

BE/CS/CompE/EE/ME Interdisciplinary Capstone Design (6 cr)

General Meeting Times:

T 3:30-4:45 (see general class session schedule)

JEB 104

Team Times: weekly meetings w/lead instructor & regular working sessions

Course Web Page and Project Archive:

www.webpages.uidaho.edu/mindworks/capstone.htm

Capstone Faculty: (department coordinators shown in bold italics)

Dan Cordon (dcordon@uidaho.edu) – ME	GJ 234
Steven Beyerlein (sbeyer@uidaho.edu) – ME	EP 324K
Michael Maughan (maughan@uidaho.edu) – ME	EP 324I
Matt Riley (riley@uidaho.edu) – ME	EP 324E
Beth Rezaie (rezaie@uidaho.edu) – ME	GJ 234
Joel Perry (jperry@uidaho.edu) – ME	EP 324D
Tao Xing (xing@uidaho.edu) – ME	EP 324F
Feng Li (fengli@uidaho.edu) – ECE	GJ217
Michael Santora (mjsantora@uidaho.edu) – ECE	GJ209
Herb Hess (hhess@uidaho.edu) – ECE	GJ 205
Brian Johnson (bjohnson@uidaho.edu) – ECE	GJ201
Bruce Bolden (bruceb@cs.uidaho.edu) – CS	JEB 232
Dev Shrestha (devs@uidaho.edu) – BE	JML ??

Graduate Student Shop Mentors (iew@uidaho.edu):

GJ 113

Support Staff:

Molly Steiner (mollym@uidaho.edu) – ME Finance Tech	EP 324
?? ECE Finance Manager - BEL 212	
Judy Vandegrift (judyv@uidaho.edu) – BAE Admin Asst	EP 401
Russ Porter (russp@uidaho.edu) – ME Scientific Instrument Machinist	GJ 124
Greg Klemesrud (gklemesrud@ece.uidaho.edu) – ECE Electronics Spec	GJ 001
Keegan Duff (keeganduff@uidaho.edu) – BE Laboratory Supervisor	JML ???

COURSE OBJECTIVE: Prepare engineering students for professional practice, specifically as encountered in entry-level design engineering positions.

COURSE PREREQUISITES (by department)

ME 424:	ECE 480/481:	ECE 482/483:	CS	BE 478:
ME 301	ECE 240, 241	CS240	CS 383	Senior standing
ME 313	ECE 310, 311	CS270	ENGL 317	
ME 325	ECE 320, 321	ECE 240, 241		
ME 330 (coreq)	ECE 330, 331	ECE 310, 311		
ME 345	ECE 340, 341	ECE 340, 341		
	ECE 350, 351 STAT 301	ECE 350, 351 ECE 440 (coreq) STAT 301		

COURSE MATERIALS

Keep a **bound personal logbook** for notes, calculations, sketches, responses to instructor/mentor questions, and evidence of progress toward course learning outcomes. Regularly refer to the **Mindworks website** for deadlines, resource materials, and assessment/evaluation rubrics (its' textbook).

COURSE LEARNING OUTCOMES

1. Design a functioning prototype system, component, or process to meet client needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. Meaningfully contribute to a multi-disciplinary engineering team, adding value to the finished product as well as enhancing the learning experience of others associated with the team.
3. Exercise professional and ethical responsibility in keeping personal documentation, interacting in public settings (especially Snapshot Days), and upholding client/societal obligations.
4. Communicate effectively in formal and informal project settings (verbally, orally, and graphically).
5. Recognize the need for life-long learning, regularly practicing self-assessment, peer-assessment, and self-directed learning aligned with a personal/professional life vision.

COURSE ROLES & RESPONSIBILITIES

Lead Instructors (Project Managers)

- secure sponsors, scope projects, set project budgets, orient clients about our program
- communicate course objectives, performance standards, and milestone dates for deliverables
- provide timely assessment feedback on team processes and products
- monitor team and customer relations, facilitating open communication
- evaluate project deliverables and assign grades

Technical Advisors (Other ME, BAE, and ECE faculty)

- serve as external customer for competition/internal projects
- provide technical input and leadership to team/sub-teams
- provide input on evaluation of project deliverables and performance

Fabrication/Instrumentation/Lab Specialists (Russ Porter, Greg Klemesrud, Keegan Duff)

- final word on shop safety and proper equipment/instrument usage
- inform advisors/guides on shop training and scheduling
- when requested, review designs for inventiveness & manufacturability

Shop Mentors (IEW students)

- oversee safety, training, sign-up, and use of shop equipment
- provide consulting on prototypes, software and experimentation
- first contact for review of drawings/schematics and fabrication plans

Design Teams (students in the class)

- display professional team dynamics, including high personal commitment
- take responsibility for project decisions and work areas, leading to timely and innovative products that can be attractively presented in short order
- keep advisors/guides/instructors/customers regularly informed of progress, decisions, and obstacles encountered
- actively support public design events (Snapshot Days & UI Design Expo), representing yourselves and your work in a constructive manner that informs advisory board members, engages external visitors, and leaves a legacy for future students

GRADING (COURSE EVALUATION)

Team Products – 25%

Professional working prototypes, presentations, reports, wikisite, and posters that feature high quality visual aids, explain design details, and market the program

- working hardware/software that meets engineering specifications
- attractive displays and posters at Snapshot Days as well as the Design Expo
- Design Expo technical presentation about the final product and its realization
- project wikisite that conveys information on multiple aspects of the project (goal statement, specifications, project learning, detailed design, and testing)
- final report/portfolio of design documents

Team Processes – 25%

On-time, on-budget solution that meets or exceeds customer needs by following an organized, well-planned and executed design process involving all members

- productive team meetings that regularly track budget, schedule, work assignments, project quality, and professional development of team members
- planning and facilitation of periodic design reviews with project stakeholders
- ongoing client communication and client relations
- design process that is planned and logical, guided by clear specifications
- positive team dynamics

Individual Products – 25%

Individual accountability for project success involving technical effort and teamwork

- design team commitment and contribution
- documentation of personal analysis, solid modeling, and experimentation
- effective work breakdown, time management, and task completion w/quality
- accurate and frequent reporting on personal work assignments

Individual Processes – 25%

Individual engagement in the design process through reflective activities, team participation, and logbook usage

- ongoing log of personal project activity
- lessons learned – writing to capture new knowledge
- assessment – writing to capture strengths, ideas for improvement, and action plans
- team meeting participation and performance
- open communication with client/instructors/guides/staff
- professional demeanor at Snapshot Days & Design Expo

CAPSTONE TERMINOLOGY

Related to Project Deliverables...

Engineering Specifications	A statement containing the details of the design of a product that is approved by your team and your client (identifies prioritized needs, metrics, and target values)
Engineering Analysis	Calculations, modeling, and simulation results based on engineering principles that supports quantitative decision making
Design Documentation	Explanation of design rationale, part/assembly drawings, purchased components/materials, flowcharts, and manufacturing instructions used to realize a design solution and inspect its performance
Working Prototype	Project outcome that displays all of the functionality required by engineering specifications and is accepted by your client

Related to Project Implementation...

Client/Customer Satisfaction	Providing more than is expected, quicker than expected, at a lower cost than expected, at an acceptable level of quality
Open Communication	Free expression of ideas in a respectful, courteous, and constructive manner
Project Management	Weekly actions related to defining and assigning project tasks, responsible parties, due dates, and expected quality of results
Design Team	Individuals with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable on a design project
Engineering Logbook	Daily record of personal activity that includes project learning, engineering analysis, product development, and lessons learned
Project Wikipage	Public record of team activity in each major stage of the design process (part of online course archive)

Related to Course Processes...

Process	A series of actions/steps that adds value to the final result
Design	Developing a product or process to meet a specific need
Problem Solving	Removing or reducing a gap between current and desired situation
Research	Expanding boundaries of knowledge within a discipline or a community of scholars (investigation done in graduate work)
Project Learning	Locating, understanding, and mastering new personal knowledge and skills to benefit a project (investigation done in this course)
Evaluation	Process for determining quality (done at the end of each course)
Assessment	Process used for improving quality (done daily/weekly) peer-assessment => feedback is given by a colleague or peer self-assessment => feedback from studying one's own process
Rubric	Tool to distinguish different levels of performance based on a verbal description of observable behaviors/results

Related to Design activities...

Need	A condition requiring supply or relief; often met by a product produced by design (starting point for your capstone project)
Client	Contact for whom work is performed under an explicit formal agreement/contract (person you will meet in a kick-off client interview)
Stakeholder	Anyone who has an interest in, need for, or who could be impacted by a design product
Customer	Someone who will use the product produced from design, not necessarily the client
Mentor	Someone with whom you have a long-term relationship to provide consultation/training as well as timely assessment feedback
Problem Definition	Exploration of the need to be met or the problem to be solved through the design process (results in a set of specifications)
Idea Generation	The act of determining several possible solutions to the design problem (through project learning, engineering analysis, reverse engineering, CAD, and/or experimentation)
Best Practice	Package of tools and techniques used by experts in the field
Prototype	A partial or fully functional design of a product used for assessment of design concepts and/or validation testing
Concept Selection	The act of selecting the best solutions from the many possibilities from solution generation (affirmed through a <u>conceptual design review</u> with your client)
Detailed Design	Creation of an integrated system architecture, design documentation, approved budget for purchased parts as well as materials, and product fabrication plan (affirmed through a <u>detailed design review</u> with your client)
Validation	The act of assessing the correctness of a design for its intended use (involves testing/evaluation against specifications)
Quality	Excellence of the design solution and resulting product for meeting a need (in the eyes of multiple stakeholders)