MECH 498B

2021-2022 Guidebook

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Course Information

Instructor: Christian M. Puttlitz, PhD
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Class Hours: T, Th 12:30-1:45 in 231 Scott Bioengineering

Required Text: None

Pre-requisites: Permission of the instructor. In general, the student must satisfy the requirements for admission in the Mechanical Engineering's IDP+ (combined BS/MS) program. In addition, this course has the following course pre-requisites: C grade or better in MECH 301, MECH 325, MECH 402 (or concurrent registration), CIVE 363, and MECH 338.

Description: This is a capstone research practicum intended for seniors in the Mechanical Engineering Department. The practicum is taught over the course of two semesters, requiring the acceptable completion of 2 companion courses (MECH 498A and MECH 498B). This capstone experience is designed to give students the opportunity to integrate the technical skills and knowledge gained while completing their undergraduate curriculum through conducting a single-investigator research project. The student will work closely with a primary research adviser to propose and execute a project that will include a review of the open literature; application of a design of an experimental test facility, engineered component, system, or computational technique to a current research problem, and a project report summarizing the student's effort. Students taking this course are expected to be exceptionally well-prepared for graduate-level research in academia or industry. The quality of the final product should be equivalent to an archival journal publication or technical conference proceeding.

Course Objectives:

1. To provide students with a capstone design experience that integrates engineering fundamentals and design skills accumulated during their course of study to a defined research problem.
2. To develop single investigator skills for conducting graduate-level research, including reviewing the open literature, problem definition, research plan development, skill integration, and project execution.
3. To develop written and oral presentation skills for conveying complex engineering concepts and solutions.
4. To expose students to cutting-edge technology, instrumentation, computational software, and/or research areas of study.

Organization: Within the first week or prior to the start of the first semester, the student and primary research adviser will select a research topic area and form an examination committee that includes the primary advisor, the instructor of record, and one tenured or tenure-track faculty within the Mechanical Engineering Department. The student will then conduct a comprehensive review of the peer-reviewed literature and submit a written summary of the literature and background information (fundamental science, equations, etc.) to be graded by the instructor of record. Once completed, the student will draft a research proposal (in counsel with their faculty advisor) document and give a formal presentation to the committee for acceptance, grading and comment. It is expected that each student integrates their engineering fundamental analysis and design skills into the execution of the project. The student will conduct

the activities in their research plan. Midway through the second semester (MECH 498A), the student will give a progress update presentation to their committee. Finally, the student will submit a final research (publication quality) report and defend their results to a committee during an open forum oral presentation.

Expected Effort: It is expected that the time spent by the student on their capstone experience is substantial and befitting of a junior-level graduate student. Therefore, it is expected that students will spend no less than 20 hours per week on their research project and associated responsibilities (i.e. literature review, etc.). If it becomes clear that this level of effort is not being put forth by the student, then the student's semester grade (as determined by the instructor of record and the examination committee) will be appropriately reduced.

Grading Plan

The second course (MECH 498B) grade will be weighted using the following scheme and fractional contributions of effort:

1. Update presentation 10%
2. Written update report 15%
3. Mid-semester presentation 15%
4. E-days poster/presentation 15%
5. Final report 20%
6. Final research presentation 25%

Grades for each of the course grade components listed above will be determined by the grading rubrics included in this document. As stated above, the student's grade may be deleteriously affected by a perceived lack of effort or progress throughout the course of each semester.

Required Lecture Attendance: A number of the topics to be presented in MECH 486 (Senior Design Practicum) will be beneficial for completing your research project as well as serve you well beyond graduation. A list lectures that you may be required to attend will be distributed in the first 2 weeks of the Spring 2022 semester.

Tentative Key Dates:

15 and 17 February	Update presentations
28 February	Written update report
7-10 March	Mid-semester presentations
22 April	E-days poster/presentation
29 April	Final report
2-4 May	Final research presentation

Late Work Penalty: Research is a deadline-driven field, frequently if you miss a deadline then your work is not considered at all. Therefore, all written deliverables are due at noon on the date specified. If the work is submitted even one minute late, then it is considered late. The penalty for late submissions is one letter grade per 24 hours. This is not negotiable after the deadline has passed. You may contact the instructor in advance if there are extenuating circumstances that impedes your ability to make the stated deadline in order to discuss an extension.

Confidentiality and Approval: The update presentations given to the entire class may constitute public disclosure of your research and associated designs and may limit your, your adviser, and your research collaborators' ability to protect intellectual property. It is therefore imperative that you discuss the content of your presentations with your adviser and obtain their explicit approval prior to giving presentations in class. If it is impossible for you to limit the

content of your presentation to avoid enabling disclosures, Dr. Puttlitz will make alternative accommodations so that you can still participate in the class assignments. In addition, those who attend presentations are expected to exercise discretion in sharing the contents of those presentations.

Student Update Presentations and Peer Review - Guidance

Update Presentations
Please adhere to the following guidelines for the first update presentation:

1. Please email your Powerpoint presentation in advance or bring it on a thumb drive so that it can be loaded before class on one computer in order to expedite moving from one student to the next.

2. Each student will be limited to 6 minutes of presentation time. Any presentation lasting less than 4 minutes, 30 seconds will also incur a penalty (so please practice and timing is important).

3. You will be limited to a total of 6 slides. In these slides you should answer the following:
   a. Review the problem that you are trying to address?

   b. Discuss progress accomplished toward specific aims last semester.

   c. Discuss progress accomplished since last semester/proposal presentation.

   d. Show where you are on your originally planned timeline and briefly discuss future activities that will be accomplished before the mid-semester presentation.

Peer-Review
One of the hallmarks of scientific/engineering discovery involves the concept of peer-review. The acceptance of your work by your colleagues is imperative, and that acceptance is usually quantified on a relative scale. Therefore, in this course, you will be introduced to this concept by assigning relative scores to your peers. These scores must be EVENLY distributed using the whole grading scale (1 to 5, with 5 being the best score). Part of your student update presentation score will be determined by how well you grade your colleagues. A penalty will be assessed to your presentation grade if you do not evenly distribute your scores from 1 to 5. There are 14 students in this course, therefore, each score (1, 2, 3, 4, and 5) must be assigned at least twice, with 4 of these grades assigned three times.

Please let me know if you have any questions.

Student Update Presentations - Evaluation Form

This form will be provided and used for each student to evaluate their peers' presentations. The evaluations are blinded so that honest and constructive feedback can be provided. Please evenly distribute these grades.

Student's name

What did you like about the student's presentation?

What do you feel could use some improvement?

Out of five points (five being the best), how would you rate this presentation:

Written Update Report – Guidance

1. Format
    a. 1 inch margins (top, bottom, right, left)
    b. Arial font, 12 point

2. Length
    a. No less than 1500 words, no more than 2000 words.
    b. Word count does not include title page and references. Figure captions are included in the word count.
    c. You must include a word count on the title page.

3. Table of contents/figures
    a. A table of contents/figures is not necessary, but if you choose to include one then it should not be included in the word count.

4. Figures
    a. Any figure that you did not make yourself must be properly referenced.
    b. Try to limit your use of figures to 5 or less.

5. Equations
    a. Use a proper equation editor for all equations (do not cut and paste from one of your references).
    b. Define all variables in each equation so that the reader knows what they are or what they represent.
    c. Equations should be centered on their own text line.

6. Style
    a. Your document should include the following major sections:
        i. Introduction and Specific Aims
        ii. Review of Work Accomplished Last Semester
        iii. Work Accomplished Since Last Semester
        iv. Review of Timeline and Work to be Completed

7. Sample
    a. An example of an excellent progress report will be posted to Canvas so that you have a sample of what is expected. Please note the word count from this previous report may be different from the word count specified above (please conform to the word count specified above).

Written Update Report - Grading Rubric

Name: _____

Criterion (Score 0 if element is absent)	Below Expectations (1)	Meets Expectations (3)	Exceeds Expectations (5)	Score
Introduction and Specific Aims	Motivation for the study is not sufficiently outlined.	Motivation for the study is demonstrated.	Motivation for the study is explicitly well described.	
Review of Previous Work (Last Semester)	Work accomplished last semester is not adequately described.	Research progress from last semester is delineated and is clearly written.	Work accomplished from last semester is well written and demonstrates good progress	
Work Accomplished This Semester	As written, research progress is insufficient and well below what is expected.	As written, research progress is sufficient and meets expectation.	As written, research progress exceeds expectation.	
Writing elements.	The writing is not clear and contains numerous grammatical and/or spelling errors.	The writing is clear with some minor grammatical and/or spelling errors.	The writing demonstrates advanced communication skills with no evidence of spelling/grammatical errors.	
			TOTAL	

Update Presentations - Guidance

This presentation will be delivered to your committee and is intended to inform them about your progress to date and planned activities until the end of the semester/course. I will send out a series of available one-hour blocks to schedule your presentation. It is your responsibility to coordinate with your two other committee members and schedule this presentation.

Please adhere to the following guidelines for this update presentation:

1. The total time allotted for each presentation is 15 minutes.
2. Please use the following guidelines for preparing and delivering your presentation:

    a. Provide sufficient background to motivate your study (1.5 minutes)

    b. Review the specific aims of your project (1.5 minutes).

    c. Discuss the methodologies performed and results obtained last semester (3 minutes).

    d. Discuss the methodologies and results obtained since your proposal presentation (5 minutes)

    e. Planned work to be performed before submission of the final report and final presentation (3 minutes).

    f. Review your original timeline, and outline what has been accomplished and work to be performed before the end of the course (1 minute).

I’m happy to discuss if you have any questions.

Update Presentation - Evaluation Form

This presentation will determine 15% of the student's semester grade. It is intended that the student review the specific aims of their work and research progress achieved since last semester, detailed description of research progress achieved this semester, and the proposed experiments that will be achieved before the final presentation and report.

Student:

Committee member:

Grading criteria (please grade on 1-5 scale, 1 = very poor, 3 = average, 5 = exceptional). Brief comments in each category are encouraged.

- Presentation delivery:

- Content:

- Research progress:

- Overall impression:

Do you feel the project can be reliably finished by Engineering Days (April 2019)?

General comments:

E-days Presentation - Guidance

Each student will be required to present a poster at the E-days showcase. Easels and cardboard backing will be provided to facilitate the poster demonstration. There will be a judged competition amongst the MECH 498 students, with medals being award to first, second and third places at the reception on the evening of the E-days event. Each student will be graded by at least 2 judging teams and their combined score will determine their rank amongst their peers. In addition, these judge scores will provide the basis for your E-day grade, which comprises 15% of the semester grade.

Poster Format: In order to provide enough space for each student to present their poster, the posters must be taller than wider. Therefore, each student will be required to develop and present a poster that is, at maximum dimension, 36 inches wide by 48 inches tall. Please consult your research advisor as they will probably have specific logos and other poster formatting that they prefer for research materials that emanate from their labs.

One note: when preparing your poster you should keep in mind that the material must be comprehensible to those not working in your field. The people who will be viewing your poster will range from faculty who are recognized experts in your particular field to grade school students. Therefore, the challenge is to develop a poster that has sufficient detail and depth while also making it relatable to the general population.

Display Items: Each student will have the option of displaying items associated with their research project. Due to space limitations, these items cannot be too large in dimension. Please contact Dr. Puttlitz with requests as soon as possible for special accommodations that may be required. This includes electrical power and possible table space for displaying items.

E-Days - Judging Rubric

	Fair	Good	Very Good	Excellent	Exceptional
Background or Introduction **1-5 points**	I had great difficulty determining what the project goals were and what the student's purpose was. I found many problems. **1 Point**	I had difficulty determining what the project goals were OR what their purpose was. I found some problems. **2 Points**	I had a bit of difficulty determining the project goals, or what their purpose was. I found a few problems. **3 Points**	It is very clear to me what the project goals were and what their purpose was, but I found very minor problems **4 Points**	I could find absolutely nothing wrong with the way they presented the background, goals and purpose. **5 points**
Methods and Results **1-5 points**	I have no idea what methods were used, the methods were not appropriate, the data is hard to follow and not all photos and graphs are well labeled or of good quality (if applicable). Had many of these major problems. **1 Point**	It was difficult to figure out what methods were used, or they were not appropriate, not all photos and graphs are well labeled or of good quality. Had more than one of these major problems. **2 Points**	I can figure out what methods were used, most seem appropriate, almost all photos and graphs are well labeled and of good quality. I found a few problems. **3 Points**	I know exactly what methods were used, they seem appropriate, almost all photos and graphs are well labeled and of excellent quality. I found a few very minor problems. **4 Points**	I could find absolutely nothing wrong with this section, I know exactly what methods were used, they were appropriate, everything is well labeled and of excellent quality. **5 points**
Conclusion or Discussion **2-10 points**	The student has not convinced me they addressed their purpose OR their conclusions are not supported by their data. **2 Points**	Has one of the following problems: the conclusions they drew were not well supported by their data OR not clearly articulated OR their goal was not clear. **4 Points**	The conclusions they drew were pretty well supported by their data, fairly clearly articulated, and their hypothesis was clear. I found a few problems. **6 Points**	The conclusions they drew were pretty well supported by their data and fairly clearly articulated. I found a few very minor problems. **8 Points**	I could find absolutely nothing wrong with their conclusions or discussion. The conclusions they drew were well supported by their data, and clearly articulated. **10 points**
Poster or display layout **1-5 points**	Has all of the following problems: material is poorly written, not organized, or easy to read, and could flow more logically. **1 Point**	Has more than one of the following problems: material is poorly written, not organized, or easy to read, could flow more logically. **2 Points**	The layout is pretty good, the material is well written, organized and fairly easy to read. The material could flow more logically. I found a few problems. **3 Points**	The layout is very good; the material is organized and easy to read. The material flows logically, such that it is easy to follow step by step through the project. I found a few very minor problems. **4 Points**	I could find absolutely nothing wrong with the layout of this poster or display. **5 points**
Overall Presentation **2-10 points**	I felt this student was lacking in key knowledge about this material and did a poor job of conveying what they did know to the reader. I learned very little from this student. **2 Points**	I felt this student knew some of this material and did an acceptable job of conveying what they knew to the reader. I learned a little from this student. **4 Points**	I felt this team knew most of this material and did a good job of conveying what they knew to the reader. I learned from this student. **6 Points**	I felt this team really knew this material and did an excellent job of conveying what they knew to the reader. I learned from this student. **8 Points**	I could find absolutely nothing wrong with this poster, or the team's presentation of the material. I learned a lot. **10 points**
Examination/Questions **2-20 Points**	The student could not intelligently respond to any questions. **2 Points**	The student did not display or omitted fundamental knowledge critical to their project. **6 Points**	The student did a fairly good job (i.e. better than average) responding to the questions. **10 Points**	The student displayed solid knowledge of their project and background information, only a few minor criticisms. **14 Points**	The student has displayed advanced knowledge of their topic. **20 Points**

Total Points:_____

Final Report – Guidance

1. Format
    a. ASME Conference Paper format: Please use the supplied example on Canvas and change the text (title, authors, abstract, body of the text, references, etc.).
    b. Include all of the major sections that have been provided in the example document.

2. Length
    a. No more than 2500 words.
    b. Word count does not include title, authors and references. Figure captions are included in the word count.

3. Figures
    a. Any figure that you did not make yourself must be properly referenced.
    b. Try to limit your use of figures to 5 or less.

4. Equations
    a. Use a proper equation editor for all equations (**do not cut and paste from one of your references**).
    b. Define all variables in each equation so that the reader knows what they are or what they represent.
    c. Equations should be centered on their own text line.

Final Report - Grading Rubric

Name: _____

Criterion (Score 0 if element is absent)	Below Expectations (1)	Meets Expectations (3)	Exceeds Expectations (5)	Score
Motivation	The motivation for the study is not adequately developed.	The motivation for the study is adequately developed.	The motivation for the specific aims is well developed	
Methods	The methods are not sufficient in scope and/or well delineated.	The methods are sufficient in scope and well delineated.	The methods are advanced in scope and well delineated.	
Results	The results are minimal and not well represented.	The results are sufficient and well represented.	The results are extensive and very well represented.	
Interpretation/Discussion	The results are minimally discussed and/or interpreted.	The results are appropriately discussed and/or interpreted.	The results are exceptionally discussed and/or interpreted.	
Writing elements.	The writing is not clear and contains numerous grammatical and/or spelling errors.	The writing is clear with some minor grammatical and/or spelling errors.	The writing demonstrates advanced communication skills with no evidence of spelling/grammatical errors.	
			TOTAL	

Final Research Presentation – Guidance

This is the final presentation of the course and will be delivered to your committee. This presentation should encapsulate all aspects of your project. I will send out a series of available one hour blocks to schedule your presentation. It is your responsibility to coordinate with your two other committee members and schedule this presentation.

Please adhere to the following guidelines for this final presentation:

1. The total time allotted for each presentation is 20 minutes.

2. Please use the following guidelines for preparing and delivering your presentation:

    a. Provide sufficient background to motivate your study (2 minutes)

    b. Review the specific aims of your project (2 minutes).

    c. Discuss the methodologies performed over the last 2 semesters (6 minutes).

    d. Discuss the results obtained over the last two semesters and interpret these results such that solid conclusions can be drawn (8 minutes).

    e. Show your original timeline, the work that was accomplished and work that was not accomplished (if any; 1 minute)

    f. Propose future studies that would augment what has been performed (1 minute).

I have put times associated with each section above that you might want to use as a guide as to how to distribute your time. Of course, these are only guidelines and each project may merit more or less time in each section.

I'm happy to discuss if you have any questions.

MECH 498B – Final Presentation Evaluation Form

This presentation will determine 25% of the student's semester grade. It is intended that the student present a comprehensive view of their research effort, including the background that motivated the study, specific aims of their work, research methodology and results, and interpretation of their results.

Student:

Committee member:

Grading criteria (please grade on 1-4 scale, 1 = very poor, 2/3 = average, 4 = exceptional):

- Presentation delivery (Outcomes: 3):
- Content (Outcomes: 1, 2, 3, 6, 7):
- Research progress (Outcomes: 1, 2, 6, 7):
- Overall impression:

How would you rate this student compared to your former and current 1st year MS graduate students?

General comments (please include any strengths as well as weaknesses that the student should try to improve upon):