineering
*submitted by April Bryan, Rose-Hulman Institute of Technology**
Introduces system engineering and analysis techniques, including the systems life cycle, system design procedures, risk analysis, analysis methods including reliability and maintainability. Provides applications for mechanical, electrical and a wide variety of other systems. Uses Visio or CORE software to create IDEFO drawings and other documentation for system design.

MSE 423. Product Design/Analysis (3)
submitted by Duke Perreira, Lehigh University
Integrated approach to design and analysis of products and systems. Principles for robust design and use of computer-aided engineering to model, evaluate, and enhance design. Case studies and design assignments are major components of this course.

MS&E 273 - 273. Technology Venture Formation.
Submitted by Lauren Acquino Shulzas, Stanford University, Teaching Assistant
Open to graduate students interested in high-technology entrepreneurship. Explores in detail the process of starting venture scale high-tech businesses. Coursework includes assessing opportunities, sizing markets, evaluating sales channels, developing R&D and operations plans, raising venture capital, managing legal issues, and building a team. The teaching team includes experienced entrepreneurs, venture capitalists, and distinguished guests. Student teams write a business plan and make a formal presentation to group of first tier venture capitalists. Enrollment limited. Recommended: 140, 270, 271, 272 or equivalent. 4 units, Aut (Lyons, MacLean)

PDES Design Research
submitted by Alison McKay , University of Leeds
This is a 15 credit (150 study hour) course where students carry out three research projects and write them up as empirical study papers targeted at the Research in Engineering Design journal and an industrialist reader who has design experience but no prior knowledge of the research project. Students peer review each others' papers. The projects themselves cover the three aspects of design research identified by Frayling (1993): research into design, research through design and research for design. In recent years the research projects have involved the following activities.
•research into design: VPA (verbal protocol analysis) of a student team design activity
•research through design: application of shape grammars in stylistic design
•research for design: designing for ageing population with a view to promoting independent living (eg, laundry products).

(Music) Physical Interaction Design for Music.
submitted by Wendy Ju, Stanford
In recent years, technologies for synthesizing, processing and controlling sound, as well as those for embedded computing, sensing and inter-device communication have become independently mature. This course explores how we can physically interact with electronic sounds in real time. A series of exercises introduces sensors, circuits, microcontrollers, communication and sound synthesis. We discuss critically what the merging of these technologies means for music and art. Along with new technologies, what new music practices or art forms may emerge?

PDES Multidisciplinary team design projects
submitted by Alison McKay , University of Leeds
This is a 140 credit (400 study hours per student) course where design and engineering students work together on team design projects that have been specified in collaboration with external stakeholders such as industrialists or medical practitioners. A number of the projects I supervise also have global elements.

PDES Design Policy & Integration
*submitted by Alison McKay , University of Leeds**
This 15 credit (150 study hour) course is closely allied to concepts of Product Management and provides an insight into a designers' role in design policy making and management. It reflects the importance given to developing students' recognition of design policy, highlighting how design policy is inextricably linked to a designer's understanding of the design process. Students learn current design policy theory, focusing on new product development, and innovation through linking theory to case study analysis. (led by Lisa-Dionne Morris)

PDES Product data engineering
*submitted by Alison McKay , University of Leeds**
This 15 credit (150 study hour) course enables students to understand and apply general information modelling techniques to product data, build a simple engineering information system and apply it to real engineering and design situations. Students learn to map out product structures and to develop engineering information systems for their own company's products. The module will be

delivered using a blended learning environment where approximately 40 study hours are devoted to learning product data modeling techniques through on-line resources and the rest of the time is spent on the definition and delivery of a work-based engineering information system. It is anticipated that the module will be delivered in 2010/11; materials are currently being audited by staff and PGR students.

STS 6961: Design Seminar

submitted by Dean Nieusma, Rensselaer Polytechnic University

"Design Seminar" is a graduate-level introduction to design theory from the perspective of Science and Technology Studies. The seminar explores the various pressures and factors that enter into and shape design activity, research, teaching, and outcomes, with an emphasis on the design of the built environment, technologies, and products. The course readings focus on design as a form of social and political power, where the interests, values, and assumptions of some groups become embedded in the material world, forming the background environment within which others must operate.