TAM 456: Experimental Stress Analysis

Spring 2025, Sections GR and UG

Instructor:	Shelby Hutchens	**Time:**	TR 13:00 – 14:50 CST
Email:	hutchs@illinois.edu	**Location:**	3100 LuMEB.

Course Pages:

1. Class Canvas site for course information, class resources, grades, and worksheet submission. `https://canvas.illinois.edu/courses/67024`
2. PrairieLearn for pre-labs. `http://prairielearn.engr.illinois.edu`
3. Discord for questions and occasional jupyter-related support.

Office Hours: Fri, 3:45 - 4:45 pm, 3032A LuMEB.

Main References: Most lecture notes will be provided on Canvas. Further depth and breadth are available via the non-required textbook that can be found in the Course Reserves at Grainger Engineering Library,

- Shukla and Dally, *Experimental Solid Mechanics*, College House Enterprises, LLC, (2010).

Description: TAM 456 introduces key experimental techniques for characterizing strain and stress fields. Theory and limitations of each technique are introduced and hands-on activities accompany each. Techniques include resistive strain gages, particle tracking, photoelasticity, and digital image correlation. The second focus is experimental data processing and the production of high quality graphs/figures illustrating the observed experimental results.

Prerequisites: TAM 251

Grade Breakdown:

%	Assignment Type	Number of Items
30%	Lab/Activity participation	17 (2 free drops)
2%	Lecture participation	10 (2 free drops)
20%	Pre-Labs	5
48%	Lab 'Reports'	4

Course Policies:

- *Communication:* Your campus email is your primary source of information. You should monitor it regularly for announcements or updates sent via the Canvas system.
- *Assignment due dates:*
  - Pre-labs 0, 1, 2, 3a, and 3b should be completed before class on the day they are due. They must be completed on PrairieLearn.
  - Lab Reports (and optional updated/edited lab reports) are due on Canvas by midnight on the date listed.

  - Late assignments turned in within a week of the due date may result in a loss of up to 50% of the total points at the instructor's discretion. Assignments turned in a week or more after the due date may result in a total loss of points.

- *Attendance and Participation:* This class is about *doing* things, so to obtain credit for the class you must be there to learn about and do them. Regular attendance and activity is expected. Lab (physical and computer) days are the most important and marked with a * in the class calendar at the end of the document. (There are 17 *'s total.) Everyone gets two free drops of these required days for *any* reason. **Aside from these two free drops, no absences will be excused for lab preparation or testing days** as these days cannot be made-up and therefore the information will be missed. Make-ups for in-class python activities *may* be possible: 1) if cleared in advance with the TA using appropriate documentation and if the completed notebook is turned in ***before 5 pm*** the day of class in which the absence is required, or 2) if a multi-day, unexpected, and/or physician-verified period is required for health reasons. Lecture days are worth fewer points and will be tracked using iClicker participation. These days are marked with a $^+$ in the class calendar and 2 drops are allowed for any reason. Excused absences beyond the 2 drops will not be considered.

Academic Integrity: Your rights and responsibilities outlined in Article 1, part 4 of the UIUC Student Code will be strictly enforced in this class. Unless otherwise noted, work on assignments must be entirely your own work. Group activities include meaningful contributions from all members. Your submission of assignments will be understood as a pledge to these effects.

Disclaimer: Prof. Hutchens retains the right to interpret any inconsistencies in points or dates between this document, Canvas, and PrairieLearn as she sees fit. Concerns about inconsistencies should be brought to her attention before the last two weeks of the semester.

Class Schedule:

Tuesday	Thursday
Jan 20th **1** **Overview & Solid Mechanics Review**$^+$	22nd **2** —review contd. + figure considerations$^+$
27th **3** **Intro to data analysis in python** (EH110A)*	29th **4** —Quality figure creation (EH110A)*
Feb 3rd **5** **Signal Acquisition**$^+$	5th **6** **Strain gages**—and circuits $^+$

Tuesday	Thursday
10th **7** —applications (transducers, rosettes, gage installation)$^{+}$	12th **8** —temperature compensation^{+}
17th **9** —Lab: gage application (LuMEB 2043)*	19th **10** —Lab: gage testing (LuMEB 2043)*
24th **11** —results and interpretation (EH110A)*	26th **12** —figures & report write-up (EH110A)
Mar 3rd **13** **Image Acquisition**—and Fiji (EH110A)*	5th **14** **Particle Tracking** $^{+}$
10th **15** —Lab: sample prep (Hutchens Lab, LuMEB 1235)*	12th **16** —Lab: particle tracking data (Hutchens Lab, LuMEB 1235)*
17th **No Class** **Spring Break**	19th **No Class** **Spring Break**
24th **17** —particle tracking in ImageJ & strain field determination (EH110A)*	26th **18** —application to real sample data (EH110A)*
31st **19** **Photoelasticity**—photoelastic effect $^{+}$	Apr 2nd **20** —polariscopes, calibration^{+}

Tuesday	Thursday
7th **21** —Lab: specimen prep. (LuMEB Machine Shop)*	9th **22** —Lab: model testing (MTIL, Talbot 201)*
14th **23** —photoelasticity data analysis (EH110A)*	16th **24** **Digital Image Correlation** +
21st **25** —DIC software (EH110A)*	23rd **26** —Lab: DIC sample preparation*
28th **27** —Lab: DIC testing*	30th **28** —DIC data analysis & presentation prep (EH110A)
May 5th **29** DIC presentation workshop*	7th **30** **Reading Day**