

**ENGR4201\_2 ENGINEERING**

**DESIGN PROJECT 1&2**

**Syllabus**

“Remember me for this also, my God,

and show mercy to me according to your great love.” – Nehemiah 13:22f

Fall 2022

CONTACT INFORMATION

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COURSE DESCRIPTION

This is the first of a two-semester linked sequence that includes ENGR 421. Students must take ENGR 4202 in the next sequential semester after successfully completing ENGR 4201. ENGR 4201 and ENGR 4202 require the creative application and integration of engineering hardware and software to develop a prototype which provides a solution to a stated problem. The prototype will be designed, analyzed, implemented, and tested over the two-semester sequence. Students will complete the design project as members of a team. Oral and written presentations will be required to indicate plans and progress for the design project. The first semester will emphasize designing and analyzing the prototype. The second semester will emphasize building and testing the prototype. Documentation will be emphasized over both semesters.

Prerequisite: [EENG 420](http://harding.catalog.acalog.com/preview_program.php?catoid=39&poid=3422#tt4579)0 or [MENG 410](http://harding.catalog.acalog.com/preview_program.php?catoid=39&poid=3422#tt459)0 or [BENG 370](http://harding.catalog.acalog.com/preview_program.php?catoid=39&poid=3422#tt9798)0; and [BENG 380](http://harding.catalog.acalog.com/preview_program.php?catoid=39&poid=3422#tt7327)0.

The ABET Engineering Accreditation Commission defines the key characteristics of the engineering process in terms of complex engineering problems, engineering science, engineering design and teams.

COMPLEX ENGINEERING PROBLEMS

Complex engineering problems include one or more of the following characteristics: involving wide-ranging or conflicting technical issues, having no obvious solution, addressing problems not encompassed by current standards and codes, involving diverse groups of stakeholders, including many component parts or sub-problems, involving multiple disciplines, or having significant consequences in a range of contexts.

ENGINEERING SCIENCE

Engineering sciences are based on mathematics and basic science but carry knowledge further toward creative application needed to solve engineering problems. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other.

ENGINEERING DESIGN

Engineering design is a process of devising a system, component, or process to meet desired needs and specifications within constraints. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making trade-offs, for the purpose of obtaining a high-quality solution under the given circumstances. For illustrative purpose only, examples of possible constrains include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability.

TEAMS

A team consists of more than one person working toward a common goal and should include individuals of diverse backgrounds, skills, or perspectives.

LEARNING OUTCOMES\*

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| --- |
| 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics 2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors 3. an ability to communicate effectively with a range of audiences 4. an ability to 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 5. 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 6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.   \*ABET – Accreditation Board for Engineering and Technology [www.abet.org](http://www.abet.org) |

TEXTBOOKS

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| --- | --- |
|  | **Product Design and Development 7th Edition**  By Karl Ulrich and Steven Eppinger and Maria C. Yang  © 2020  Published: July 19, 2019  ISBN 9781260043655  Publisher: McGraw Hill |
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CLASS TIMES AND LOCATION (Fall semester):

Lectures:

Tuesdays: 10:00 am – 12:50 pm

Thursdays: 10:00 am – 12:50 pm

Room: SCI 300

COMMUNICATIONS

Course materials including lectures, quizzes, calendar, rubrics and other communications will be stored in the Canvas Learning Management System [www.harding.instructure.com/login](http://www.harding.instructure.com/login) . Also, check your Harding email and Canvas course announcements daily for possible course communications.

FALL COURSE REQUIREMENTS

The final course grade for ENGR 4201 will be weighted and assigned as follows:

Quizzes . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .10%

Project Selected by Due Date+ . . . . . . . . . . . . . . . 5%

A3 Status Reports+ . . . . . . . . . . . . . . . . . . . . . . . .10%

Individual (2%)

Team (8%)

Written Reports+ . . . . . . . . . . . . . . . . . . . . . . . . . . 15%

Project Launch (3%)

System Design (6%)

Detail Design (6%)

Team+ (3%)

Individual (5%)

Oral Presentations+ . . . . . . . . . . . . . . . . . . . . . . . . 15%

Project Launch (3%)

System Design (6%)

Detail Design (6%)

Prototype Progress . . . . . . . . . . . . . . . . . . . . . . . 15%

System Design (7.5%)

Detail Design (7.5%)

Major Parts Ordered by Due Date+ . . . . . . . . . . . . 5%

Peer Performance Evaluations . . . . . . . . . . . . . . . . 5%

Individual Course Performance Evaluation . . . . . 20%

Entrepreneurial Bonus+ . . . . . . . . . . . . . . . . . . . . +2% (maximum in the fall, 4% in the spring)

SPRING COURSE REQUIREMENTS

The final course grade for ENGR 4202 will be tentatively weighted and assigned as follows:

A3 Status Reports+ . . . . . . . . . . . . . . . . . . . . . . . . .20%

Written Reports . . . . . . . . . . . . . . . . . . . . . . . . . . . 20%

Build Design (10%)

Team+ (5%)

Individual (5%)

Product Readiness (10%)

Team+ (5%)

Individual (5%)

Oral Presentations+ . . . . . . . . . . . . . . . . . . . . . . 20%

Build Design+ (10%)

Product Readiness+ (10%)

To be determined . . . . . . . . . . . . . . . . . . . . . . . . 5%

Peer Performance Evaluations . . . . . . . . . . . . . . . 5%

Individual Course Performance Evaluation . . . . . 35%

System Specifications Achieved . . . . .(10% )

Individual Subsystem . . . . . . . . . . . . (25% )

Entrepreneurial Bonus+. . . . . . . . . . . . . . . . . . . . . . +4% (maximum in the spring)

+ Denotes categories that will be scored as a team. Faculty reserve the right to adjust based on individual contribution.

COURSE EVALUATION

**Determining Your Grade:** Your work will be awarded a point value out of the total number of points possible for each particular assignment or exam. The instructor may optionally make minor modifications to the total points and/or quantity of a given work requirement and thus alter the total points for the course. Your final percentage grade will be determined by adding up all points you have received and dividing by the total. Your grade will be truncated to the nearest whole percentage point (example: 93.9 will be truncated to 93%). When figuring out your own grade, please remember that any earned extra credit points should be added to YOUR score, not the total points possible for the course.

**Grading Scale**

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| --- | --- |
| Grade | Percentage |
| A | 90-100% |
| B | 80-89% |
| C | 70-79% |
| D | 60-69% |
| F | <60% |

**Graded Work Score Changes:** If you believe that an error has been made in assigning the grade for your work, you may request to have the grade changed. All grade-change requests for any graded work should be typed and accompanied by a copy of your graded work, and they must be submitted no later than the next class session. Please note any computational errors, identify pages from the text that support your answer or articulate any ambiguity in the wording of the question that caused problems.

FALL MILESTONES

|  |  |
| --- | --- |
| **Tentative Date\*** | **Milestone (Deliverable)** |
| 08 September | Project Selected |
| 24 September (SATURDAY) | Project Launch Review |
| 18 October | System Design and Project Plan Report |
| 20 October | System Design Review (Stage Gate) |
| 21 October | Peer Performance Evaluation 1 |
| 06 November | Entrepreneurship Bonus |
| 06 December | Major Parts Ordered |
| 06 December | Detail Design Report |
| 08 December | Detail Design Review (Stage Gate) |
| 09 December | Peer Performance Evaluation 2 |
| 13 December | Lab Pickup @3:30 pm |

\*Official Dates are in Canvas

# HAPPINESS IS BEING A GRANDPARENT

Professor Wells’ first grandchild is due on November 3rd in Oklahoma City. History says 80% of expectant mothers deliver within a +/- two-week window of their due date. Schedules may be adjusted when this day comes. Look for announcements from Canvas. –“Papa”

SPRING MILESTONES

|  |  |
| --- | --- |
| **Tentative Date\*** | **Milestone (Deliverable)** |
| Late February | Entrepreneur Bonus (business plan due) |
| Tuesday Week 8 | Build Design Report |
| Thursday Week 8 | Build Design Review (Stage Gate) |
| Friday Week 8 | Performance Evaluation 1 |
| Week 14 | Product Demonstration |
| Tuesday Week 15 | Product Readiness Report |
| Thursday Week 15 | Product Readiness Review |
| Thursday Week 15 (tentative) | Computer Science and Engineering Showcase (Rhodes Fieldhouse) |
| Friday Week 15 | Performance Evaluation 2 |
| Finals Week | Exit Survey and Lab Cleanup |

\*Dates to be finalized in the Spring semester

TIME MANAGEMENT EXPECTATIONS

For every class hour, the typical student should expect to spend at least two clock hours of problem solving, reading, reviewing, organizing notes, preparing for coming exams/quizzes and other activities that enhance learning. **Successful students in this course should expect to wisely use significantly more time outside of class.**

SENIOR DESIGN LABS

Room SCI-307 is available for Senior Design teams to meet and work together. The configuration allows for one pod (two grouped desks with two computers) and workbench for each team. The rooms are meant for collaboration and small system assembly and test. Electronic instrumentation is provided for such. Also, working flat desks/benches are available in the Ulrey Engineering Lab as needed in the experimentation room. It is recommended to select location and provide team label/sign. The Buddy System is always required in SCI-316 and Ulrey labs.

QUIZZES

In the first semester, open-book quizzes may be given over the reading. No unauthorized help may be given or received on the quizzes. Missed quizzes will receive a grade of zero. No opportunities will be given to make up missed quizzes and no quizzes will be dropped in calculating your quiz grade.

PROJECT SELECTION DUE DATE

You will earn 5% of your overall course grade in ENGR 4201 by finalizing and informing the professors of what your project will be no later than 5:00 p.m. on this date.

A3 STATUS REPORTS

Each group is responsible for submitting a biweekly (once every two weeks) status report identifying concerns, indicating progress, and outlining immediate plans for the project. The status report must be uploaded into Canvas and provided in hardcopy in class. It must follow the A3 format as specified in class. Individuals will present at least one A3 each semester.

GROUP ORAL PRESENTATIONS

Throughout the two-semester sequence you will give formal and informal oral presentations describing the plans and progress for your project. Formal presentations should be representative of a typical business presentation including professionally looking visual aids and attire. For the formal presentations, all team members must orally report on some attribute of the project. **The formal oral presentation grades will be affected by a “gate” decision as a part of the “Stage-Gate” process. Each ‘redo’ required to pass through a gate will result in a 10% point loss on both the formal oral presentation scores and the written report scores associated with that gate.** Informal presentations will be done in class and will require the A3 status report and whatever additional materials are appropriate to convey progress made and immediate plans for the project.

WRITTEN REPORTS

Over the two-semester sequence there will be five main written reports (three reports each semester) to be completed by each group. These are 1) the Project Launch document [requirements specification], 2) the System Design document [system design and project plan], 3) the Detail Design report, 4) the Build Design report and 5) the Product Readiness report. One electronic copy of the main reports should be submitted for grading. Written reports should include appropriate citations to the work of others where appropriate. Group and individual reports will be due on the day and time as published in Canvas. Reports submitted one minute or more after this time will be considered late and the grade reduced by 10%. Each additional hour the report is late will result in a grade reduction of 10%. **The group written report grades will also be affected by a “gate” decision as a part of the “Stage-Gate” process. Each required ‘redo’ to pass through a gate will result in a 10% point loss on both the formal oral presentation scores and the group written report scores associated with that gate.**

ENGINEERING NOTEBOOKS

Each individual will keep an engineering notebook. The notebook will be a record of all the individual’s contributions to the project. The notebook will be reviewed by the professors approximately once every two weeks. To get full credit, the engineering notebook must show that the individual is substantially contributing to the project and the notebook must follow the proper format and conditions as specified in class.

PARTS ORDERED DUE DATE

Each member of a team will earn 5% of their course grade by the team providing evidence that all major components of their project have been ordered by 5:00 p.m. on this date. This evidence can be provided by having all purchase order requests turned in that total at least 80% of the total expected cost for building the prototype. The total expected cost is the total expected cost as of the parts ordered due date, not the original projected cost estimated for the system design and project plan report. The total expected cost does not include any reserves needed to address unexpected contingences.

PEER PERFORMANCE EVALUATIONS

Twice during each semester, an evaluation will be made by the group members on the effectiveness of each member on the team. Full credit will be given for completing all the evaluations and turning them in on time. A grade of zero will be given for any incomplete evaluations or evaluations not turned in on time. Late submissions will not be accepted.

You will assess your team mates’ contributions based on the following statements using a Likert scale (Strongly agree, Agree, Neither agree or disagree, Disagree or Strongly Disagree):

1. This team member has been cooperative and has had an appropriate attitude towards the group and project.
2. This team member has attended group meetings and has participated and arrived on time for the meetings.
3. This team member is willing to follow the team's directives.
4. This team member completes tasks effectively and independently (without excessive oversight or help).
5. This team member effectively communicates his or her work status, needs, concerns and/or problems.
6. This team member makes good design, implementation, and testing decisions.
7. This team member meets deadlines.
8. This team member participates in written and/or oral reports and presentations.
9. This team member is diligent in making sure tasks are completed correctly.
10. This team member is productive and contributes his or her fair share of the work.

BONUS – ENTREPRENEURIAL COMPETITION

Every spring, the College of Business sponsors business teams from Harding that participate in an entrepreneurial competition. Your team may choose to compete in this competition in one of two ways in order to receive bonus credit. If your team chooses to compete in the competition by itself, each member will receive a 1% credit on their fall course grade for working with Dr. Frazier to prepare for the competition in the spring. Each member of this team will then receive a 2% increase in their ENGR 4202 course grade for giving a good faith effort in competing in the contest in the spring. If a team partners with two or more business students to participate in the competition, each team member will receive a 2% increase in their course grade in the fall semester for preparing for the competition. Each member will receive a 4% increase in their ENGR 4202 course grade if they then continue and give a good faith effort in competing in the spring. Although you may wait until the spring to decide to participate in the competition, you will be eligible for bonus credit in ENGR 4201 if you decide to participate by the designated date during the Fall semester. In the Spring, The Governor’s Cup formal report will be submitted to Canvas.

INDIVIDUAL COURSE PERFORMANCE EVALUATION

Your course grade is an overall evaluation of the successfulness of your project. In the fall, it will be highly correlated to the perception that the final design will result in a successful prototype which completely meets the requirements specification. In the spring, it will be highly correlated to how well the requirements specification was met by the final prototype as determined by the acceptance tests. However, this grade will also be based on an evaluation of how well each individual developed their subsystem, documented results in the engineering notebook, responded to comments or questions and, handled problems that arose such as scheduling conflicts, team personality conflicts, and budget constraints.

SENIOR DESIGN KNOWLEDGE BASE

All past student team reports and presentations are available for review within a Canvas course titled, “Senior Design Knowledge Base.” These are organized by academic year and team (product) name. A one-page summary of technologies used is included. These are useful to understand possible technologies and specifications. They also provide examples of presentation and writing methods.

LATE WORK

Unless otherwise directed, it is expected that **ALL** assigned work will be ready to be turned in at the **BEGINNING** of the class in which it is due. Point penalties begin immediately after the instructor has collected the work.

Assignments and projects may be submitted late at the instructor's discretion. Late penalty per 24 hour period is equal to 20% of credit available for that deliverable, unless specified otherwise herein.

It may not be possible to grade late work in time to be returned to the student by the end of the semester.

ATTENDANCE

You are expected to be here! Attendance will be taken each class period. You will be given significant class time to work with your team. This is valuable time. Absences hurt the entire team. Class attendance will be considered in determining your individual project evaluation and grade.

A student is on-time if:

* The bell has not rung for the start of class and you have signed the roster.
* The bell has rung and you arrive before the instructor.

A student is tardy if the instructor is present and the bell has rung.

NOTE:

* If the roster is not signed it will be counted as an absence for that day.
* If you are more than 15 minutes late you are absent for that day.
* Dropping off books or coats and then leaving does not count as being in attendance. You will be tardy upon returning if the bell as rung.
* Persistent late arrivals or more than three unexcused absences will result in grade reduction and can lead to course withdrawal.
* Communicate with the instructor and there will be no problems.

DRESS CODE

All members of the Harding community are expected to maintain standards of modesty and decency in dress appropriate to the Christian lifestyle and consistent with professional employment expectations. For these reasons, students are expected to adhere to the established dress code in the student handbook. Additional standards of dress will be required while in the labs.

Failure to adhere to the dress code may result in an unexcused absence and quiz grade of zero for each offense. Repeated failure to adhere to these standards may result in a grade reduction or course withdrawal and/or other actions as deemed appropriate and consistent with Harding University guidelines. This applies to what is viewable in video conferencing.

Class Incumbent Weather Policy

In case campus is closed due to bad weather, we will meet via Zoom at the regular time per course schedule.

CLASS CANCELLATIONS

In the event that class is canceled, assignments due on the day of the canceled class will be due at the NEXT class meeting. ***This policy does not apply to any assignments that are required to be turned in electronically.***

On days when the university has NOT canceled classes, students should wait **15 minutes** for the instructor to arrive in the classroom. If the instructor has not arrived in that period of time, the class will be considered time for team work **UNLESS OTHER INSTRUCTIONS ARE POSTED IN THE CLASSROOM OR NEAR THE DOOR OF THE CLASSROOM OR IN CANVAS.**

AFTER HOURS LAB ACCESS

Past students have found the need to access engineering labs outside of normally open hours. Requests for such must be made within 24 hours of the need via a request email sent to Professor Wells or Dr. Olree no later than 2:00 pm of the same day. This provides adequate time to notify the proper administration officials and public safety of engineering department approval. The email must include the student’s dorm parent name and email address when applicable. NOTE: There is an all-campus security curfew from 12:15 until 5:00 a.m., Sunday through Thursday, and1:15 a.m. until 5:00 a.m., Friday and Saturday. For protection and security purposes, any activity on campus will be regulated during these hours. Any person needing to come on campus or leave during these hours must report to Public Safety.

INCOMPLETE GRADE

An incomplete grade will only be granted in the most extraordinary of circumstances and must be requested by the student and approved by the instructor and the office of the Vice President of Academic Affairs. Requests must be submitted using the ‘Incomplete Grade Agreement Form’. The instructor will adhere to Harding Policies. Please refer to the Harding University Catalog for additional information.

WITHDRAWALS

If you stop attending class without formally withdrawing, you may receive an “F” for the course and must repeat the entire two semester sequence. Please make sure you have completed the necessary paperwork with the instructor and the Registrar Office if you find it necessary to stop attending this semester.

# REMOTE STUDENTS

Remote students are responsible to complete all course activities including attendance during posted class times.

Zoom (or equivalent) video conferencing will be available for all live classes.

Live class lectures/activities will be recorded and stored in Canvas.

All Harding policies for such will be enforced.

# COVID-19 STATEMENT

Our goal is to provide a safe and positive learning environment for all of our students. As a faith-based university, we have a responsibility to care for one another. The current COVID-19 pandemic gives us a good opportunity to do so, by following the guidelines to minimize transmission of the novel coronavirus.  Every precaution will be taken to be sure that class is conducted in a way that is safe and in compliance with state and university guidelines. If you feel a situation needs to be addressed in the classroom environment, please speak with me as soon as possible so that the situation can be improved.

Due to the uncertain and unusual climate during which this course is being offered, certain adjustments may have to be made including changes to meeting times, modalities and work assignments. Every effort will be made to notify students of any change as soon as possible. Because this course may/will be meeting using video conferencing, students are expected to find a safe, secure and reliable internet connection in order to participate in virtual meetings at the required level.

# SYLLABUS POLICY EXCEPTIONS

The instructor reserves the right to utilize professional judgment to make exceptions to the syllabus policies. In general, exceptions to the policies in the syllabus will only be made in the most extraordinary of circumstances (i.e. a *verifiable* emergency or long-term illness). Students may be required to provide documentation of such extraordinary circumstances, and the instructor shall be the one who determines what constitutes acceptable documentation. The instructor may require an alternative format for evaluating student performance in the event of extraordinary circumstances. The instructor reserves the right to assess penalties for late work, regardless of the circumstances.

# ACADEMIC INTEGRITY

Honesty and integrity are characteristics that should describe each one of us as servants of Jesus Christ. As your instructor, I pledge that I will strive for honesty and integrity in how I handle the content of this course and in how I interact with each of you. I ask that you join me in pledging to do the same.

Academic dishonesty will result in penalties up to and including dismissal from the class with a failing grade and will be reported to the Associate Provost. All instances of dishonesty will be handled according to the procedures delineated in the Harding University catalog.

Direct copying work from other students in this or previous classes or from available textbook answer keys will be considered a violation of this policy and treated accordingly. A first offense will result in a grade of zero on all pertinent work and a letter sent to the office of the Provost. A second offense will result in failure of the entire course.

# ASSESSMENT

Harding University, since its charter in 1924, has been strongly committed to providing the best resources and environment for the teaching-learning process. The board, administration, faculty, and staff are wholeheartedly committed to full compliance with all Criteria of Accreditation of the Higher Learning Commission as well as standards of many discipline-specific specialty accrediting agencies. The university values continuous, rigorous assessment at every level for its potential to improve student learning and achievement and for its centrality in fulfilling the stated mission of Harding. Thus, a comprehensive assessment program has been developed that includes both the academic units and the administrative and educational support units. Course-specific student learning outcomes contribute to student achievement of program-specific learning outcomes that support student achievement of holistic university learning outcomes. All academic units design annual assessment plans centered on measuring student achievement of program learning outcomes used to sequentially improve teaching and learning processes. Additionally, a holistic assessment of student achievement of university learning outcomes is coordinated by the university Director of Assessment used to spur continuous improvement of teaching and learning.

# STUDENTS WITH DISABILITIES

It is the policy for Harding University to accommodate students with disabilities, pursuant to federal and state law. Therefore, any student with a documented disability condition (e.g. physical, learning, or psychological) who needs to arrange reasonable accommodations must contact the instructor and the Office of Disability Services and Educational Access at the beginning of each semester. If the diagnosis of the disability occurs during the academic year, the student must self-identify with the Office of Disability Services and Educational Access as soon as possible in order to get academic accommodations in place for the remainder of the semester. The Office of Disability Services and Educational Access is located in Room 226 in the Student Center, telephone, (501) 279-4019.