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HUMAN-CENTERED ENGINEERING

CAPSTONE HANDBOOK

(Starting from academic year 2025-2026)

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1. Introduction to the Capstone

The Human-Centered Engineering Capstone course at Fulbright University Vietnam represents a culmination of students' engineering education, where they apply their knowledge to tackle real-world challenges through a major project. This capstone experience allows students to focus on several types of projects, whether they prefer to design practical solutions or conduct academic research.

This handbook guides students through the capstone process, offering a clear outline of expectations, objectives, and resources. It provides essential information on project guidelines, assessment criteria, and timelines to help students meet academic and professional standards. By following this handbook, students will be well-prepared to complete a capstone project that demonstrates their engineering competencies, aligns with the requirements from the Accreditation Board for Engineering and Technology (ABET), and equips them to address complex challenges in their chosen focus area.

Examples of Capstone projects:

- *Product Development:* Students may choose to design and develop tangible products or digital systems that address specific needs. This could involve creating prototypes, refining designs, and adhering to industry standards while integrating user-centered design principles. Projects may range from physical products to digital systems, providing hands-on experience in delivering practical, impactful solutions.

- *Academic Research:* For a more research-focused project, students might conduct in-depth studies on engineering topics, contributing new knowledge or insights to the field. This could include replicating established methodologies from the literature to validate or expand upon existing work, formulating hypotheses, and analyzing data to produce validated results.

2. Capstone Objectives

Real-World Problem Solving

Capstone project will allow students to pursue a problem of their interest that considers environmental, economic, health, and safety constraints, as well as fulfilling technical requirements in terms of engineering methodologies and standards. Students will start with problem definition followed by developing and testing solutions with stakeholder input.

Program Integration

Capstone project will allow students to utilize the knowledge and skills from previous coursework in mechanics, electronics, AI, and systems engineering in the design and execution of their capstone project. Furthermore, it is expected that for any knowledge gap identified, students need to do further research, which will cultivate their life-long learning skills.

3. Capstone's Learning Outcomes

As advanced courses, the Capstone's Learning Outcomes (CLO) are derived from Human-Centered Engineering's Major Learning Outcomes (MLOs) as defined by ABET Engineering Accreditation. This alignment enables direct assessment of the MLOs within these courses.

- **CLO1**: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- **CLO2**: 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.
- **CLO3**: an ability to communicate effectively with a range of audiences.
- **CLO4**: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- **CLO5**: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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Mapping the CLOs to Human-Centered Engineering's MLOs

	MLO1	MLO2	MLO3	MLO4	MLO5	MLO6	MLO7
CLO1	X						
CLO2		X					
CLO3			X				
CLO4						X	
CLO5							X

4. Project Guidelines

Application process

It follows UG program policies as stated explicitly in Capstone Guidelines.

Project Scope and Definition

Capstone project should focus on practical, real-world applications in human-centered engineering or target contributing knowledge in scientific and engineering fields via research activities. Suitable projects will demonstrate originality, sound research process, and feasibility in expanding to practical application, with clear objectives.

Project Constraints

The project should account for constraints within the reasonable resources that the students and advisors can mobilize for conducting the research and development activities, and should consider environmental, economic, health, sustainability and manufacturability factors. Guidance will be provided to integrate these factors systematically.

Engineering Standards

The students should follow the widely accepted research practices as well as the appropriate engineering standards to deliver the expected project outcomes.

5. Roles and Responsibilities

In essence, the students are responsible for doing the work, while the advisor provides support and ensures the project is on the right track.

Student Responsibilities

- *Take ownership*: Students are in charge of their own capstone projects.

- *Follow guidelines*: Adhere to the rules outlined in the capstone handbook.
- *Be proactive*: Complete tasks on time and as assigned.
- *Communicate*: Regularly meet with the Advisor(s) at least once a month to discuss progress and get feedback.

Advisor Responsibilities

- *Provide guidance*: Offer direction and support to students.
- *Monitor progress*: Keep track of students' work and offer feedback.
- *Offer technical expertise*: Help students with technical issues or questions.

6. Project Phases and Deliverables

The Capstone project, spanning two semesters, is structured into **Capstone 1** and **Capstone 2**. This section provides the primary focus, key milestones, and submission requirements for each phase.

- **Capstone 1: Problem Definition and Pilot Study:** In Capstone 1, students are expected to engage in comprehensive research and strategic planning to establish a solid foundation for their projects. Successful completion of Capstone 1 is required to advance to Capstone 2.
    - ***Focus areas***
        - Defining clear objectives for the project
        - Conducting a thorough literature review to understand the context and prior work
        - Developing a detailed project plan and timeline for Capstone 2.
    - ***Submission Requirements:***
        - *Deadline:* Submit your individual report on Canvas by **5:00pm on the last day of the semester**.
        - *The report* should include at least the following sections:
            - *Introduction/Motivation for the problem*: Introduce the problem and its significance.
            - *Literature review:* Summarize relevant research and existing solutions.
            - *Problem statement/description:* Clearly articulate the problem you are addressing.
            - *Proposed methods, plan and timeline for Capstone 2:* Propose the methods/ approach and outline your activities for the next semester.
- **Capstone 2: Solution Development and Testing:** Students who successfully complete Capstone 1 will proceed to Capstone 2, which emphasizes the practical implementation and testing of your solution. This phase is centered on translating your research into a tangible system or product.

- ***Focus areas:***
  - Designing and developing the system or a product
  - Building simulations or prototypes
  - Conducting experiments or testing to validate your design
  - Analyzing the results to draw meaningful conclusions
  - Reflecting on the process to state the achievements, identify improvements and future directions.
- ***Public Defense:***
  - The defense date will be announced during ***the first week of the semester***.
  - Each student will have ***up to 20 minutes*** to present their project, followed by ***up to 10 minutes*** for Q&A with the judging panel and audience.
- ***Submission Requirements:***
  - *Final report*: Submit your individual report on Canvas and provide a copy to the judging panel members ***at least 7 days before the last day of the semester***. The report should include:
    - *Final design:* Detailed description of the system or product.
    - *Simulation/Prototype details:* Explain the setup and functionality.
    - *Testing/Experimental results:* Provide data and analysis of the outcomes.
    - *Conclusion:* Summarize what has been achieved and the impact of your work.
    - *Future work:* Offer recommendations for further development or research.
  - *Additional deliverables*
    - **By 5:00pm on the last day of the semester**, upload your presentation slides and any demonstration videos onto Canvas.

7. Assessment and Evaluation

Capstone Project 1

The completion and submission of the report is the Passing requirement for Capstone 1 which is evaluated as P/NP by the advisor(s) using the below table of "Evaluation Rubric for Proposal Development". The criteria of the rubric have the same weight. If the student gets "Unacceptable" scores for at least two of the following four categories in the table below, then he or she receives No-Pass (NP) grade.

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Evaluation Rubric for Proposal Development

	Unacceptable (0.0-6.9/10)	Acceptable (7.0-7.9/10)	Good (8.0-8.9/10)	Superior (9.0-10/10)
Research question (25%)	Failed to communicate the question and/or its significance in the context of previous work.	Adequately communicated the question and/or its significance in the context of previous work.	Clearly communicated the question to be addressed and/or its significance in the context of previous work.	Clearly and fully communicated the question to be addressed and its significance in the context of previous work.
Methods (25%)	The student has failed to communicate the methodology to be employed and/or its appropriateness to the question	The student has adequately communicated the methodology to be employed and/or its appropriateness to the question	The student has clearly communicated the methodology to be employed and/or its appropriateness to the question	The student has clearly and fully communicated the methodology to be employed and its appropriateness to the question
Outcomes (25%)	Student has failed to define the hypothesis to be investigated, and/or the potential outcomes, and/or how they will be distinguished	Student has adequately defined the hypothesis to be investigated, and/or the potential outcomes, and/or how they will be distinguished	Student has clearly defined the hypothesis to be investigated, the potential outcomes, and/or how they will be distinguished	Student has clearly and fully defined the hypothesis to be investigated, the potential outcomes, and how they will be distinguished
Budget (25%)	Budget fails to reflect an understanding of methodology and/or fails in justification of expenses.	Budget does not account for proposed methodology and/or is not justified	Budget does not fully account for proposed methodology and/or is not fully justified	Budget reflects the methodology and is fully justified

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Capstone Project 2

Students are required to submit a final report, which will be evaluated by the advisor(s) and an independent reviewer using the following table of "Evaluation Rubric for Final Report". The criteria of this rubric for final reports have the same weight. Students are also required to go through a public defense for their works, which will be evaluated by a capstone panel of at least three members appointed by the major using the following table of "Evaluation Rubric for Public Presentation". The criteria of this rubric for public presentation have the same weight. The capstone panel should include the advisor(s). The final scores are computed with the following weight distribution:

- The score by the advisor(s) weights 40%.
- The score by the independent reviewer weights 30%.
- The score by the capstone panel weights 30%.

In exceptional cases of significant achievement, the capstone project can be evaluated as Pass with Honor, otherwise it will be Pass and No Pass. The Pass grade is equivalent to ***at least 70% to 89.9% of the final scores***. The Pass with Honor grade is equivalent to ***at least 90% of the final scores***.

Evaluation Rubric for Final Report

	Unacceptable (0.0-6.9/10)	Acceptable (7.0-7.9/10)	Good (8.0-8.9/10)	Superior (9.0-10/10)
Content	Student has failed to communicate the ability to interpret the significance of their research and/or place it in the context of existing geologic knowledge	Student has adequately communicated the ability to interpret the significance of their research and/or place it in the context of existing geologic knowledge	Student has clearly communicated the ability to interpret the significance of their research and/or place it in the context of existing geologic knowledge	Student has clearly and fully communicated the ability to interpret the significance of their research and place it in the context of existing geologic knowledge
Mechanics	Writing is poor and may or may not be in the style appropriate for the project	Writing is adequate and may or may not be in the style appropriate for the project	Writing is clear, concise and in the style appropriate for the project	Writing is clear, concise and is of publication quality

Organization	The paper is poorly structured and may or may not be in an appropriate format	The paper is adequately structured and may or may not be in an appropriate format	The paper is logically structured and in an appropriate format	The paper is logically structured and in an appropriate format for publication

Evaluation Rubric for Public Presentation

	Unacceptable (0.0-6.9/10)	Acceptable (7.0-7.9/10)	Good (8.0-8.9/10)	Superior (9.0-10/10)
Content	The presentation fails to convey the problem, the methodology, data analysis, interpretation and results	The presentation adequately conveys the problem, the methodology, data analysis, interpretation and results	The presentation clearly conveys the problem, the methodology, data analysis, interpretation and results	The presentation clearly and fully communicates the problem, the methodology, data analysis, interpretation and results in a professional manner
Organization	The presentation was poorly organized, and failed to include an introduction which states the problem and/or its significance	The presentation was adequately organized, including a introduction which states the problem but not necessarily its significance	The presentation was logically organized, including a introduction which states the problem and its significance	The presentation was logically organized, including an informative introduction which clearly states the problem and its significance with seamless transitions between topics
Media	Involved technology that distracted from the audience's ability to understand the	Involved technology that did not enhance the audience's ability to understand the data	Presentation used technology in an appropriate way	Presentation used technology in an appropriate way that enhances the ability of the audience to

	data and its interpretation.	and its interpretation.		understand the content
Q&A	Student's responses fail to demonstrate an understanding and/or depth of the problem	Student's responses demonstrate an incomplete understanding and/or depth of the problem	Student's responses demonstrate complete understanding and depth of the problem	Student's responses clearly demonstrate complete understanding and depth of the problem beyond the presentation

8. Resources and Support

Available Resources

Students have access to labs, tools, and software relevant to their project work. Support will be provided for learning new software or techniques where necessary.

Mentorship and Industry Involvement

Industry mentors may be available for project guidance, helping bridge academic learning and industry practice. They could be secondary advisors for Capstone projects, but not primary advisors or independent reviewers. They could also be invited to join the capstone panel. As either a secondary advisor or a member of the capstone panel, industry mentors could participate in grading.

Funding and Material Procurement

Projects will have access to limited funding for materials and resources. Policies on budgeting and purchasing will be provided.