

The University of Texas at El Paso
MECH 5336: Aerospace Structures
Fall 2023

Instructor: Alejandra G. Castellanos, Ph.D. Department of Mechanical Engineering A116 Engr. Building castellanosa@utep.edu	Office Hours: Tuesday 4:30-5:30 pm and Thursday 1:30-2:30 pm or by appointment in A116 Engr. Building
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Class meeting time and location: T, TR 3:00 - 4:20 pm COBA 304

Catalog Description: Advanced mechanics of materials analysis of spacecraft and aircraft structural components: elasticity; torsion and bending of beams, analysis and design of thin-walled beams; failure modes; elastic buckling; in-plane stresses in monocoque and semi-monocoque pressure vessels.

Prerequisites: MECH 2322: Mechanics of Materials and MECH 4326: Finite Element Analysis

Course overview: Review of plane states of stress and strain. Includes analysis of thin-walled beams with open and closed section, unsymmetrical bending of wing sections, torsion of skin-stringer and multi-cell sections, flexural shear in open and closed sections, Shear Center and failure criteria. This course is mathematically intense and requires prior knowledge of advanced mechanics of materials.

Textbooks:

- (Recommended) T.H.G. Megson, Aircraft Structures for Engineering Students 5e or 6e

The material covered in class will parallel the text, but it will not duplicate entirely. You are responsible for the content covered in the lectures. (see schedule for topics)

Software:

- (Required) MATLAB
- (Required) Fusion 360, NX, Solid Works, ABAQUS, Ansys Mechanical or any other finite element software.

(available on ETC repository site: <https://www.utep.edu/engineering/etc/Software/repository.html> installation instructions are here as well) NOTE: You should not use MyDesktop or some other virtual connection. These are typically unreliable. Issues with MyDesktop will not be considered as a valid excuse for not completing homework.

Other course materials:

- Any Mechanics of Materials (MoM) textbook. A free e-book on Introductory Mechanics of Materials by M. Vable can be downloaded at <http://madhuvable.org/books-2/introduction/>
- Supplemented example problems posted in Blackboard and distributed in class.
- Slides posted in Blackboard. (Class notes will **NOT** be uploaded).

Course home Page: The “Course Home Page” has been created on Blackboard. Make sure you have access to this site; it will be used to distribute lecture notes, assignments and grades. The email distribution list for the class will be used for announcements and reminders. **Check your email account on a regular basis.**

Grading:

Syllabus Quiz	2%
Homework	25%
Projects (2)	15%
Exam 1	20%
Exam 2	20%
Final Project	18%
Total	100%

Grading will be conducted on an absolute scale. Under this system it is possible for the entire class to get an A or the entire class to get an F depending on the ability and performance of the individuals in the class. It is also easy for you to evaluate how you are doing in the class during the semester. The following criteria will be used to assign a grade for the course:

100-91%	A
81-90%	B
71-80%	C
61-70%	D
<60%	F

Technology Requirements:

Course content is delivered via **Blackboard** learning management system. Ensure your UTEP e-mail account is working and that you have access to the Web and a stable web browser. Google Chrome and Mozilla Firefox are the best browsers for Blackboard; other browsers may cause complications. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

You will need to have access to a computer/laptop. You will need to download or update the following software: Microsoft Office, Adobe Acrobat Reader, Windows Media Player, QuickTime, and Java. Check that your computer hardware and software are up-to-date and able to access all parts of the course.

IMPORTANT: If you encounter technical difficulties beyond your scope of troubleshooting, please contact the **UTEP Help Desk** (<https://www.utep.edu/technologysupport/>) as they are trained specifically in assisting with the technological needs of students. Please do not contact me for this type of assistance. The Help Desk is much better equipped than I am to assist you!

Homework:

When? Due at the beginning of each class (see schedule at the end of the syllabus for dates)

Where? You will submit it through Blackboard (BB) as a **single** pdf. Failure to submit your homework as a pdf will result in a zero grade. If your file is corrupted or I cannot open it, you will receive a zero grade. Before submitting your homework make sure it is a readable file. **IMPORTANT: What you submit through BB is what you will be graded on. Homework through email will not be accepted. Make sure to double-check that the file that you are uploading is the correct file.**

All problems should be worked on a separate piece of paper. One to two problems will be randomly selected for grading from each assigned homework set.

For **Full Credit**, each homework problem must include the following information:

- Your name
- Problem number
- A diagram describing the problem when appropriate (e.g. Free body diagram)
- State appropriate formula
- Complete and detail solution: step-by-step solution and appropriate units
- Write 2-3 sentences describing in words the concepts covered in the problem

You must show your work for all problems. If no work is shown or your procedure does not match your answer you may not receive credit.

Homework is due at the beginning of each class (see schedule for dates) through Blackboard. Late homework is NOT accepted and will result in a zero grade. The lowest homework grade over the course of the semester will be dropped. You will receive an email once your HW has been graded.

If you believe your grade is incorrect after you have checked the solution, you will have one week after you have received your grade to consult with me about it. After that date, your grade will be permanent.

Projects:

Instructions will be provided in class for each of the three projects that will be assigned during the semester. Students may work in groups of **two or three** people. The report produced must be a collaborative effort with every individual listed as an author contributing to writing some part of the report and understanding ALL of the report. The report should be uploaded ONCE and with all contributing authors listed on the first page of the report. Your goal in the writing is to convey your results and understanding of the topic thoroughly and concisely. Reports must be **no less than 1.5 or more than 2 pages**, including figures, tables, and references. Figures and tables must be numbered and captioned and referred to in the text of the report. Any references utilized must be cited in either a footnote or endnote. **IMPORTANT: Failure to submit at least 1.5 pages or less than 800 words will result in a zero for the assignment.**

The report must include:

- Title
- Contributing Authors
- Abstract: The formula for an abstract is as follows:
 - Begin with 1-2 sentences motivating the work. These sentences answer the question of why the “general topic” is interesting.
 - State a key unknown question in the field (1 sentence). This focuses your abstract onto a specific topic. (Note: The unknown question is what your explanation will address.)
 - Explain the methods you used to address this question. State results and conclusions. (3-5 sentences)

The hardest part of writing the abstract will be identifying the key question. This is also the most important part of the abstract, because it tells the reader what they will learn from reading your manuscript.

- Methods
 - List materials used
 - Describe step-by-step procedures
 - Provide drawings or images of the experimental setup
- Results
 - Include all relevant data/observations (inclusion of images may be helpful)
 - Include an analysis of the results (often a graph or table will assist). If a table is used make sure to include the standard deviation.
 - Discuss sources of error in the experiment/measurements if any
- Discussion and Conclusions
 - Describe the topic investigated
 - Provide explanations for your results.

Late reports are NOT accepted and will result in a zero grade.

You can also provide an Appendix. Please refer to the report example in Blackboard.

Exams:

There will be four exams. All exams are closed book and closed notes with the following exceptions:

- For Exams 1 and 2, students are allowed to bring notes on one 8.5” x 11” sheet of paper with notes on *both sides*.

The note sheet can include problems, derivations, and concepts, anything you can fit in it as long as it is written by you. The note sheets must be written by the student. Photocopies are NOT allowed. Student will turn in their note sheets with their exams. Failure to submit your notesheet with your exam will result in a 0 for that exam. If two students have the same note sheet, a 50% reduction will be applied to each problem, which means that the maximum grade that you can obtain is 50. More than one notesheet will result in a 0 for the exam.

If you arrive more than 15 minutes late on an exam, you will not be allowed to enter the examination room.

There will be no makeup exams administered. No exceptions!

If you believe your grade is incorrect after you have checked the solution, you will have one week until to consult with me about it. After that date, your grade will be permanent.

Excused Absence for Exams:

The UTEP catalog allows an Exam Absence to be excused ONLY for University-Recognized Activities or other specific situations listed in the Academic Catalog. You must notify the instructor with at least **10 days prior to the absence**. If a student does not take the test and does not have an excused absent by the instructor based on the guidelines of the university catalog, the test will be graded as zero (0). No exceptions! There will be no makeup exams administered, unless it is an excused absence approved by the UTEP Graduate Catalog. Please observe the university's academic regulations outlined in the UTEP Graduate Catalog (<http://catalog.utep.edu/policies-regulations/attendance-grading/>).

Final Project

Students may work in groups of **two or three** people like in their Projects. You will be working in your final project after Exam 2. You will be designing and manufacturing a wing with what you have learned in class. **The objective is to design the lightest, but stiffer wing.** The instructions for the dimensions, materials, loadings and analysis will be given in class. The last two weeks of class will be for the final project. You and your group will meet with me on week 14 and week 15 to give me an update on your project. You can use the time of the class to work on your final project.

You will also need to create a poster on the design process of your wing. You do not need to print it, I will display your posters in my webpage. The template for the poster will be provided.

Meeting 11/30	2.0%
Meeting 12/5	2.0%
Wing	7%
Poster	7%
Total	18%

If you fail to show up to your meeting or not provide the necessary documentation requested by the professor, it will result in 0 points. No exceptions!

Email Policy:

The best communication method is through UTEP email, office hours and during class. I will reply to general questions or concerns within 2 to 3 business days, Monday through Friday, during business hours (8:00AM-5:00 PM). Emails received after 5:00 PM, may not be responded to until the next business day.

- If the answer is in the syllabus, I will not reply unless the question is about clarifying information.
- I do not answer emails during the weekend.
- I do not explain complete lectures or solved problems through email. If you need clarification on one of the topics, attend my office hours. If you cannot make it, please schedule an appointment. The meetings will be scheduled several days after your initial email due to my busy schedule. Office hours are not a substitute for the class.

Bottom line: Ask questions in class and during office hours.

If we (student and professor) agree on a make-up exam/assignment due to an excused absence, you MUST have an email from me agreeing to that make-up exam/assignment. Otherwise, no make-up exam/assignment will be administered and its grade will be zero (0).

Attendance Policy:

Attendance in the course is determined by participation in the learning activities of the course (Homework, Projects, Exams and Final Project) and class participation. Your participation in the course is important not only

for your learning and success but also to create a community of learners. Participation is determined by completion of the following activities:

- Syllabus Quiz
- Homework
- Exams
- Projects

Because these activities are designed to contribute to your learning each week, they cannot be made up after their due date has passed.

Attendance is mandatory. Anyone with 3 or more absences (missing assignments) will be dropped from the class. A drop for not attending will count toward the State Allowed Six Drop Limit. If you are failing the class at the time of the drop you may also be given a WF designation. Be advised that a drop could adversely impact visa status, financial aid, and other programs. Students must arrive to class on time. If you will not be able to make it to the class session, contact the instructor in advance via email.

As per UTEP rules, you may be asked to show a UTEP ID at any time during class. Anyone who is present and/or registered in the class will be subjected to disciplinary action unless the instructor gives prior approval.

Students with special needs:

Students with disabilities or special need, including both permanent disabilities (including learning disabilities, Attention Deficit Disorder, visual, mobility and hearing impairments, psychological disabilities, and chronic systemic disorders) as well as some temporary medical conditions (e.g. broken arm), are encouraged to see the UTEP Center for Accommodations and Support Services (CASS) located at Union East Room 106 or contact them at (915) 747-5148 or at cass@utep.edu.

Diversity:

Diversity is a source of strength, creativity, and innovation. All students in this course are expected to value the contributions of each person and respect the ways in which their identity, culture, background, experience, status, abilities and opinion enrich our learning experience and university community.

Departmental Policy

Academic Honesty:

- During exams and quizzes, you are not allowed to use any form of wifi enabled electronic device, including cell phones or other electronic communication devices or methods (wrist watches, earbuds, etc.). No wrist watch or other electronic device may be worn. Calculators and watches may be subject to inspection. You may be asked to temporarily remove glasses to allow for their inspection.
- **You must show your work for all problems.** You must use the paper provided by the instructor. **If no work is shown you may not receive credit.** After the exam, the instructor may require you to explain how you solved a problem on the exam. If you refuse to or cannot explain your work you may be subject to disciplinary action.
- No electronic version of the book, loose paper print-outs of the book or extra sheets of paper of any kind are allowed unless explicitly mentioned in writing by the instructor. As a part of the zero-tolerance policy, if you have a cellphone or other electronic device capable of communication on your person; or if any proctor sees or hears any electronic device during the exam or if you share your work with someone else, you will be reported to the proper authorities and you may receive a zero on the exam or an F in the class. Other actions including suspension may also be pursued.
- University approved recording devices may be located at various locations in the room and may be out of sight of the students. These recordings will be managed according to the UTEP approved regulations for such media. The instructor may create a record of your activity during the exam and may take photographs of your work during the exam.

- If you arrive more than 15 minutes late to an exam, you will not be allowed to take the examination.
- There will be no makeup exams administered. If you have a university approved excuse, your instructor will have a process for determining how to handle the missing grade outlined in the syllabus. However, no makeup exams will be given.
- If you miss more than one exam, the instructor may choose to administratively drop you from the class. This may adversely impact a visa and financial aid.
- All students must present their UTEP issued ID prior to and during every exam and may be required to sign in. Not having a UTEP issued ID when asked will result in forfeiture of the exam. No other IDs will be accepted.
- **Scholastic dishonesty on homework, lab assignments and all other class assignments will be held to the same standards and requirements of academic honesty as quizzes and exams.**
- **Use of 3rd party websites for answers (Chegg.com, CourseHero, SparkNotes, Quizlet, etc.) is considered academic dishonesty.**
- **If you are suspected of scholastic dishonesty you may or may not be directly confronted about your conduct by the instructor or proctor. You will however, be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) and your exam may not be admissible. Your grade in the class may not be available until OSCCR makes a final ruling, this may adversely impact your ability to enroll in other classes.**

Harassment policy:

The department has a zero-tolerance policy harassment. Engagement in any behavior considered harassment would be reported to the proper authorities. In addition to generally understood forms of harassment, the department also treats the following behavior as harassment:

- Repeated emails and/or calls regarding subjects that have already been addressed. Once a decision has been made, or a question answered, a student who continues to ask the same question will be given a warning by the recipient of the email/call. If the student continues, the behavior will be reported. Questions that seek understanding of course material are not harassment, but repeated questions about a grade or n administrative decisions are.
- Grades are not negotiable, ever. If you believe a grading mistake has been made, you must follow the process described in the UTEP catalog. Any request for a grade elevation that is NOT based on mistake is considered harassment and will be reported immediately.
- Remaining in an office after the occupant requests you to leave is considered harassment and potentially threatening. You will be reported immediately without warning and depending on the severity, may be reported to law enforcement.
- Similar behavior towards department staff and student advisors will also be treated as harassment, including persistent phone calls, emails and badgering. Department staff and student advisors are there to help students and should be treated with due respect.

MECH 5336 Schedule

The approximate schedule is below. Slight changes may occur as needed.

Week	Date	Topic	Assignment
1	8/29	Course overview, Ch. 12: Structural Components	Read syllabus
	8/31	Ch. 12: Structural Components/Ch. 1: Basic Elasticity	Syllabus Quiz due on Friday 9/1 by midnight
2	9/5	Ch. 1: Basic Elasticity	
	9/7	Ch. 1: Basic Elasticity <i>Case Study I</i>	
3	9/12	Ch. 1: Basic Elasticity	HW 1 due at the beginning of class (BB)
	9/14	Ch. 11: Materials <i>Case Study II</i>	
4	9/19	Ch. 11: Materials/ Surface tension, free energy and wettability	
	9/21	Review	HW 2 due at the beginning of class (BB)
5	9/26	Test 1: Covers lectures from Aug 29 to Sept 21	
	9/28	Ch. 15: Failure Criteria and Fatigue	
6	10/3	Ch. 15: Failure Criteria and Fatigue <i>Case Study III</i>	
	10/5	Ch. 16: Bending of open and closed, thin-walled beams	HW 3 due at the beginning of class (BB)
7	10/10	Ch. 16: Bending of open and closed, thin-walled beams	
	10/12	Ch. 17: Shear of Beams	Project #1 due by midnight (BB)
8	10/17	Ch. 17: Shear of beams	HW 4 due at the beginning of class (BB)
	10/19	Ch. 17: Shear of beams <i>Case Study IV</i>	
9	10/24	Review	HW 5 due at the beginning of class (BB)
	10/26	Test 2: Covers lectures from Sept 28 to Oct 24	
10	10/31	Ch. 3: Torsion of Solid Sections	
	11/2	Ch. 3: Torsion of Solid Sections	Project #2 due by midnight (BB)
11	11/7	Ch. 3: Torsion of Solid Sections/ Ch. 19: Open and Closed Section Beams	
	11/9	Ch. 19: Open and Closed Section Beams <i>Case Study V</i>	HW 6 due at the beginning of class (BB)
12	11/14	Ch. 22: Fuselages	
	11/16	Ch. 23: Wings	HW 7 due at the beginning of class (BB)
13	11/21	Ch. 24: Fuselage frames and wing ribs	
	11/23	No Class/ Thanksgiving Holiday	
14	11/28	Ch. 24: Fuselage frames and wing ribs	Final Project Selection
	11/30	Final Project through Zoom or in person	
15	12/5	Final Project through Zoom or in person	HW 8 due at the beginning of class (BB)
	12/7	Final Project	
16	12/14	FINAL PROJECT: Thursday, Dec. 14th 4:00-6:45 pm (according to UTEP Scheduling Office: https://www.utep.edu/student-affairs/registrar/Scheduling/Final%20Exam%20Schedule%20Fall%202023.pdf)	