ME 4182 / ME4723
Capstone Design

Summer 2024

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REMINDERS

- ALL Links and Slides are posted here: http://mecapstone.gatech.edu/students
- Update your profile on Capstone Marketplace: https://projects.gatech.edu/
  - How to guide: https://mecapstone.gatech.edu/howto
- Common MS Teams Support Network: https://mecapstone.gatech.edu/support
- Attend the 1st Lab on Tuesday, 14th May at 12:30pm in Klaus Advanced Computing 1447:
  - Project pitch by sponsors
  - Deadline to form groups & submit project ideas online

What is Capstone Design all about?

1. Identify an unmet need

   WHAT'S THE PROBLEM?
2. Invent/design something useful

   CREATIVITY, INNOVATION
3. Apply your analytical knowledge to design it

   ANALYTICAL SKILLS
4. Prove it will work (Simulate it, build it, test it, virtually, physically)

   MODELING AND HANDS-ON
5. Document your process (reports, presentations)
6. Demonstrate it at the Expo
7. Give to sponsor for use or patent it and start company

Course Expectations

- CAPSTONE – Synthesize knowledge & skills acquired in UG curriculum
  - Identify & apply relevant topics from ***earlier courses***
  - Critically ***evaluate*** designs
- DESIGN – Address broad range of requirements
  - *Identify and specify design **requirements***
  - *Apply **systematic design process** to develop a design from problem to a detailed, proof-of-concept design meeting all of the specifications*
- *PROFESSIONAL EXPERIENCE*
  - *Clearly **communicate/document** design ideas and information*
  - *Work collaboratively and responsibly as a **team***
  - *Demonstrate ability to facilitate own learning by identifying design issues and questions that require additional investigation beyond basic undergraduate curriculum knowledge, then formulating appropriate courses of action.*

Course Deliverables – Submit to your ***assigned*** team advisor

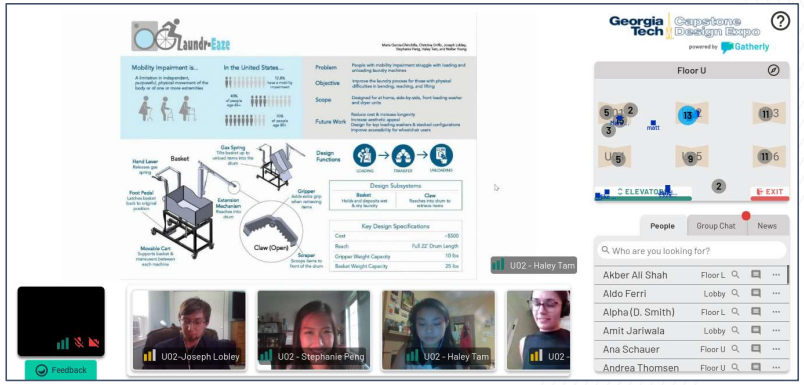
- Team Deliverables
  - Interim Report and oral presentations
  - Final Report, Final Presentation, Fab package right after the Expo
  - Weekly lab deliverables (at the discretion of your assigned team advisor)
- Individual Deliverables
  - Class participation
  - Individual presentation on behalf of team
  - Peer evaluation

- ***All team members need not receive the same grade!***
  - Check with your assigned team advisor for specific grading policies

➔**Peer evaluation tool:** https://gtcapstone.edusourcedapp.com/

Georgia Tech Capstone Design Expo

Video Recap of Summer 2020 Expo:
http://www.me.gatech.edu/First-Ever-Virtual-Capstone-Mini-Expo



List of Past Projects since Summer 2020:
https://capstone.gatech.edu/past_projects

Capstone Design Mini-Expo

Tuesday, July 23, 2022, 4-7pm

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Course Logistics (starting next week)

- **Studios** on Mondays/Wednesday 5:00 pm - 6:15 pm in Klaus Advanced Computing 1447
  - Lectures on various topics of engineering design
  - Group learning and open discussion

  ➔**Watch/Study lecture videos offline**

- **Labs** on Tuesday 12:30 pm - 2:40 pm in Klaus Advanced Computing 1447
  - **Individual team meetings with faculty advisor or group presentations**
  - Progress update and discussion on technical aspects of the project

- **Labs** on Thursday 12:30 pm - 2:40 pm in Klaus Advanced Computing 1447
  - **Independent team work on the project**

Common Studio Topics

1. Course Overview, Projects, Teams and Bids, Communication
2. User needs / Engineering Design Specifications
3. Industrial Design & Human Factors
4. Ideation, Concept Generation, Design Process
5. Market research and Prior Art
6. Risk, Liability, Codes & Standards
7. Analysis
8. Social, environmental, sustainability considerations
9. Prototyping
10. Intellectual Property Protection, Filing Patent Claims
11. Forming a company
12. Communication with the expo judges and the public

Associated deliverables and reports may be due in your section lab meetings

Typical Timeline

Schedule – Summer 2024

Students in Mechanical Engineering are required to take ME 4182 or ME4723 to meet their Capstone Design Course requirements. Studios are on M/W 5-6:15 pm and mixed labs on T/R 12:30-2:40 pm in Klaus #1447

Important Deadlines:

- 5/14 at 11:59pm: DEADLINE to **form groups** and submit your **own project idea** on http://mecapstone.gatech.edu/marketplace
- 5/15 at 8:00pm: DEADLINE to submit bids for projects (sponsored as well as your own project) http://mecapstone.gatech.edu/marketplace

Week	Day/Date	Studio Topics/Slides	Lab & Deliverable(s)
0	Pre-class activity	**How to form teams?**	▪ Introduce yourself to find team members on **MS Teams Channel** ▪ Review **Syllabus**
1	Monday 13-May	**Slides** | **Course Introduction**	▪ Set up your teams and check out currently available projects **online**. ▪ Check How-to Guide for Project Marketplace
	Tuesday 14-May	**Slides**	▪ Project pitch by sponsors ▪ Project Discussions, Student Introduction & Team Formation ▪ Deadline to form groups & submit project ideas online
	Wednesday 15-May	**User Needs, Design Specifications, etc** (Video)	▪ Deadline to submit project bids
	Thursday 16-May		▪ Problem Statement and Organization [More Details]
2	Monday 20-May	**Market Research and Prior Art Search** (Video)	▪ User Needs [More Details] ▪ Market Research & Prior Art Report [More Details]
	Wednesday 22-May	**Ideation & Concept Generation** (Video)	
3	Monday 27-May	Institute Holiday (Memorial Day)	
	Wednesday 31-May	**Risk, Liability, Codes & Standards** (Video) **FMEA Template**	▪ Ideation Report [More Details]
3	Wednesday 31-May	**Risk, Liability, Codes & Standards** (Video) **FMEA Template**	▪ Ideation Report [More Details]
4	Monday 3-Jun	**Prototyping** (Video) Supplemental Information:**1700 Animated Linkages**	▪ Relevant Codes, standards, and risk analysis [More Details]
	Wednesday 5-Jun	**Industrial Design / Human Factors** (Video)	
5	Monday 10-Jun	**Intellectual Property Overview Slides**	▪ Report #1 and Presentation (due on 6/16)
	Wednesday 12-Jun	**Engineering Analysis** (Video)	
6	Monday 17-Jun	▪ **Expo Plan** ▪ **Posters and Presentation Basics (Video)** ▪ **Videos (Video Recording)** **Capstone Expo Judging Rubric**	▪ Feasibility analyses and preliminary CAD
	Wednesday 19-Jun	Institute Holiday	
7	Monday 24-Jun	**Sustainability** (Video)	▪ Engineering analyses, CAD, and prototyping update [More Details] ▪ Submit Intent for Reimbursement [Details]
	Wednesday 26-Jun	**Societal Impact Assessment SIA outline; SIA Template** (Video); **(Methodological Sheets for Social Life Cycle Analysis**	
8	Monday 1-Jul	No Lectures	▪ **NO LAB Meeting** ▪ **Expo Registration.** *Review Expo Info here.* ▪ **Expo video Preview Assignment** (*all teams share a 1-minute video of their project problem/background with the class). Submit on **CANVAS**.***Submitted Videos from the past semester for reference***
	Wednesday 3-Jul	No Lectures	
9	Monday 8-Jul	No Lectures	▪ **Discuss your IP** plan prior to public disclosure ▪ Engineering feasibility analyses, CAD update [More Details]
	Wednesday 10-Jul	No Lectures	
10	Monday 15-Jul	No Lectures	▪ Submit draft poster on **CANVAS** by 19th July ▪ Expo Poster and draft final presentation Feedback session
	Wednesday 17-Jul	No Lectures	
11	Monday 22-Jul	Upload expo video and poster online before 11:59 on Monday	▪ Final class presentations in Lab at 12:30 pm
	Tuesday 23-Jul	**Capstone Design Mini-Expo** starting at 4:00 pm	
	Friday 26-Jul	N/A	▪ Final Report and Fabrication Package

*Individual section instructors have latitude on deliverables, timing, and grading. The preceding information is a set of general guidelines.

Peer Evaluation Form

Contacts:

Name	Title	Role	Email
Roger Jiao	Lead Instructor	Lead studio discussions and assess student deliverables.	rjiao@gatech.edu
Amit Jariwala	Director of Design and Innovation	Sponsor engagement, and oversee Expo	amit.jariwala@gatech.edu
Stacy Ross	Graduate Teaching Assistant	Design consulting, provide past best practices	sross60@gatech.edu
Jacob Blevins	Lab & Facilities Coordinator, co-instructor	Equipment library, mechatronics consulting	jacob.blevins@me.gatech.edu
Ashley Andrews	Mech. Engr. – III, co-instructor	Machining Mall Liason	ashley.andrews@me.gatech.edu
Jacob Tompkins	Mech. Engr. – III	Machining consulting	jt217@gatech.edu

https://mecapstone.gatech.edu/students

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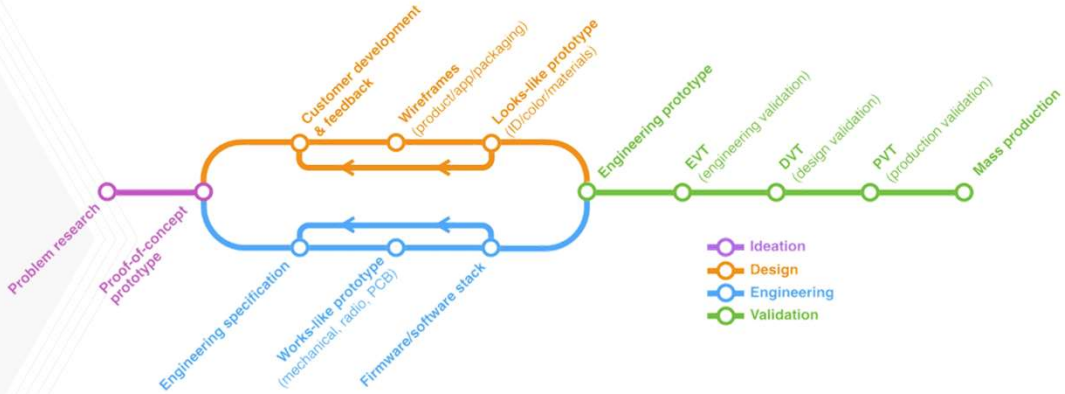
Barriers to success

- Lack of commitment, initiative and anticipation
- “Is this what you want?” – expecting to be told what to do, rather than acting independently
- Lack of consideration and systematic evaluation of alternatives
- Dithering over alternatives and not selecting a final design
- Lack of questioning assumptions, preconceived notions, etc.
- Team Dysfunction
  - Lack of leadership
  - Lack of a shared and coherent vision
  - Lack of accountability and progress
  - Personality conflicts
  - And on and on…
- Confusion between role of student team, sponsors and faculty

Design your ***product***…

… not your ***prototype***

Cardboard iPhone Scanner made by designer Kyle A Koch. Credit Image: Kyle A Koch



A typical Product Development Timeline (https://blog.bolt.io/ideation)

Prototyping is a means to an end and not an end in itself!

Team Formation & Registration

1. Find team members or call for team members:
   - Based on project interest on https://projects.gatech.edu/
   - Based on skills and experience on https://projects.gatech.edu/
   - Introduce yourself on common MS Teams: https://mecapstone.gatech.edu/support
   - Self-identified/assembled during studio/lab meeting in the first week

1. Team sizes are **5-6** students per team.

2. Create your “Group” on the marketplace website
   - Refer HOW TO guide for marketplace here: https://mecapstone.gatech.edu/marketplace_howto

Types of Projects

- External sponsored projects
  - Industry partners
  - Entrepreneurs
  - Non-profits, NGOs
- Faculty (**F**)
- Student initiated ideas (**S**)

Visit this page to check out past Capstone Design projects for inspiration: http://capstone.gatech.edu/past_projects

- Each team should propose one backup project idea that they wish to work on in case their bids for sponsored projects are not awarded
- If your team does not wish to work on any sponsored projects, then it is Ok. You still need to submit your own project idea and send a dummy bid for that project

NDA and IP

NDA:

- In rare circumstances, a Company's proprietary information must be shared with Georgia Tech, such as with the faculty coordinators and/or Project Team's faculty mentor. In such cases, a confidentiality agreement with the Georgia Institute of Technology (GIT) might have been executed. Student teams working on such projects will be required to accept the GT NDA form (which will be sent after the project is assigned to the team)
- Some projects might only need an NDA between the student team and the company. in such cases, the student team would be required to accept an NDA directly with the company. they will have to make sure to not disclose any company confidential information with anyone other than their own team (not even their faculty advisor).

IP:

- For the course, students working on the project typically own the resulting IP that they create, and not Georgia Tech. Hence, students (and not GT) can assign any resulting IP to the company.
- Most **sponsors prepare an IP assignment document** for students to accept at the start of the project.

More info: https://mecapstone.gatech.edu/sponsors/intellectual-property/

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Elements of a Good Student Project

- What's the problem?
  - NOT "We're going to design a better mousetrap"
- Creative/Innovative - not just an assembly of off-the-shelf parts (room for concept exploration and evaluation)
- Lends itself to analysis
- Sufficient scope for senior design
- Team should have or acquire the skills to complete the project.
- Produce a proof-of-concept and learn from it
  - Design revisions
  - Validate design decisions
- Submit your own project idea on the marketplace website before **the deadline**
- You can present your project to the class tomorrow during this Wednesday's lab
  - Prepare 2 slides about the PROBLEM you are trying to solve AND
  - Submit your project idea on projects.gatech.edu site. NOTE that it takes a few hours before the project is made visible for the entire class including yourself.

What is a Good Bid?

Basically, convince us that you are the best group for the project.

- What is your understanding of the project?
- Why do you want the project?
- What are your skills, talents, experiences relevant to the project?
- Anything else that is relevant

- Your team can…
  - Only assign one priority rank per project bid. Rank of "1" means your first choice
  - Submit bids for as many projects as available for your team
  - Your team will be required to work on the project for which a bid was submitted and was awarded by faculty
  - You are required to submit a bid for your own project idea as well
  - Create/Edit/Cancel bids anytime until **the deadline**
  - Add/remove team members anytime until same deadline as above

How are teams matched to projects?

1. Two avenues
   - Bid for an existing project from the marketplace site
   - Propose your own project on the site and then bid on it
2. Teams are matched to projects and then to faculty

Even if you plan on bidding for sponsored projects, should have a "Plan B (C, and D)" project idea of your own

Role of the Capstone Design Team Advisors/Instructors

- Supervise the design process
  - Map the expectations & outcomes to each unique project
  - Ask good questions
  - To require alternatives and implications
  - To require analysis
  - To be a resource
  - Challenge you
- Sponsor scoping, advice, expectation management
- **Not** designers; **not** decision makers
  - Help guide you to answer the questions yourselves
- Design Process Experts
  - But you're to try to answer/solve the problem first!

Facilities

- **Montgomery Machining Mall**

www.me.gatech.edu/facilities/machine_shop

- **Hours:** Main shop area: 6:00 a.m. - 4:30 p.m. Monday – Friday (closed between 12:00-12:30pm)

- **Completing this survey** will register you for training.
- E-mail: steven.sheffield@me.gatech.edu

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Flowers Invention Studio

- https://inventionstudio.gatech.edu/
- Starting on 1st June, 2021 for Summer 2021
- **Hours:** Monday - Thursday between 11:00 AM and 4:00 PM
- Visit the website for online training component and then in-person for hands-on training
  - DO NOT wait to get trained on tools in the space.
- Contact: Dr. Amit Jariwala (amit.Jariwala@gatech.edu)

The Hive – Interdisciplinary Design Commons

- https://hive.ece.gatech.edu/

Electronics Fabrication/Testing

www.me.gatech.edu/facilities/electronic_lab

ME Electronics Lab

2nd floor MRDC, next to IDEA Lab

Andrew Keller

Kyle French
Electrical Engineer
kyle.french@me.gatech.edu

Amy Wang

ECE Senior Design Lab

Van Leer

Staff Contact: James Steinberg
james.steinberg@ece.gatech.edu

Project Prototyping Expense Reimbursement

- EVERY team in ME Capstone design will receive reimbursement from the School and/or the sponsor

- For ME only and ME majority teams, review the process overview here: https://mecapstone.gatech.edu/resources/reimbursement-guidelines/
  - Your team's reimbursement limits will be posted here after 1st October: https://mecapstone.gatech.edu/assignments

- Only ONE person per team is reimbursed: Assign a Finance Manager within your team
- Receipts must show payment: last 4 digits of CC
- Receipt with ANY personal items will be rejected
- Final Reimbursement Package Due: Friday after the expo

Past CIOS Comments from Students?

Best Aspect

- *The most I learned was basically more interpersonal skills like teamwork, rather than technical skills. Which both are important*
- *I really enjoyed the feedback and the presentations forced us to step back and evaluate our progress in relation to our goals.*
- *The ability to choose your own project / choose amongst given topics made it possible to learn something new or choose something in which we had knowledge about.*
- *Meetings with the advisor were the most helpful in preparing for course deliverables; in terms of what was the most enjoyable aspect of the course, building a prototype of our product and conducting analyses of it was certainly a very rewarding experience.*

Past CIOS Comments from Students?

Student Effort

- *6-9 hours is probably a fair average of my team's work every week, but it was always concentrated over a few days; 10-12 hours, spread out over 6-7 days, probably would've felt like a much lighter load.*

- *It's capstone, so was expecting it to take up any and all free time*

- *The expected and expended effort was appropriate for the course. I did expect to spend more time in this class compared to others and it was true.*

Past CIOS Comments from Students?

Course Improvements

- *Push for teams to do the analysis as soon as possible during the semester.*

- *The report projects, while helpful, were not always the correct format or required the right information we needed to be focused on at that moment. I believe a more flexible or variable deliverable would help teams. There needs to be something that facilitates their design process, decisions, and documentation while they are working so that there isn't a feeling of stopping progress to write a report.*

REMINDERS

- ALL Links, SLIDES and VIDEOS are posted here: http://mecapstone.gatech.edu/students

- Update your profile on https://projects.gatech.edu/
  - How to guide: https://mecapstone.gatech.edu/howto
- Form and register your team on marketplace site ASAP!

Important Dates for Students

- Pre-semester activities:
  - Create a profile on https://projects.gatech.edu/and enter skills/experience
  - Introduce yourself on MS Teams for the class at https://projects.gatech.edu/
  - Soft deadline to propose your own idea for premium pitch opportunity on https://projects.gatech.edu/
- 13th May (First Day/Studio of Class)
  - 5:00pm in KLAUS #1447
  - Course Introduction and Overview
- 14th May (First Lab of Class)
  - 12:30pm in KLAUS #1447
  - Learn about Industry Sponsored Projects
  - Propose your own idea, if any
  - 11:59pm: DEADLINE to form groups and submit your own project idea on https://projects.gatech.edu/
- 15th May (Second Studio of Class)
  - ~~5:00pm in KLAUS #1447~~ ➔**Watch/Study lecture videos offline**
  - Studio lecture on User Needs, Design Specifications, etc.
  - 8:00pm DEADLINE to submit bids for sponsored projects on https://mecapstone.gatech.edu/marketplace (you will be required to work on ANY project that your team bids on if it is assigned)
- 16th May (Second Lab of Class)
  - 12:30pm in KLAUS #1447
  - Projects assigned to teams

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