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BIOM 4760: Biomedical Engineering Design Principles (Syllabus)

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BIOM 4760: BME Design Principles

Course Information

3 credit hours: 3 hours lecture per week

Class meeting: Tu, Th 1:00p - 2:25p  ET238

Instructor

• Carl Herickhoff, PhD, ET 321E; Email: Carl.Herickhoff@memphis.edu
  • Office Hour: M by appt, Th 2:30-3p

Course Description

This course gives practical design methods emphasizing the front-end or concept development stage of engineering design; students will design a system, component, or process to meet desired needs within realistic constraints while functioning on multi-disciplinary teams.

Course Goals/Learning Objectives

During & after completion of the course, students should/be able to:

• Design a system, component, or process to meet desired needs within realistic constraints (overall goal).
• Identify a problem and develop and refine a problem statement.
• Translate a problem and develop it into a clinical needs statement that is accurate, appropriate in scope, and solution independent.
• Objectively compare design concepts against a needs specification to determine which concepts to pursue.
• Apply knowledge from earlier course work to solve engineering problems.
• Develop an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. Anonymous peer-to-peer feedback on team function will be provided by a mid-semester CATME survey on team member participation.
• Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
• Recognize the need for and be able to engage in lifelong learning.
Prerequisites and Corequisites

- C-grade or higher in BIOM 3010, BIOM 3110 (or BIOL 3730), BIOM 2720, BIOM 3710 and either MECH 2332 or MECH 2320 (or CIVL 3322)

Course Topics
The following is a brief list of some of the topics to be covered:

- Observation/problem identification
- Needs statement development
- Disease state and treatment options
- Stakeholder analysis
- Market analysis
- Needs filtering
- Ideation and brainstorming
- Concept screening
- Design criteria/specification
- Human factors
- Intellectual property basics
- Regulatory basics
- Privacy laws, IRB, etc.
- Protocols for working with people with disabilities, ADA
- Prototyping
- Final concept selection

Textbooks, Hardware and Software Requirements

Required Textbooks/Resources


Design notebooks. These will be provided by the department and will remain the property of the department.

Hardware and Software Requirements
The minimum requirements can be found at: https://www.memphis.edu/umtech/student_success/recommendedHardware.php
Assessment and Grading

Behaviors
Rather than a prescriptive, convoluted point-based rubric for tracking student and team progress, students will be generally assessed by the instructor (and to some degree, their teammates and fellow students in the course) based on the following elements:

- **Active Engagement** (i.e., attendance & participation/contribution in class & with team—assessment aided via CATME)
- **Diligence** (consistent, thorough, complete in one’s preparation & execution)
- **Doing YOUR Best** (striving for excellence, *not just doing the bare minimum*)

Deliverables/Assessment Vehicles
(Individual)
- Design Notebook: proper format/consistent use throughout
- Weekly Summaries (Canvas): team meetings, team member responsibilities, & deliverables
- In-class Prep/Concept Tests
- Essays

(Group)
- Project, Prototype Presentations & Report (+CATME peer evals)

Each component will be graded as follows:
Above expectation: A
At expectation (perform at level expected of a senior BME student): B
Below expectation: C
Failure to meet the minimum expectations for any assignment: D
Failure to submit an assignment or deliverable on time: F

Design Notebooks (no substitutes):
READ CAREFULLY. A major part of your individual grade will be determined by how you keep your design notebook, both in terms of adherence to the rules, quality and frequency of entries, neatness, relevance. The notebook should provide evidence of your sustained personal contribution and thoughts and your active participation in the design process rather than serve as a record of class notes. The design notebooks will be provided to each student and retained by the department at the end of the semester. Use the notebook to keep a careful record of meetings, individual thoughts about the design project, drawings of
ideas, background information with adequate sourcing, concepts and experiments, to learn from the data and information you collect, and to develop solutions to the problem. SIGN AND DATE EACH PAGE AFTER YOU MAKE AN ENTRY. The solutions to problems will often be obtained from information that appears in pieces in various places and you will need to be able to retrieve the information and arrange the pieces. Use each page in sequence. DO NOT LEAVE BLANK PAGES. DO NOT SKIP PAGES AND DO NOT MAKE ENTRIES IN THE BACK OF THE NOTEBOOK UNTIL YOU FILL ALL THE PREVIOUS PAGES. If you have a blank page between entries draw a line diagonally across the page, and date and sign along the diagonal to indicate that it was not used. Do not white-out or erase entries. Do make all entries in PERMANENT INK. IF AN ERROR IS MADE DRAW A SINGLE LINE THROUGH THE ERROR. DO NOT OBLITERATE ERRORS OR WRITE OVER ERRORS. Initial and date any corrections and sign and date a page when you complete it. Write legibly. You may securely paste or tape in relevant copies or printouts, but this should be limited to copies of emails, CAD drawings and required forms. If it is loosely attached and can easily be removed it will be considered a non-entry. Sign and date the past-in along the edge partially covering the notebook and the paste-in. Do not cover up or obscure any notebook entries with the paste-ins and avoid fold-out past-ins. Most of your entries in the notebook should be hand-written and legible. If the instructor cannot read the entry it will be considered not to exist. Keep track of all relevant bibliographic sources and the relevant URL of any information you obtain from the web (with the date it was accessed). Each team member must write down the time and place of every team meeting, who was present, what time each member arrived and left the meeting as well as what was delivered by each team member and what each team member’s deliverables will be for the next meeting! This is in addition to the team meeting minutes form which must be filled out and attached to the notebook after each meeting.

Projects:
Students will be assigned into teams of 4-5 students/each; each team must identify and state a problem, develop a needs statement, generate and compare design concepts, and select and thoroughly vet and specify a complete design to address the problem & need. A conceptual and/or functional prototype will be created (with further credit given for testing and/or validation). Projects will be developed throughout the course, with intermediate ‘check-points’ and team presentations of progress, to gather and respond to feedback.
Course Ground Rules

1. Attendance and Participation Policy: Attendance and participation in all scheduled in class or online meetings is required. Missing more than two class sessions without an acceptable excuse (such as illness with timely notification, pre-arranged absences for acceptable reasons, or verifiable unavoidable circumstances) will result in administrative removal from the course without exception. You are expected to participate actively in discussion.

2. Academic Integrity: Plagiarism, cheating and other forms of academic dishonesty are prohibited. Students guilty of academic misconduct, either directly or indirectly, through participation or assistance, are immediately responsible to the instructor of the class in addition to other possible disciplinary sanctions which may be imposed through the regular institutional disciplinary procedures. 
   https://www.memphis.edu/osa/students/academic-misconduct.php
   Also see the “Code of Student Rights & Responsibilities” for further details.  
   https://www.memphis.edu/osa/students/code-of-rights.php

3. Student Health: Please review the UofM COVID-19 webpages for latest information on UofM policies. Students should not come to class if they are sick. Seek medical attention or advice and inform your team members and the instructor as soon as possible.

4. No late assignments (homework, reports) will be accepted. Without prior documentation approved and permission from the instructor, late assignments will be assigned zero credit.

5. Policies may be revised or augmented as required during the term.

Library, Tutoring, and Other Resources
- The myMemphis Portal system, eCampus Student tab provides access to University library.
- The tutoring link in the course navigation bar provides access to free online tutoring through UpSwing tutoring.

Students with Disabilities
Qualified students with disabilities will be provided reasonable and necessary academic accommodations if determined eligible by disability services staff at the University of Memphis. Prior to granting disability accommodations in this course, the instructor must receive written verification of a student's eligibility for specific accommodations from the disability services staff. It is the student's
responsibility to initiate contact with Disability Resources for Students (DRS) and to follow the established procedures for having the accommodation notice sent to the instructor.

**Sexual Misconduct and Domestic Violence Policy**
This policy specifically addresses sexual misconduct which includes dating violence, domestic violence, sexual assault, and stalking. The policy establishes procedures for responding to Title IX-related allegations of sexual misconduct. Complaints can be reported to the Office for Institutional Equity (OIE). You may contact OIE by phone at 901.678.2713 or by email at oie@memphis.edu. Complaints can be submitted online at File a Complaint. OIE’s office is located at 156 Administration Building.

**Non-Discrimination and Anti-Harassment Policy**
University policy prohibiting discrimination and harassment based on protected characteristics and classes. Complaints of discrimination and harassment can be reported to the Office for Institutional Equity (OIE). You may contact OIE by phone at 901.678.2713 or by email at oie@memphis.edu. The full text of the policy can be found at GE2030 - Non-Discrimination and Antiharassment.

**Syllabus & Schedule Changes**
The instructor reserves the right to make changes as necessary to this syllabus and schedule. If changes are made during the term of the course, the instructor will immediately notify students both by individual email communication and posting both notification and nature of change(s) on Canvas.