EID 101: Engineering Design and Problem Solving

**Course Description:**

EID 101 provides a broad introduction to the varied skill sets required by effective engineers of the future, while immersing students in a non-traditional, student-centered learning environment – as such, this is one of the most important introductory courses at The Cooper Union. The complexity and interdisciplinary nature of the significant challenges facing humankind require educators to revolutionize their approach to teaching students. In this class, a holistic approach to the engineering design process is adopted, emphasizing the often-conflicting demands of scientific, societal, environmental and sustainable requirements. Other 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. Each section will be assigned a writing fellow to provide support, workshops, and consultation on writing, reading, listening and speaking issues. Each section will design and maintain a publicly accessible website describing their key activities and achievements. All sections meet mid-semester to present their progress; the course concludes with a multimedia presentation and formal written report from each section. Finally, each individual is required to complete a workshop safety course and take an examination as an integral component of the class.

**Fall 2012 Projects:**

 EID101A: “GAIA” (Prof. Cumberbatch)

 EID101B: “Design of Building Blocks for the Building Industry” (Prof. Tzavelis)

 EID101C: “Competitive Motorsports for Undergraduates” (Prof. Delagrammatikas)

 EID101D: “Biosensors and Novel Exercise Systems to Fight Obesity” (Prof. Wootton)

 EID101E: “Assistive Devices” (Prof. Kirtman)

**Class Schedule (Tentative):**

September 6th: Introduction and presentations for all projects **All Sections meet in LL117**

September 11th: First class meeting in individual sections

September 18th: Section C - *Technical Writing Workshop I* (1 Hr)

September 20th: Sections A & B - *Technical Writing Workshop I* (1 Hr)

September 20th: Section D & E – *How to Find and Evaluate Information* (1 Hr)

September 25th: Section A - *How to Find and Evaluate Information* (1 Hr)

September 25th: Section D - *Technical Writing Workshop I* (1 Hr)

September 27th: Sections B & C - *How to Find and Evaluate Information* (1 Hr)

September 27th: Section E - *Technical Writing Workshop I* (1 Hr)

October 9th: CONNECT Workshop: *Oral Presentation Skills* **All Sections meet in LL117**

October 25th: Midterm: Each section presents to whole class **All Sections meet in LL117**

October 30th: Section B - *Technical Writing Workshop II* (1 Hr)

November 1st: Sections A & C - *Technical Writing Workshop II* (1 Hr)

November 6th: Section D - *Technical Writing Workshop II* (1 Hr)

November 8th: Section E - *Technical Writing Workshop II* (1 Hr)

December 11th: *Everything you wanted to know about Patents* **All Sections meet in LL117**

December 13th: Final: Each section presents to whole class **All Sections meet in LL117**

December 18th: The Last Class – Debrief and Feedback

**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:**

 G. Voland, *Engineering by Design*, 2nd ed. Upper Saddle River, N.J.: Pearson/Prentice Hall, 2004

**Class Hours:**

Tuesday: 11am – 12pm Thursday: 12pm – 2pm

**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 identify electronic components and build electronic circuits

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 the appropriate balance between virtual and physical design techniques and manifestation has long been considered a critical engineering skill. This balance 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 Mr. Michael Schaff. Mr. Schaff 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. Mr. Schaff will then administer an orientation and give example uses of the machines before students take the test.

*Orientation classes will be held 6 - 8pm Monday to Friday for the weeks of September 17th and Sept 24th. Sign up sheets will be placed outside the workshop and each class will be limited to 15 students.*

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; future health care may depend on systems of biosensors that identify problems before they lead to a crisis. Much like internal combustion and diesel engines, 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 of Mr. Glenn Gross and Mr. Dino Melendez, each pair of students will build a simple circuit comprising signal inputs derived from electronic sensors, a simple signal processing unit comprising one or more transistors and integrated circuits and an output indicator.

**Assessment of Student Progress towards Course Objectives:**

Class attendance is *mandatory*: you must get prior approval from your instructor to be absent

 from class – (for whatever reason).

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 (*Course Coordinator*)

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 1-2, Thursday 2-3 and by appointment (Rm 513)

*Section C:* George Delagrammatikas, Ph.D., Associate Professor of Mechanical Engineering

Email: georged@cooper.edu

Telephone: 212-353-4293

Office Hours: By appt, Deans’ Office

*Section D:* David Wootton, Ph.D., Associate Professor of Mechanical Engineering

Email: wootto@cooper.edu

Telephone: 212-353-4393 or 267-997-7383

Office Hours: (tentative) Wed 3-4, Thurs 10-11, Friday 1-2, or by appointment (Rm 704 or 714)

*Section E:* Stuart Kirtman, Ph.D., Associate Professor of Electrical Engineering

Email: sek@cooper.edu

Telephone: 212-353-4339

Office Hours: When in office (Tuesday, Wednesday & Thursday) & by appointment (Rm 618)

**Guest Instructors**:

 *Michael Schaff*, Supervisor, Student Machine Shop, Department of Mechanical Engineering

*Julie Castelluzzo*, M.S., M.S.L.S., Electronic Services Librarian (juliec@cooper.edu)

*Gwen Hyman*, Ph.D., Director, Center for Writing and Language Arts

*Carol Salomon,* M.S., M.S.L.S., Engineering and Science Librarian (salomo@cooper.edu)

*Etai Lahav*, B.E., J.D., Associate, [Gibson, Dunn & Crutcher](http://www.linkedin.com/company/6627?goback=%2Efps_PBCK_*1_Etai_Lahav_*1_*1_*1_*1_*2_*1_Y_*1_*1_*1_false_1_R_true_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2_*2&trk=pro_other_cmpy) LLP, New York, NY

*Glenn Gross*, Supervisor, Department of Electrical Engineering

*Dino Melendez*, Technician, Department of Electrical Engineering

*Jim Elliott*, BA., M.F.A., Director, Teacher, and Producer, New York, NY

*Christopher Nicholls*, Ph.D., Center for Writing and Language Arts

**Recommended Reading:**

D. F. Beer and D. A. McMurrey, *A Guide to Writing as an Engineer*, 2nd ed. New York: Wiley, 2005.

S. C. Florman, *The Introspective Engineer*, 1st ed. New York: St. Martin's Press, 1996.

W. Kamkwamba and B. Mealer, *The Boy who Harnessed the Wind: Creating Currents of Electricity and Hope*, 1st ed. New York: William Morrow, 2009.

R. B. Landis, *Studying Engineering: A Road Map to a Rewarding Career*, 2nd ed. Los Angeles, CA: Discovery Press, 2000.

*Make Magazine*, O’Reilly Media, http://makezine.com

D. A. Norman, *The Design of Everyday Things*, 1st Basic paperback. ed. New York: Basic Books,

 2002.

**Related Texts:**

M. Alley, *The Craft of Scientific Writing*, 3rd ed. New York: Springer, 1996.

R. A. Day and B. Gastel, *How to Write and Publish a Scientific Paper*, 6th ed. Westport, Conn.: Greenwood Press, 2006.

C. L. Dym and P. Little, *Engineering Design: A Project-based Introduction*, 2nd ed. New York: John Wiley, 2004.

G. E. Dieter, *Engineering Design: A Materials and Processing Approach*, 3rd ed. Boston: McGraw-Hill, 2000.

A. R. Eide, *Engineering Fundamentals and Problem Solving*, 5th ed. Boston: McGraw-Hill Higher Education, 2008.

G. Heckman and D. Ingre, *Thomson Engineering Guide to Web Research 2007-2008*, Toronto: Thomson Learning, 2008.

D. Ingre, *Engineering Communication: A Practical Guide to Workplace Communications for Engineers*, Australia; United States: Thomson, 2008.

S. Moaveni, *Engineering Fundamentals: An Introduction to Engineering*, 3rd ed. Toronto, Ont.: Thomson, 2007.

G. Pahl and W. Beitz, *Engineering Design: A Systematic Approach*, London; New York: Springer, 1996.

H. Petroski, *To Engineer is Human: The Role of Failure in Successful Design*, 1st Vintage Books ed. New York: Vintage Books, 1992.

H. Petroski, *Design Paradigms: Case Histories of Error and Judgment in Engineering*. Cambridge

England; New York, N.Y.: Cambridge University Press, 1994.

H. Petroski, *Success through Failure: The Paradox of Design*. Princeton University Press, 2006.

A. E. Samuel and J. Weir, *Introduction to Engineering Design: Modeling, Synthesis and Problem Solving Strategies*, Oxford; Boston: Butterworth-Heinemann, 1999.

T. J. Cumberbatch

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