Capstone Design

Rose Hulman Institute of Technology

Syllabus and Timeline
Example from AY25-26

Contents

Calendar for ME470 AY25-26 (Fall)

Red – Major deliverables,
Blue – professionalism credit,
Green – Bi-weekly Project Deliverables

Week # *Date on Monday*	**Monday/Tuesday**	**Thursday/Friday**
Week 0 Sep 1		Lec: Intro to Class and Projects Assignment Process **Project Preferences due on Friday at 5 pm** Shop Access Homework
Week 1 Sep 8	Assign Projects Sign NDAs Lec: Project and Team Expectations 1) First Client Email draft, 2) Teaming Activity Worksheet, Lec: Design Process & Project Needs 3a) Meeting Agenda draft, 3b) Project Needs activity	Lec: Benchmarking & Other Factors that influence design 1. **Email your client** *(once draft is approved, send it to client and cc your instructor on the email)* 2. **First Meeting Agenda** *(it is due before the client meeting)* 3. **Teaming Activity Worksheet** *(worksheet is on Moodle)* 4. **Project Needs** *(continue working outside of class)*
Week 2 Sep 15	Lec: Design Objectives **Submit Space Request**	Career Services to Class Lec: Project Deliverables & Ethical Considerations
Week 3 Sep 22	Lec: Technical Specifications **Project Deliverable 1 – Wed 8 am** **CATME – trial** *– complete after your project deliverable is submitted*	Lec: Problem Statement & Problem Definition & External Review *Peer review assignments & feedback form* **Shop Tours**
Week 4 Sep 29	Lec: Functional Model	Lec: Concept Generation Peer Review during assigned time, upload **Draft slides for External Review** to Moodle after your presentation is completed.
Week 5 Oct 6	Lec: Concept Selection **Anonymous Plus/Delta** **Project Deliverable 2 – Wed 8 am**	**Fall Break**
Week 6 Oct 13	**External Reviews** *External Review will be scheduled based on your team's progress and the reviewer's availability (Between week 5 and week 6)*	**External Reviews** **CATME – mid due**

Week # *Date on Monday*	**Monday/Tuesday**	**Thursday/Friday**
Week 7 Oct 20	Lec: Prototyping & Demo Day Proposal Presentation **Project Deliverable 3 – Wed 8 am**	Lec: End-of-Quarter deliverables & Purchasing & Basics of MS Word
Week 8 Oct 27	**Proposal Presentation & Written copy of proposal** *Proposal Presentation will be scheduled based on your team's progress and client's availability (Between week 7 and week 9)*	
Week 9 Nov 3 DST ends	Lec: TBD **Project Deliverable 4 – Wed 8 am** *DST ends, check client meeting times*	Project Worktime
Week 10 Nov 10	**Draft report – Peer Review** **Qtr. I Report Due** 5 pm Wed wk10 - 2% extra credit 5 pm Fri wk10 for – full credit 5 pm Mon Finals wk – 2 % penalty	Friday by 5 pm □ Qtr 1 Course feedback □ Time Log link □ Meeting time for winter □ Draft of email to client
Finals Nov 17	**Proof-of-Concept Demo** Scheduled during the final exam time slot **CATME Qtr1 final:** due on Monday of finals week	

Calendar for ME471 AY25-26 (Winter)

Week # *Date on Monday*	**Monday/Tuesday**	**Thursday/Friday**
Week 1 Dec 1	Return Qtr I Report Lec: Project Planning & Project Budget Approval Client presentation **Teaming Reflection Qtr 2**	Lec: Self-Directed Learning & External Review & Technical Analysis **Quarter-Goals – whole team** **Sprint #1 plan – PM#1**
Week 2 Dec 8		
Week 3 Dec 15	**Self-Directed Learning Plan** Part 1: Topic & Part 2: Plan Monday 8 am – individual submission	**Sprint 1 Due**
Holiday Break: Dec 20th, 2024 to Jan 4th, 2026		
Week 4 Jan 5		
Week 5 Jan 12	Lec: Failure Modes and Effects Analysis (FMEA) **External Review** (flexible)	**Sprint 2 Due**
Week 6 Jan 19	MLK day – No class on Monday Tuesday project work time for both sections	
Week 7 Jan 26		**Sprint 3 Due** **FMEA Activity Due** (with Sprint 3)
Week 8 Feb 2	**Project Approval by Client** (flexible)	
Week 9 Feb 9	Lec: End of Quarter Deliverables	**Sprint 4 Due**
Week 10 Feb 16	**Peer Review - Draft report** **Quarter-Goals Final Due**	**Qtr II Report Due** 5pm Wed wk10 - 2% extra credit 5 pm Fri wk10 for – full credit 5 pm Mon Finals wk. – 2 % penalty Lessons Learned with FMEA Reflection Due Time Log link – post on Teams Course Evals
Finals Week Feb 23	**Functioning Prototype Demo** in finals week **Qtr 2 Final CATME due**	
Quarter Break: March 1st to March 9th ,2026		

Calendar for ME472 AY25-26 (Spring)

Week # *Date on Monday*	**Monday/Tuesday**	**Thursday/Friday**
Week 1 Mar 9	**Qtr III Team Reflection** Lec: Intro to ME472 & Rose Show	
Week 2 Mar 16		
Week 3 Mar 23	**Project Updates #1**	**Self-Directed Learning Complete** Parts 3 & 4, along with parts 1 & 2
Week 4 Mar 30	**External Review** (flexible week 4/ 5/ 6) Rose Show Registration: Wednesday, April 1, 2026 (11:59 PM)	
Week 5 Apr 6	**Project Updates #2**	**Qtr 3 mid CATME due**
Spring Break: April 11th to April 19th, 2026		
Week 6 Apr 20	Lec: End of Capstone Deliverables	**Rose-Show Poster Due** by 5 pm on Friday for grading
Week 7 Apr 27	**Project Updates #3** Email poster for printing by 8 AM on Wed, April 29th, 2026	
Week 8 May 4	**Rose Show** Wed of Week 8 (May 6th, 2025) from 1 pm to 3 pm in the SRC fieldhouse	
Week 9 May 11	**Final Defense to Client** (flexible week 8/ 9/ 10)	**Qtr III Report due** 5 pm Wed Wk 9 - 2% extra credit 5 pm Fri Wk 9 for – on time 5 pm Mon Wk10 – 2% penalty
Week 10 May 18		**Qtr 3 Final CATME due** *Summative – no peer-to-peer feedback* □ Capstone Exit Interview □ Capstone Brochure □ Qtr 3 Course Evals □ Time Log link – post on Teams
Project Completion: May 22nd, 2026 Grades Due: May 26th, 2026 for graduating seniors		

Syllabus for ME Capstone at Rose-Hulman

Course Objectives

The main goal of the capstone course sequence (ME470, ME471, and ME472) is to prepare engineering students for transitioning to professional practice. You will be assigned to a design project with a student team. For success in the capstone sequence, a design project emphasizes the **design process**, the **design outcome**, and the **design communication**. On occasion, designs fail to achieve project outcomes. The learning that occurs from such failure is the most critical educational objective. We expect students to be introspective and open-minded so that they can grow from their experience. The core course learning objectives for the capstone sequence (ME470, ME471, and ME472) are

- Experience the entire cycle of design, build, test, **and iterate!**
- Improve the ability to communicate with peers, technicians, staff, project advisor (your instructor), other faculty or subject area experts, and the external project client
- Demonstrate an ability to learn new knowledge (self-directed learning)
- Document the evidence of completion of individual and team tasks *(Documented evidence, both with regard to the amount of work completed and the quality of work completed, is directly proportional to the course grade)*

Course Outcomes

At the completion of the capstone sequence, ME470, ME471 and ME472, students will demonstrate the following engineering outcomes:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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.
    a. Identify specified needs that consider public health, safety, welfare, global, cultural, social, environmental, and economic factors
    b. Develop technical specifications that address customer/client needs and constraints
    c. Develop a conceptual design by generating multiple solutions, evaluating the feasibility of the solutions, and choosing the appropriate solution
    d. Realize a conceptual design using appropriate design tools and methodologies
    e. Test and refine the implementation until the technical specifications are met or exceeded
    f. Demonstrate that the design meets the goals based on technical specifications.
3. Communicate effectively with a range of audiences
    a. Communicate effectively with a non-technical audience

   b. Demonstrate ability to communicate effectively and professionally using a variety of formats
   c. Document the finished product or process
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment.
   a. Demonstrate that you are part of a team by explaining your common goal and describing your diverse backgrounds, skills, or perspectives
   b. Demonstrate that, as a teammate, you are collaborative and inclusive
   c. Demonstrate that your team provides effective leadership
   d. Demonstrate that you meet team objectives by helping keep the team on track
6. Plan and execute the assigned project by establishing goals, planning tasks, and meeting objectives
   a. Establish measurable goals for the team
   b. Plan tasks needed to achieve the goal
   c. Demonstrate how you can meet objectives
7. Acquire and apply new knowledge as needed, using appropriate learning strategies
   a. Establish a goal by identifying new knowledge required
   b. Document a plan to acquire knowledge
   c. Provide evidence of learning via application of knowledge gained

Attendance

This course is not a series of lectures and labs. This course is designed to prepare students for professional careers after graduation. You work for the Rose-Hulman Mechanical Engineering consulting company. You owe the company **12 good hours of work per week**. You will be assigned to a project and are expected to help with other projects when needed. This company's goal is to complete client projects professionally. There is some flexibility if it is managed professionally. For example, we offer flexible hours during the week of the career fair or when a student is scheduled for an interview.

The course instructor reserves the right to penalize a student's grade for excessive absenteeism or unprofessionalism.

- Attendance is expected for pre-scheduled lecture time, lab time, client meetings, project team meetings, and other activities.
- Arriving late or leaving early without notifying people ahead of time is considered unprofessional.
- Excessive excuses that interfere with project work are also considered unprofessional.
- A client meeting that is scheduled outside of class time and communicated with the team is considered a required component of the class.

For the capstone course, an **absence of more than 8 hours for class-related activities per quarter** may result in a failing grade. In case of any absences, the student is expected to make a plan to catch up and communicate with the instructor via email. The responsibility for any absences and making plans to resume lies with the student. Since this class is intended to teach students to be professional, the instructor will not reach out to students regarding any absences. ***The plan for catching up must be approved by the instructor within five business days after resuming classes.*** Sometimes, the plan needs a few revisions before the instructor approves it. Students are expected to communicate their plan as soon as they resume so that it can be approved within five business days. For more information specific to this course, refer to the time log and attendance guidelines (an example of a plan is explained here).

For general Rose-Hulman guidelines, refer to the attendance policy for Rose-Hulman.

Commitment to Diversity, Equity, and Inclusion

Creating an inclusive environment of individual attention and support requires that we remain open to making adjustments when needed. If you or a classmate experiences an unwelcoming learning environment as a result of my actions or your classmates' (intentional or unintentional), please talk to me. You can do so individually or by bringing along a trusted peer. If we cannot resolve the conflict, you could also speak with other ME faculty members or the ME Department Head, Dr. Onyancha.

Student Well-Being and Academic Success

Rose-Hulman cares about the well-being of every student. Stress is a regular part of the college experience and is often compounded both by classwork and unexpected challenges outside the classroom. I encourage you to reflect on how you take care of yourself throughout the term, especially before the demands of exams and projects reach their peak. You can reach out to the Learning Center, Student Academic Success, or the Student Counseling Center (which offers both online and in-person resources) for assistance. Additional resources to help maintain your work-life balance can be found on the Campus Life web page and within the Student Success Guide. If you, or someone you know, is struggling, you can let us know through the Rose Cares system, and someone will reach out.

Team Peer Evaluations

Your grade will be adjusted based on the evaluations that you receive from your teammates. This adjustment can and has resulted in students failing the course. It is possible for a team to receive an "A" on all deliverables and for a team member to receive an "F" in the course. Part of professional practice is evaluating your teammates honestly and fairly. **CATME** will be used for team peer evaluation (https://catme.org/). CATME peer evaluations, team's time log, weekly meeting minutes, and instructors' observations will be used to assign individual grades. ***Students will only get credit for their contributions to the project's outcome***.

Removal from Project Team

Any student who fails to perform well on their assigned design project tasks will be removed from the project and assigned to another project without an external client. The course instructor reserves the right to ***remove a student from a project team for excessive absenteeism or continued unprofessionalism***. Students will be warned and given a chance to improve their contribution before dismissal. We will not risk the reputation of Rose-Hulman and the program. Documented evidence of completion of (individual) tasks during the week is required to stay on the assigned project team.

Professionalism

Your grade will be adjusted based on the professionalism you show in the class. Points will be deducted from the professionalism grade if students are late, missing, leave early, not completing peer evaluations, etc. Students are also expected to be professional, adapt to changing circumstances, and deliver the design project to the best of their ability.

Course Materials and Communications

Information related to this course is available on **Moodle**. Each quarter, expectations are outlined in the capstone guidelines document, which is shared on Moodle. In addition, students have access to course grading rubrics on Moodle. Students are expected to use this information to guide their development process. Students are also expected to maintain a design notebook (an electronic version is recommended) and a time log that is easily accessible to both their team members and their instructor.

Microsoft Teams group is available for students. Each project team will be assigned a private channel. This channel will be used to distribute graded rubrics and other team-specific communication.

Class communication will be conducted via RHIT Email and Microsoft Teams. You are responsible for any class communication sent via email and Microsoft Teams. Remember to **turn on the notifications** to suit your preferences.

Travel Documentation

There are two travel forms for you to complete. The Assumption of Risk and Release Waiver must be completed once for the school year. The Student Travel Request must be completed each time you travel (one form per team).

Grading

You will receive a grade for this course, but achieving it is no longer your primary objective. Instead, you aim to deliver a well-documented product to your client that has been thoroughly tested to demonstrate it performs as specified by the client. Do that, and you will receive a good grade. If you fail to do that, you will receive a poor grade or may fail the course.

Grade Descriptions

Grades in a course are determined by comparing a student's performance with that of classmates and with the performance of students in that course in previous years or other sections. The following definitions are used as a guide.

- *"A" is an honor grade. It is awarded as a mark of outstanding performance and for achievement clearly of a higher order than average. It indicates that the student has demonstrated not only the ability to work successfully, but also the ability to do creative thinking or problem solving in the field. It will not be given for the routine performance of the assigned work in the course.*
- *"B" and "B+" indicate very good performance, definitely above a satisfactory level, but not as good in analytical thinking and originality as that required for the grade of "A." Thorough competence to do excellent work in the field is required for the grades of "B" and "B+" which will not be given for mere compliance with the minimum essential standards of the course.*
- *"C" and "C+" are the grades given for satisfactory performance. They indicate compliance with the standards set for successful completion of the course and minimum performance acceptable for graduation from the Institute.*
- *"D" and "D+" are penalty grades. They are recorded to show that the student's performance has been below a satisfactory level, deficient in quality and/or content, and not of a standard high enough in this field to meet graduation requirements. They may be used to indicate that, in the opinion of the instructor, the student is ill-prepared to proceed with the work either in a continuation course or in one for which the course in question is a prerequisite. They are the lowest passing marks. For more information see Grade Replacement.*
- *"F" is a penalty grade. It indicates failure and entirely unsatisfactory performance. It carries the requirement that to obtain credit, the entire course must be repeated. The grade of "F" stands on the student's record and cannot be removed by subsequent satisfactory work. For more information see Grade Replacement.*

Use of AI (Artificial intelligence)

It is expected that any work submitted for assessment represents the intellectual work of the individual(s) submitting the work. Any attempt to pass off the intellectual work of another (including the work generated by Large Language Models like ChatGPT) as their own or without proper attribution is an example of academic misconduct and is subject to the penalties described in the Rose-Hulman Academic Rules and Procedures and Student Handbook documents. Additionally, some organizations severely restrict use of AI, it is your responsibility to be aware of such limitations when working with external project sponsors. An example from ASTM.org is shown below.

"Artificial Intelligence Policy: ASTM International prohibits the entry of ASTM standards and related ASTM intellectual property ("ASTM IP") into any form of Artificial Intelligence (AI) tools, such as ChatGPT. Additionally, creating ----derivatives of ASTM IP using AI is also prohibited without express written permission from ASTM's President. In the case of such use, ASTM will suspend a licensee's access to ASTM IP, and further legal action will be considered."

Weekly Project Meetings

You will be meeting **with your instructor** weekly for **~45 minutes**. Some meetings may be held during Wednesday's lab hours, and some may be outside of class time. Bring an agenda (a sample is available on Moodle) and provide an overview of the discussion topics before the discussion begins.

- Every team member must present documented evidence of their progress. A task is not completed unless there is evidence to show – **bring evidence** to the meeting
- Individually, report time spent and activities performed.
- Weekly meetings are not graded, but they facilitate open conversations.
    - If you haven't made much progress, we can cancel the meetings. Be efficient with your time.

Design Notebook

Design notebooks should be continually maintained (**all 3 quarters**) and must be available at all major presentations and meetings. Any confidential information must be handled in accordance with the agreement. The electronic version is highly encouraged. Students can creatively organize content to make the most sense and improve their team's efficiency. Items in the notebook/folder should be organized such that appropriate documents can be easily **made available upon request**.

The chronological documentation method will require a table of contents listing the activities completed each week. It is challenging to follow a chronologically organized folder when you work iteratively on documents for 3 quarters. Choose a format wisely.

- Record of all meetings (dated). Traceability of individual accountability
    - Agendas, Minutes, To Do lists, time logs
- Problem definition and necessary background information
    - All meeting records with the clients
    - Information researched or gathered
- Any major presentation
    - Presentation slides (2 slides per page)
    - Feedback received and graded rubrics
- Report Documentation
    - Save the submitted version of the report
    - Feedback received and graded rubrics
- Other folder headings as applicable to your design
    - Research and benchmarking
    - Data collection
    - etc., etc.

Time Log and Attendance

To successfully complete the project, the team must keep a record of the time spent and the activities performed. This time log will be used to assign individual grades in addition to peer team evaluation.

Week # _____ Team Member Name	Hours Spent (min. **12 good hours**)	Tasks Completed	Notes
1.			
2.			
3.			
4.			

Hours Spent and Attendance: We intend to be more flexible with accommodating students. We are training you to be future employees who are professional, responsible, and can adapt to changing circumstances while delivering engineering solutions to the best of your ability. In Capstone, a minimum of 12 hours of good work is expected per week. This includes time spent on all class-related activities and meetings.

Students are expected to continue contributing to the team in a meaningful way, whether in person or remotely. If you are sick, you may choose to work remotely. If you are unable to work in-person or remotely, then we will treat it as an "absence." Any absence (inability to contribute to the teamwork) needs to be addressed.

- If the **absence is more than 2 weeks**, it is challenging to catch up in a 10-week quarter, and it negatively impacts the team's performance. For absences of more than 2 weeks, we will have a separate discussion and manage it on a case-by-case basis. There is a strong possibility that the student may need to re-take the class, or they may be moved to another project.
- For **absences of less than 2 weeks,** students will plan to make up for the missed time and then follow up on that plan. ***A plan to make up the missed time must be approved within 5 business days of resuming classes.*** Sometimes, the plan needs a few revisions before it is approved by the instructor; students are expected to meet with the instructor and ***plan ahead***. If you missed some meetings/classes, read the example below.
    - *For example: A student attended class on Monday, Week 4 (1 hour) and collaborated with the team outside of class (3 hours). They were unable to contribute after Tuesday of week 4 till the end of week 5. They also missed the external review presentation. The total time missed = 8 (part of week 4) + 12 (entire week 5) = 20. Here is an example of the plan the student drafted to make up for the missed time. This plan was created in consultation with the instructor and approved by the instructor within 5 days of resuming classes.*

Time Missed: 20 hours Name: S. Sangelkar	Regular hours		Make-up hours	Planned tasks for make-up time	Total hours
Week 6.	12	*Activities planned as usual from your project plan.* *Do write these tasks down clearly.*	2	Create CAD model for the pin joint	14
Week 7.	12		6	FEA analysis of the pin joint	18
Week 8.	12		6	Write up for pin joint analysis, create CAD model for the hinge joint	18
Week 9.	12		6	FEA analysis for hinge joint	18
Week 10.	12		-	Back on track *15 min presentation of FEA analysis of pin joint – substituted for External review grade*	12

On Tuesday of week 10, the same student presented their individual make-up work along with the actual time log. And it is all good!

Time Missed: 20 hours Name: S. Sangelkar	Actual Regular hours	Task completed	Planned Make-up hours	Actual make-up hours	Make-up Task Accomplished	Total hours
Week 6.	10		2	2	Create CAD model for the pin joint	12
Week 7.	14		6	4	FEA analysis of the pin joint	18
Week 8.	12		6	10	Write up for pin joint analysis, create CAD model for the hinge joint	22
Week 9.	12		6	6	FEA analysis for hinge joint	18
Week 10.	12		-	-	Back on track *15 min Presentation of FEA results – Substituted for External review grade*	12

Absence by default does not mean failure in capstone course. Failure to make a plan and follow up on that plan may lead to failing the course. It may also cause delays in graduation, please speak with your academic advisor in such a case.

Major Milestones

Each quarter the course will have a set of major milestones. Completion dates will vary by group. Each student needs to have a passing grade on the final report to pass each course in the capstone sequence.

Grade Distribution

ME470 Course deliverables include:

- Professionalism -(10%)
- External Review-(15%)
- Proof of Concept Demo-(15%)
- Proposal Presentation to Client-(20%)
- Quarter I Report-(30%)
- Bi-weekly Project Deliverables-(10%)

Every student must pass the Quarter 1 design report to pass ME470.

ME471 Course deliverables include:

- Professionalism -(10%)
- Project Planning -(10%)
- External Review -(15%)
- Functioning Prototype Demo -(15%)
- Project Approval by the Client -(20%)
- Quarter II Report -(30%)

Every student must pass the Quarter II design report to pass ME471.
Every student must pass the technical analysis section of the report to pass the course.
At least one detailed analysis per team member is required in the report.

ME472 course deliverables include:

- Professionalism -(10%)
- Self-Directed Learning -(20%)
- Rose-Show Participation & Poster (10%)
- External Review-(10%)
- Quarter III Report-(25%)
- Final Defense to the Client -(15%)
- Capstone Exit Interview/ ABET Brochure -(10%)

Every student must pass the Quarter III design report to pass ME472.
Every student must pass Self-Directed Learning (individual submission) to pass the course.