EID 101: Engineering Design and Problem Solving

Course Description:

EID 101 is one of the most important introductory courses at The Cooper Union. Providing a broad introduction to the varied skill sets required by effective engineers, you are immersed in a non-traditional, student-centered learning environment. The challenges facing humankind require educators to revolutionize their approach to teaching students. In this class, a holistic, interdisciplinary approach to the engineering design process is adopted, emphasizing the often-conflicting demands of scientific, societal, environmental and sustainable requirements.

Key components of the course include an introduction to working in teams, leadership, workshop safety, prototyping skills, written and oral communications, intellectual property, information gathering and evaluation, and library usage. A writing fellow is assigned to each section to provide support, workshops, and consultation on writing, reading, listening and speaking issues.

The only route to really understanding the engineering design process is complete immersion in a real project. The class formulates and implements its own ideas—each student actively encouraged to take risks by sharing their ideas and concerns. Technical compromises are required to satisfy the resources available; design compromises required to accommodate different ideas. Through this dialog, you learn that teamwork reaches consensus; you learn to be a good listener and the role of critical feedback—however harsh it may appear to be. Most importantly, you comprehend that learning through "failure" is a critical component of "engineering". Engineers have to make things “work” and not all ideas “work”. You gain confidence in voicing your opinions and ideas and receiving critical feedback—the information exchange that drives iterative design. The roles of faculty are those of an agitator, a mediator, the devil’s advocate, a champion when needed, intervening only to keep the conversation on point.

You are required to attend, and actively participate in all classes. To aid documentation of their progress, each section will design and maintain a publicly accessible website describing their design process, key activities and achievements. Outside regular class hours, each student is required to complete a short course and pass an examination in workshop safety. A short course on the principles of electronic circuit design, construction, troubleshooting and evaluation is being run for the first time.

Your performance is assessed through class participation, written submissions and oral presentations throughout the semester, the mid-term and final multimedia presentations from each section to the rest of the class. The course concludes with a formal written report from each section. In a sense, your performance is based upon failure—what was learnt from the event, how was the outcome used to move forwards and how well was the process documented. From the outset, the class needs to understand that failure to achieve goals set at the beginning of the course is not an indicator of poor performance. A logical progression through, and good documentation of the ups and downs of the engineering design process is the outcome sought.

Last but not least, engineering is all about people—engineers do not work in isolation. Throughout the engineering design process, materials usage, manufacturing processes and costs, delivery to the end user and end-of-life must all be taken into consideration. Good engineering designs satisfy a very broad cross section of criteria. But in the end, a design is only useful if someone else will pay you for it—in essence, good engineers should be natural entrepreneurs!

Fall 2016 Projects:

EID101A: Living with the Land (Prof. Cumberbatch)
EID101B: Introduction to Engineering Design with application to Sustainable off-site construction and BIM (Prof. Tzavelis)
EID101C: Competitive Motorsports for Undergraduates (Prof. Delagrammatikas)
EID101D: Competitive Unmanned Aerial Vehicles (UAVs) (Prof. Luchtenburg)
EID101E: Low Cost Prosthesis (Prof. Raja)
Class Schedule (Tentative):

- September 6th: Introduction of class and support staff  
  All Sections meet in LL117
- September 8th: Presentation of class projects by instructors  
  All Sections meet in LL117
- September 20th: Sections A & B – Technical Writing Workshop I (1 Hr)
- September 22nd: Sections A & B – How to Locate and Evaluate Information (1 Hr)
- September 24th: Sections C & D – Technical Writing Workshop I (1 Hr)
- September 27th: Section E – Technical Writing Workshop I (1 Hr)
- September 29th: Sections D & E – How to Locate and Evaluate Information (1 Hr)
- October 18th: CONNECT Workshop: Oral Presentation Skills  
  All Sections meet in LL117
- October 27th: Midterm – Each section presents to whole class  
  All Sections meet in LL117
- November 22nd: Sections A, D & E – Technical Writing Workshop II (1 Hr)
- November 29th: Sections B & C – Technical Writing Workshop II (1 Hr)
- December 13th: Everything you wanted to know about Patents  
  All Sections meet in LL117
- December XX: Final Presentations xx  
  All Sections meet in LL117
- December YY: The Last Class: Debrief and Feedback yy

Contributions to Professional Component:

- Introduction to the design process and its application to real-world problems
- Effective participation in teams and an introduction to leadership skills
- Research methods and their application to real-world problems
- Communication of technical information through different media
- Critical thinking skills

Text:


Class Hours:

- Tuesday: 11am – 12pm
- Thursday: 1pm – 3pm

Course Objectives:

- Develop a systematic and scientific problem-solving methodology
- Develop critical thinking skills
- Gain an appreciation of design aesthetics and the engineering design process
- Learn how to handle and use simple tools and develop basic workshop skills
- Learn how to seek, gather, evaluate and organize information
- Develop effective technical communication (oral and written) skills with a variety of media
- Learn how to work in a team, understand team dynamics, manage and organize your time
- Develop an awareness and appreciation for the societal, legal, ethical and environmental responsibilities of engineering

ME Safety Workshops:

The need to strike a balance between virtual and physical design techniques and manifestation has long been considered a critical engineering skill. This requires that students gain a minimum expertise with hand and power tools to complement the theory learned in concurrent classes, while preparing them with the physical experiences necessary to understand the theory taught to them in upcoming courses.

Students in EID 101 are required to schedule time to take the ME Design Studio Orientation and Safety Exam administered by Cooper Union staff who will supply students with reading materials explaining the laboratory safety practices and policies, hours of operation, types of allowable projects, and the different tools and machines available to students to build their projects. Prior to the test, Cooper Union staff will provide a workshop orientation and demonstrate the use of different machines.

After successful completion of the examination (a mandatory requirement to pass EID 101), student hours in the Design Studio and Central Machine Shop will be logged for the duration of their career at Cooper...
Union. The experience gained through logged hours and a series of subsequent proficiency tests administered by Cooper Union staff will give students the privilege to use different machines in the Studio with appropriate supervision. Students can ultimately be certified as teaching assistants and paid supervisors with the appropriate training.

Introduction to Electronic Components, Circuit Design and Assembly:
Whether you be a mechanical, civil, chemical, general or electrical engineering student, few would disagree with the assertion that electronics are everywhere. Automobiles, once the domain of mechanical engineers, now share their engine compartment with a plethora of electronic sensors and control modules; the built environment is closely monitored and its behavior recorded with arrays of wireless sensors and laser beams; health care uses systems of biosensors to identify problems before they lead to a crisis. Virtually all installations involving chemical reactions, be they coal fired power stations or pharmaceutical production lines, incorporate thousands of electronic sensors and integrated circuits.

For these reasons, we believe that that is important for each student to be exposed to the building blocks of electronic circuits—their inputs and outputs, methods of assembly and simple debugging. Under the direction Mr. Dino Melendez, each student will build a simple circuit.

Assessment of Student Progress towards Course Objectives:
Class attendance is mandatory: you must obtain prior approval to be absent from class.
Participation in the class and your team’s engineering and class activities
Performance in class assignments: written exercises and oral presentations
Peer and Self-Evaluation
Contribution to:
Website maintenance
Group Presentations: Midterm and Final
Final Written Report

Instructors:
Section A: Toby Cumberbatch, Ph.D., Professor of Electrical Engineering
Email: toby@cooper.edu
Telephone: 212-353-4332
Office Hours: When not in class (Tuesday, Wednesday & Thursday) & by appointment (Rm 619)

Section B: Cosmas Tzavelis, Ph.D., Professor of Civil Engineering
Email: tzavelis@cooper.edu
Telephone: 212-353-4297
Office Hours: Tuesday 2-3, Wednesday 1-3p & by appointment (Rm 513)

Section C: George Delagrammatikas, Ph.D., Professor of Mechanical Engineering
Email: georged@cooper.edu
Telephone: 212-353-4293
Office Hours: Wednesday, Thursday, Friday 10-11am & by appointment (Rm 207)

Section D: Dirk Martin Luchtenburg, Ph.D., Assistant Professor of Mechanical Engineering
Email: dluchten@cooper.edu
Telephone: 212-353-4310
Office Hours: Mon 3-5 & by appointment (Rm 719)

Section E: Anita Raja, Ph.D., Associate Dean of Research and Graduate Programs
Email: araja@cooper.edu
Telephone: 212-353-4309
Office Hours: Tuesday 2-3, Wednesday 12-1, Thursday 1-12 & by appointment (Rm 214)
Guest Instructors:

Aladino Melendez, Department of Electrical Engineering
Brian Yudin, Department of Mechanical Engineering
Carol Salomon, M.S., M.S.L.S., Engineering and Science Librarian (salomo@cooper.edu)
Christopher Nicholls, Ph.D., Director, Center for Writing and Language Arts
Etai Lahav, B.E., J.D., Of Counsel, Radulescu LLP, New York, NY
John Lundberg, M.F.A., Associate Director, Center for Writing and Language Arts
Jim Elliott, B.A., M.F.A., Director, Teacher, and Producer, New York, NY
Julie Castelluzzo, M.S., M.S.L.S., Electronic Services Librarian (juliec@cooper.edu)
Sinisa Janjuaevic, Department of Mechanical Engineering

Recommended Reading:

Cincinnati, Ohio, Writer's Digest Books, 2015

Related Texts: