EGR 101L - Engineering Design & Communication
Fall 2019

COURSE LEARNING OUTCOMES

Overview
Students work in a team to learn and apply the engineering design process to solve an open-ended, client-based problem drawn from a community partner.

Course objectives
Students should learn to:
1. Apply an engineering design process to meet the needs of a client.
2. Iteratively prototype a solution using tools and materials appropriate to the solution.
3. Work collaboratively on a team to design an engineering solution.
4. Communicate the critical steps in the design process in written, oral, and visual formats.

Course outcomes
Students completing the course should be able to:
1. Successfully solve a client-based design challenge by following the critical steps in the engineering design process:
   a. Define a client’s need
   b. Complete a design context review
   c. Establish design criteria
   d. Generate solution ideas
   e. Select an appropriate solution using a decision matrix
   f. Iteratively prototype and build a physical, electronic, or code solution
   g. Evaluate a solution against established design criteria.
2. Develop proficiency to safely deploy two or more prototyping strategies or engineering tools.
3. Work collaboratively on an engineering team to complete an engineering design project.
4. Write technical memos, present oral reports with supporting visuals, and present a poster that captures critical decisions and steps during the engineering design process.
5. Apply project management skills.
6. Upon reflection, recognize the engineering process and technical content knowledge gained during the course.

COURSE FOUNDATIONS

Course Materials
- Required: EGR 101L Engineering Design and Communication workbook. This is available at the Duke bookstore.
- Required: Sakai course website resources, including videos, assignments, and documents.

Class Time
Class and lab times will be used in a variety of ways, including short lectures, in-class exercises, design team meetings, and student presentations. Attendance and active engagement are expected of all students in EGR 101L. The faculty will lead lectures and in-class exercises. Design teams are expected to work in class during all class meeting times.
Team Formation and Expectations
Teams will be formed based on student interests and skills. Students will work in their design team throughout the entire semester. Students completing the project preference form are expected to commit to the class for the entire semester. Students will have design team meetings during most class and all lab periods. For this reason, attendance in class is expected of all students except for illness or family emergency. Design teams are also expected to meet outside of scheduled class meeting times.

Each member of the design team is expected to contribute equally to the project. While types of contributions will vary, effort should be comparable. It is also important that regular team roles rotate. For example, one person should not act as the recorder for every meeting nor should one person do all the prototyping; rather, everyone on the team should take turns with these roles.

ASSIGNMENTS AND GRADING POLICY

Course Assignments and Schedule
Due dates for assignments, activities and other deliverables are listed in Table 1 (section-specific attachment) and can be found on the Sakai site for your section. There are 12 Assignments associated with the creation of the design solution. For all team and subteam A/B assignments, all members of the team should be intellectually engaged in the step in the design process, as well as participate in discussion and decision making. All assignments should represent the understanding and decisions made by the entire team.

Technical Memos
Four technical memos (TMs) record the progress of the projects. Each person in a team will be assigned to subteam A or subteam B, and each subteam will write two TMs (Assignments 1 and 6 for subteam A; Assignments 5 and 8 for subteam B).

Each TM will be graded using a rubric. If the Version 1 (Assignment X.1) grade is a High Pass (HP, numerical score of 98) or Pass (P, numerical score of 93), the Version 1 grade will stand. Subteams scoring a No Pass (NP) must submit a Version 2 (Assignment X.2) of the assignment. For these second submissions, the recorded grade will be a No Pass/Pass (NP/P, numerical score of 90) or a No Pass/Low Pass (NP/LP, numerical grade of 85 or lower).

All technical memos should be uploaded to Sakai in the corresponding Assignment. Only one student from each subteam should submit the assignment online.

Other Assignments
There are other assignments, including research sheets (Assignment 2), note cards with solution ideas (Assignment 4), and project planning documents (Assignment 9); these all have written components but are not formatted as technical memos. All members of the team will contribute to these assignments, which should be submitted (typically in hard copy form) in class. These assignments will be graded using rubrics. If the Version 1 (Assignment X.1) grade is a High Pass (HP, numerical score of 98) or Pass (P, numerical score of 93), the Version 1 grade will stand. Subteams scoring a No Pass (NP) must submit a Version 2 (Assignment X.2) of the assignment. For these second submissions, the recorded grade will be a No Pass/Pass (NP/P, numerical score of 90) or a No Pass/Low Pass (NP/LP, numerical grade of 85 or lower).

Oral Presentations and Poster
Developing technical communication skills is an important aspect of this course. Students will demonstrate their visual and oral presentation skills by developing a technical poster
Final Prototype Evaluation and Video

The quality of the final physical prototype will be evaluated in Assignment 11 (final prototype evaluation). The team’s grade will be determined based on effort and the quality of the final produced product. The instructors will look for evidence that the final prototype meets the design criteria and has been tested with the client. The team will also complete a short (3-4 min) video for Assignment 12 documenting the features and functions of their final prototype.

Participation – Team and Pre-Class Videos

A team participation score will be given three times during the semester and will range from 0 to 100%. The individual team participation grade is based on technical contribution, peer evaluation, instructor evaluation, self-evaluation, attendance, etc. Peer evaluation will be formally conducted using the CATME software. The course instructors make the final decision about a student’s participation score.

Individuals are expected to watch all assigned videos before class and complete all online quizzes. Completion of these tasks will earn full credit for the pre-class video participation grade. Individuals are expected to complete online quizzes independently and not in collaboration with other students.

Grading

The final grade will be based on the percents shown in Table 2. All members of the team will receive the same grade for team assignments. Individual student performance will be assessed through individual and subteam/group assignments, team participation, and pre-class video participation.

No late assignments will be accepted. Work that is submitted late will assessed a 25% per day (including weekends) penalty. Illness and family emergencies will be addressed on an individual basis. Students who fail to clean their workspace and check out through proper procedures at the end of the semester will receive grade deductions.

Table 2. Calculation of Course Grade

<table>
<thead>
<tr>
<th>Assignment</th>
<th>% of Final Grade</th>
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<tbody>
<tr>
<td>Assignments T1 and T2 (tools mastery modules)</td>
<td>10%</td>
</tr>
<tr>
<td>Assignments 2, 4 (team assignments: research sheets, generate ideas)</td>
<td>10%</td>
</tr>
<tr>
<td>Assignments (1 and 6) or (5 and 8) (subteam writing assignments)</td>
<td>10%</td>
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<tr>
<td>Assignment 9 (project planning and prototyping work)</td>
<td>10%</td>
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<tr>
<td>Assignment 3 or 7 (oral presentation)</td>
<td>10%</td>
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<tr>
<td>Assignment 10 (poster)</td>
<td>10%</td>
</tr>
<tr>
<td>Assignment 12 (video documentation of solution)</td>
<td>5%</td>
</tr>
<tr>
<td>Assignment 11 (final prototype evaluation)</td>
<td>15%</td>
</tr>
<tr>
<td>Team participation (CATME I, II, III + instructor evaluation)</td>
<td>10%</td>
</tr>
<tr>
<td>Pre-class video participation</td>
<td>10%</td>
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RESOURCES

In-class Teaching Assistants
Teaching Assistants (TAs) will be supporting teams during the class and lab times. The TAs are undergraduate engineering students with experience in design and teaming. Each TA will mentor two or three teams.

Lab RATS
Lab RATS (i.e., Lab Really Awesome Technical Staff) work in the POD or Foundry on weekday evenings and weekends. The Lab RATS schedule and contact information can be found on Sakai. They will primarily assist teams with the tools mastery projects and prototyping their designs.

Writing Consultants
Trained writing consultants will assist student teams in preparing high quality technical memos. On many lab days, at scheduled times, these writing consultants will meet with subteams and teams to help them improve, clarify, and edit their written submissions for assignments. Meeting dates with writing consultants are listed in Table 3 (section-specific attachment). Prior to meeting with a writing consultant, each team must have a hard copy of a complete draft of their technical memo. Before each technical memo is submitted, teams are expected to revise their document after meeting with a writing consultant. Note that sections 3 and 5 will operate without writing consultants.

Technical Mentors
Technical mentors will also support teams. These individuals are faculty members, lab managers, members of the engineering community, or advanced graduate students. Technical mentors have engineering expertise and design knowledge that are valuable to helping your team complete its project. Your team is expected to meet with your technical mentor once a week, either during the lab period or at a separately scheduled time. Students should maintain regular communication with their technical mentors and prepare questions for their mentor before meetings.

Lab Manager and Program Coordinator
Amanda Cyprowski (amanda.cyprowski@duke.edu) is the coordinator for the course. Students should contact the program coordinator with any administrative questions. The lab manager at the POD is Murad Maksumov (murad.maksumov@duke.edu), and the lab manager at the Foundry is Ali Stocks (allison.stocks@duke.edu). Students should consult them with questions related to working with POD and Foundry lab equipment and product orders. Students are expected to follow all lab protocols and safety instructions outlined by the lab manager at all times, and are expected to sign a document at the outset of the semester verifying their commitment to a safe and clean working environment. Amanda, Ali, and Murad are integral to the course, and it is expected that students will respond to emails and other requests made by them.

Students with disabilities who believe they may need accommodations in this class are encouraged to contact the Student Disability Access Office at (919) 668–1267 and speak with an instructor as soon as possible to better ensure that such accommodations can be implemented in a timely fashion.