Junior Convocation 2016

Mechanical Engineering

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Outline

- A note on the Fundamentals of Engineering exam
- Motivation
- Procedures
- Senior project examples will be posted:

  https://www.scu.edu/engineering/academic-programs/department-of-mechanical-engineering/undergraduate/

- Q&A

Fundamental of Engineering

- First step to a Profession Engineer certification
- Demonstrates your knowledge as an engineer
- Useful for job interviews
  - Item on your resume
  - You will verify what you know or don't and you will be prepared for the interview
- The Mech. Dept. will subsidize: 50% to take 75% to pass (Mechanical Engineering specialization)

Goal (Challenge)

- We want 100% of the projects to be successful
  - What does that mean?

Goals

- Work in an area that is interesting, and that inspires you to apply yourself fully
- Work in a good group
- Good interaction

  team  advisor

  Your senior project will demonstrate what you can or cannot do. It is a compliment to your academic record, work experience, and skill set.
- Work leads to successful completion and a sense of accomplishment.

Procedure

- Check out the descriptions, discuss with faculty (make an appointment).
- Submit a proposal to the Department office:
  - Project description
  - Itemized deliverable goals
  - Student team (include your resumes)
  - Estimated cost
  - Requested advisor (much more likely if you have met with adviser)
- Proposals due by **May 29th** . Projects start only with the commitment of an advisor and department approval. Some projects have special rules.
- We may send back projects based on questions raised or need for details to be specified. You may submit a draft proposal.
- Two teams could potentially do the same project.

Constraints

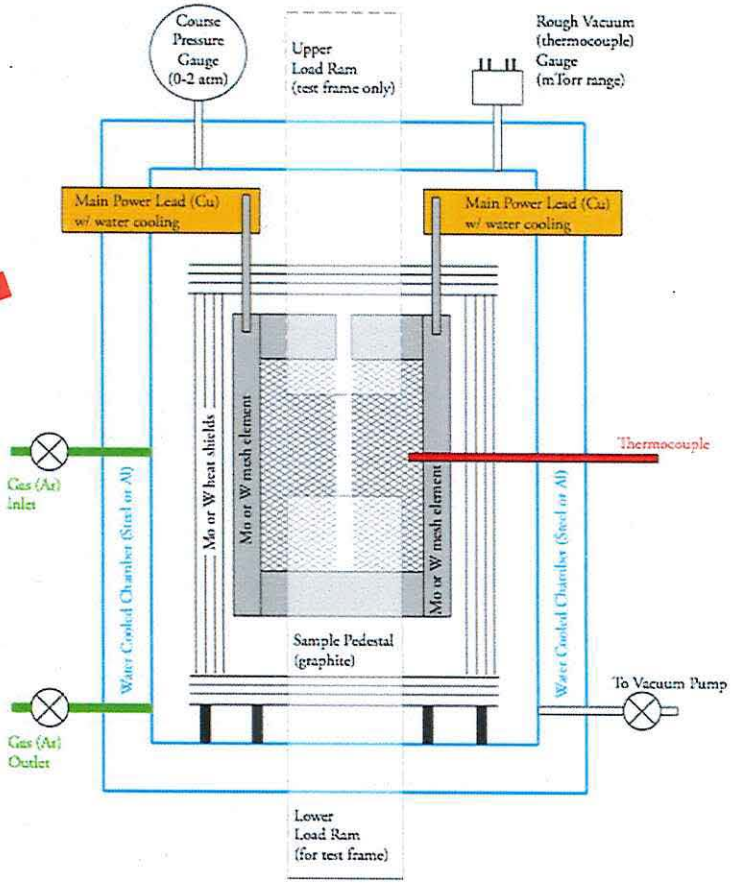
- Tech writing, ENGL 181 section in the fall.
- Mech 101L
  - Must be taken, and safety test passed, before any work in the shop
- GO TO SENIOR DESIGN PROJECT PRESENTATIONS this year

Avoid pitfalls

- Group personal dynamics
- Lack of planning/scheduling
- Designing too late
- Not asking questions (making assumptions)
- Spinning the results
- Repeating last year's ideas/equipment
- Not being aware of the effort required

Team 2017°C

Are you looking for the ultimate challenge in your senior design project? If so, then Dr. Marks has just the project for you. A few years ago SCU purchased a state-of-the-art servo-hydraulic mechanical testing machine (see figure). However, Dr. Marks has always had in mind the idea of doing more than mechanical tests at room temperature. His vision is to outfit the apparatus with a furnace capable of reaching temperatures of ≈2000°C. Not only would this enable testing of materials under extreme conditions, the mechanical tester could also serve as a hot press, enabling us to process specialized materials onsite via powder metallurgy or similar processes. Dr. Marks has worked extensively with similar equipment throughout graduate school and knows the requirements and vendors for several components of such a device (see figure). This project is ideal for a group of 4–6 highly motivated students who are ready to start designing the product this summer.



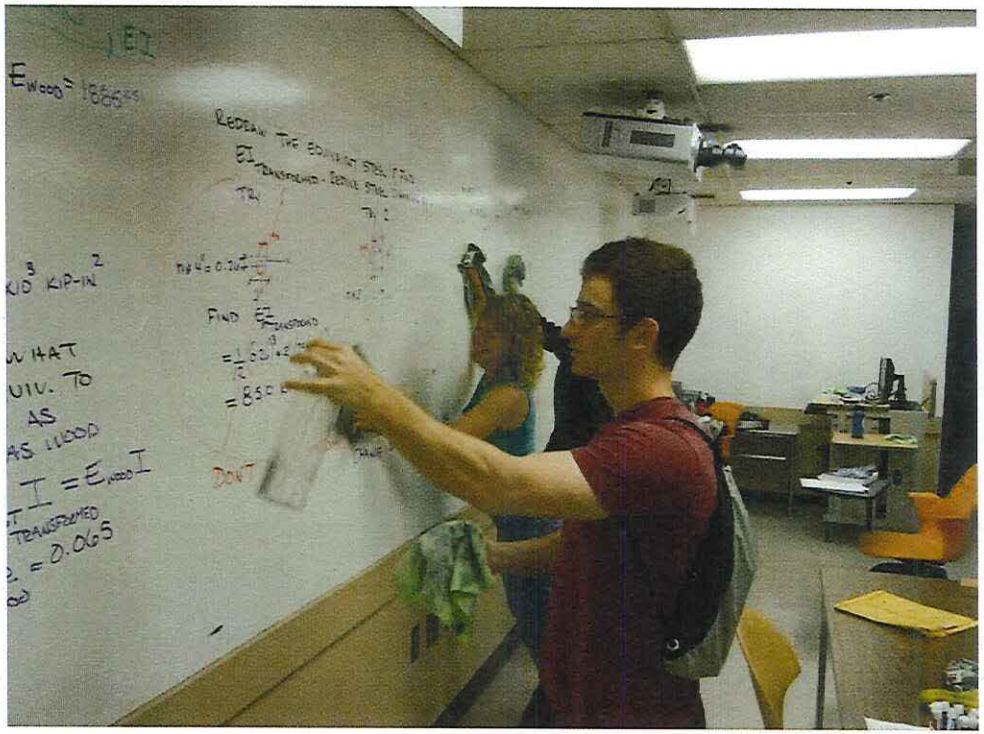
Team Centrifuge

A class of 2014 team designed and assembled a centrifuge for our materials lab. Their analysis predicts the centrifuge should operate up to rotational speeds of 2,000 rpm; however, validation of this design is needed. If you are interested in troubleshooting a control system and extensive testing of an existing device, then this project is for you. Ultimately, classification of sedimentation rates and other properties of various suspensions is needed. Controls, dynamics/vibrations, and fluids are the key areas of expertise required. Ideal for a team of 3 MECH students.

Team SCRUB

We all know SCU has been on a mission to institute state of the art classrooms such as EC602. Instructors love the extensive writing space and students can't get enough of the colorful and rotating chairs. But then class is over and Dr. T makes you wipe down the walls before you can even ask her a question.

Now is your chance to save future SCU alums from this misery. The mission: create a device that will automatically clean the writing space in a classroom such as EC602. Interested in working with a COEN and/or ELEN student? The final device might be integrated with other classroom features so that it can be operated through the same user interface that controls all 7 projectors in the room. Ideal for 3–4 MECH students plus students from other departments depending on overall scope.



Sample of projects

Chris Kitts

Robotics / Mechatronics / Automation Projects for 2015-16

These are potential capstone projects to be hosted through the Robotic Systems Laboratory (and partners) for the 2015-16 academic year. These will most likely fill up on a first come first served basis; it is probable that we will not conduct all of the projects as senior capstones (some may ultimately be performed as graduate student projects, by interns, etc.). Contact Dr. Kitts at ckitts@scu.edu for more information.

- **Marine robot autopilots and more (potentially several projects):** Autopilot and advanced automation for boats and/or underwater robots. To begin, we may be developing a boat autopilot for a commercial partner. In addition, we will probably also be extending the automated navigation capabilities of the current MARV boat so that it can do things beyond simply mowing the lawn, which it can do based on the current team's work. These advanced capabilities include things like planning its own routes, avoiding obstacles, detecting problems and signaling a remote operator, etc. Finally, we have interest in developing advanced control systems for our underwater robots; they can currently do depth and heading control, but we're interested in adding more advanced capabilities such as underwater waypoint navigation, path control, altitude control, etc.

- **Automated control of bioprinters:** This will significantly extend the capability of a bioprinter being developed by a commercial partner. We will be rebuilding all of the standard motion control portions of such a printer, controlling the flow of the biological material out of a nozzle, controlling the temperature and lighting of the environment to support biological incubation, and enabling automated camera operation as a form of instrumentation control. We hope to have a new grant to fund this work - we will find out about this by the end of May.

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Sample of projects

Chris Kitts

Robotics / Mechatronics / Automation Projects for 2016-17

- **Building a new small satellite and/or its subsystems, to include a pointing control subsystem:** The development of small satellite subsystems (and possibly our own complete small satellite), to include work on a electromagnetic torque and/or a reaction wheel system for pointing control as well as a thermal control system. This project may also include design of new satellite structure (possibly a 3D printed structure), etc. Partners/sponsors include a university partner as well as NASA. We have a new grant to fund this work. In addition, we may have another new grant (we'll know about this in late May) to work with several industry partners to develop several new satellites and to control them for NASA. If this is funded, there will be multiple project opportunities involving embedded system development, mechanical/thermal test equipment, mobile mission control capabilities, etc.
- **Advanced UAV controllers:** The development of novel outdoor UAV controllers for real field missions. We have a new grant to fund this work.
- **Large antenna pointing control system:** The development of improved antenna pointing systems (2 DOF trajectory control) to support satellite communications, with partners from NASA. This may evolve into a small production run commercial product. We have a grant to fund this work.
- **Multi-robot control:** Control of multi-robot clusters, to include clusters of quadcopters, groups of land rovers, fleets of robotic kayaks, and/or schools of underwater robots. Note that the underwater robot testbed is a simulator for a satellite formation flying project that we hope to conduct on the International Space Station. The multi-robot work would normally be conducted with partners from NOAA, MBARI and NASA. For students interested in graduate research and/or the SCU 5-year program, this is an excellent way to develop a system for your capstone project and then potentially use that system for an MS thesis. We have grants to fund this work.

Sample project

Drazen Fabris

ASME Human Powered Vehicle Challenge "ASME's international Human Powered Vehicle Challenge (HPVC) provides an opportunity for students to demonstrate the application of sound engineering design principles in the development of sustainable and practical transportation alternatives. In the HPVC, students work in teams to design and build efficient, highly engineered vehicles for everyday use—from commuting to work, to carrying goods to market."

Questions and Answers

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