The Edgerton Center specializes in experiential learning and offers interactive subjects in electronics, high-speed photography, and video production. The Center is also the home of D-Lab classes (see EC.700-EC.799).

Seminars

EC.050 Recreate Experiments from History: Inform the Future from the Past
Subject meets with EC.090
Prereq: None
U (Fall, IAP, Spring)
1-3-2 units

Provides perspective for thinking about the future through the study of historical physical science and historically significant experiments. Designed to build awareness of the unexpected through both observation of the sky and lab activities that focus on light, electricity, and motion. Labs are complemented by museum and site visits; readings include accounts by Galileo, Archimedes, and other historical observers. Individual and team assignments provide opportunities to develop skills in observation, exploration, and evaluation. Students must keep an observing notebook and write a reflective paper; students taking the graduate version complete additional assignments.

J. Bales, E. Cavicchi

EC.074 The Start-up Experience at MIT
Prereq: None
U (Fall)
2-0-4 units

Explores some of the critical actions in starting up a technology-based business, including concept generation, searching prior art and patents, protecting intellectual property, founders agreements, forming and building teams, and work-life balance. Students review case studies and complete exercises that develop practicable knowledge in these areas. Each student keeps an "idea log book," which includes critical assessments of each case study, to be presented at the end of the term. First in a two-part series (seminars do not have to be taken sequentially; see EC.075 in spring term).

J. Hadzima

EC.075 Starting Up New Technology-Based Business Enterprises at MIT
Prereq: None
U (Spring)
2-0-4 units

Seminar participants define and study the development stages of new enterprises at MIT, from the exciting moment a new idea for a tech product or service is realized, through to selling, customer support, and the next new idea. Follows the history of successful MIT spin-off companies with attention to the people (and their ideas) behind the start-up. Students attend MIT technology and science start-up case presentations given by individuals and teams working from zero-stage, and by partners in going concerns of historical relevance to the Institute and the economy. Second in a two-part series (seminars do not have to be taken sequentially; see EC.074 in fall term).

J. G. Hadzima

EC.090 Recreate Experiments from History: Inform the Future from the Past
Subject meets with EC.050
Prereq: None
G (Fall, IAP, Spring)
1-3-2 units

Provides perspective for thinking about the future through the study of historical physical science and historically significant experiments. Designed to build awareness of the unexpected through both observation of the sky and lab activities that focus on light, electricity, and motion. Labs are complemented by museum and site visits; readings include accounts by Galileo, Archimedes, and other historical observers. Individual and team assignments provide opportunities to develop skills in observation, exploration, and evaluation. Students must keep an observing notebook and write a reflective paper; students taking the graduate version complete additional assignments.

J. Bales, E. Cavicchi
Electronics and Programming

**EC.100 Electronics Fabrication and Design I**
Prereq: None
U (Fall, Spring; first half of term)
Not offered regularly; consult department
0-3-0 units

Explores the science and art of building electronic devices. Using soldering techniques, each student builds the circuit board for a power supply from a kit, and installs the circuit into a case. In the process, students decide what connectors are required, where to place them, and how to incorporate a meter to measure the output voltage. No previous electronics experience necessary.

A. Caloggero

**EC.101 Electronics Fabrication and Design II**
Prereq: None
U (Fall, Spring; second half of term)
Not offered regularly; consult department
0-3-0 units

Covers printed circuit board (PCB) technologies that enabled the electronics revolution. Explores techniques for making circuit boards using computer-based design tools. Each student designs and fabricates a PCB, and has the opportunity to build it into useful circuits. No previous electronics experience necessary.

A. Caloggero

**EC.110** Introduction to Digital Electronics
Same subject as 6.072**
Prereq: None
U (Fall, Spring)
0-3-3 units

Design your own circuits for times when off-the-shelf solutions are not available. Seminar begins with assembly of a utility board. Weekly labs cover digital logic gates, memory elements, and finite-state machine design. Seminar concludes with a team-based design project. Preference given to freshmen.

J. Bales

**EC.120** Electronics Project Laboratory
Same subject as 6.070**
Prereq: None
U (Fall, Spring)
2-2-2 units

See description under subject 6.070**.

J. Bales

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Imaging and Visualization

**EC.210 Visualization for Mathematics, Science, and Technology Education**
Prereq: None
U (Spring)
3-2-7 units

Introduces principles and techniques for visual communication of educational concepts in mathematics, the natural sciences, and engineering. Students complete interactive assignments and class activities in visual arts media, such as photography, illustration, stop-motion and computer animation, and web graphics. A final project in a visual arts medium of the student’s choice must meet professional aesthetic standards for visualization; it must also be applicable for teaching and learning concepts in mathematics, science, or engineering in a formal or informal setting. Coursework requires use of production equipment (e.g., photo and video cameras) and software tools (Adobe Creative Suite, Final Cut Studio, and Maya) at the New Media Center.

V. Ivanova

Media and Production

**EC.305 Digital and Darkroom Imaging**
Subject meets with EC.A305
Prereq: None
U (Fall)
2-0-4 units
Credit cannot also be received for EC.310

Students use both film and digital photography to develop a creative imaging project of their own choice. Develops skills in the use of image editing software to enhance, select, and combine images that the student has taken. Uses the darkroom to develop film for scanning and for chemical enlargement. Discusses topics such as the camera, composition, lighting, modes and formats, image compression, and halftone and dye sublimation printing. Students are expected to produce a duplicate set of black and white and/or color prints, along with a writeup and digital copy as the project output.

T. Mislick
EC.310 Creative Imaging
Prereq: None
U (Spring)
2-1-6 units. HASS-E
Credit cannot also be received for EC.305, EC.A305
Focuses on film and digital photography. Develops skill in the use of chemical darkrooms, scanners, digital printers and cameras to create striking still images capable of evoking strong emotional and intellectual responses from a viewer. Emphasizes the interplay between classical chemical and digital techniques and how they can be used to control the use of lighting, color, depth, and composition in an image. Students present their intermediate assignments to the class for critical discussion; at the end of the term, they submit a substantive project presenting their own creative images for critique and evaluation.
T. Mislick, J. K. Vandiver

D-Lab

EC.700 D-Lab: Field Study
Prereq: One D-Lab subject, permission of instructor
U (IAP)
Units arranged
Can be repeated for credit.
Provides the opportunity to gain direct fieldwork experience in a global context. Subject spans three-four weeks in which students continue work from a prior D-Lab subject. Students work directly with international community partners to find solutions to real world problems, focusing on one or more issues in education, design, or public service. Group presentations and written reflection required.
A. B. Smith

EC.701[j] D-Lab: Development
Same subject as 11.025[j]
Subject meets with 11.472[j], EC.781[j]
Prereq: None
U (Fall)
3-2-7 units. HASS-S
Issues in international development, appropriate technology and project implementation addressed through lectures, case studies, guest speakers and laboratory exercises. Students form project teams to partner with community organizations in developing countries, and formulate plans for an optional IAP site visit. (Previous field sites include Ghana, Brazil, Honduras and India.) Recitation sections focus on specific project implementation, and include cultural, social, political, environmental and economic overviews of the target countries as well as an introduction to the local languages.
S. L. Hsu, A. B. Smith, B. Sanyal

EC.702[j] Cross-Cultural Investigations: Technology and Development
Same subject as 21A.801[j], STS.071[j]
Subject meets with EC.792[j], 21A.839[j], STS.481[j]
Prereq: None
U (Spring)
3-0-9 units. HASS-S
See description under subject 21A.801[j].
C. Walley

EC.711[j] D-Lab: Energy
Same subject as 2.651[j]
Subject meets with EC.791
Prereq: None
U (Spring)
3-3-6 units
Provides a project-based approach that engages students in understanding and addressing the applications of alternative energy technology in developing countries. Focuses on compact, robust, low-cost systems for generating electrical power. Includes projects such as micro-hydro, solar, or wind turbine generators along with theoretical analysis, design, prototype construction, evaluation and implementation. Students will have the opportunity for an optional spring break site visit to identify and implement projects. Students taking graduate version complete additional assignments.
S. L. Hsu

EC.712 D-Lab: Information and Communication Technologies for Development (ICT)
Subject meets with EC.782
Prereq: None
U (Fall)
Not offered regularly; consult department
2-2-8 units
Explores the use of information and communication technologies (ICT) to address specific needs in developing countries. Establishes knowledge and engineering skills needed to successfully deploy an ICT project, with a focus on appropriateness, transferability, and long-term sustainability. The first half of term presents an introduction to communication hardware, including antenna design, RFID, Bluetooth, Wi-Fi, and low-power sensors. Second half covers development of mobile phone applications and server communications, as well as system architecture for data collection and mapping. Students work in multidisciplinary teams, collaborating with local community partners. Culminates in a final project to be deployed in the field. Students taking graduate version complete additional assignment related to the term project.
R. Fletcher, A. Smith
EC.713[J] D-Lab Schools: Building Technology Laboratory
Same subject as 4.411[J]
Prereq: Physics I (GIR), Calculus I (GIR)
U (Fall)
2-3-7 units. Institute LAB
See description under subject 4.411[J].
L. K. Norford

EC.714 D-Lab: Earth
Prereq: None
U (Spring)
2-0-4 units
Multidisciplinary seminar that explores the dynamic nexus connecting natural resources, global biodiversity, and human well-being. Includes guest lectures, experiential activities and projects. Covers topics such as reforestation, poaching, eco-tourism, ecological sensing, and governance. Develops skills in cross-cultural engagement, ecological measurement, and sustainable technology or value chain design. Potential opportunities for travel.
A. B. Smith, A. Phillips, E. Reynolds

EC.715 D-Lab: Disseminating Water/Environment, Sanitation, and Hygiene Innovations for the Common Good
Subject meets with 11.474
Prereq: None
U (Spring)
3-0-6 units
Focuses on disseminating Water, Sanitation and Hygiene (WASH) or water/environment innovations in developing countries and underserved communities worldwide. Structured around field-based learning, case studies, lectures and videos in which teams propose an idea and are mentored through the process of bringing that innovation to fruition. Emphasizes core WASH and water/environment principles, culture-specific solutions, tools for start-ups, appropriate and sustainable technologies, behavior change, social marketing, building partnerships, and the theory and practice of innovation diffusion. Term project entails entering the IDEAS or other competition(s) while implementing a WASH or water/environment innovation in a specific locale. Guest lectures on specific real-world WASH and water/environment projects which have been disseminated by MIT faculty, students, alumni, and others. Students taking graduate version complete additional assignments.
S. E. Murcott

EC.716 D-Lab: Waste
Subject meets with EC.786
Prereq: None
U (Fall)
3-2-4 units
Provides a multidisciplinary approach to managing waste in low- and middle-income countries with strategies that diminish greenhouse gas emissions and provide enterprise opportunities for marginalized populations. Studies waste management strategies in cities in Africa, India, and Latin America; examines case studies of collection, recycling, and waste-to-energy businesses developed in low-income settings; and researches public policy that supports sustainable, integrated, solid waste management systems. Student teams develop waste management strategies that culminate in a two-week IAP trip to Nicaragua where students will work with a local NGO and the municipality to assist in the implementation of waste management initiatives. Includes guest speakers and field trips. Students taking graduate version complete additional assignments.
P. Reynolds-Cuellar

EC.717 D-Lab: Education
Prereq: None
U (Spring)
4-0-8 units
Explores education in the international development context and how modern best practices can be applied to overcome challenges, such as limited resources, language barriers, large class sizes, and entrenched pedagogy. Through an overview of core teaching skills emphasizing experiential and project-based learning, provides the necessary background to nurture creativity in youth and develop interactive lessons around science, technology, engineering, and math. Students draft and deliver lessons, receive feedback from peers and mentors, and then practice teaching in local Boston-area schools. Opportunity to teach abroad over summer.
P. Reynolds-Cuellar, J. Huang
EC.720[J] D-Lab: Design
Same subject as 2.722[J]
Prereq: 2.670 or permission of the instructor
U (Spring)
3-0-9 units
Addresses problems faced by underserved communities with a focus on design, experimentation, and prototyping processes. Particular attention placed on constraints faced when designing for developing countries. Multidisciplinary teams work on long-term projects in collaboration with community partners, field practitioners, and experts in relevant fields. Topics covered include design for affordability, manufacture, sustainability, and strategies for working effectively with community partners and customers. Students may continue projects begun in EC.701[J].
A. B. Smith, M. McCambridge

EC.721 Wheelchair Design in Developing Countries
Prereq: None
U (Fall, Spring)
2-2-5 units
Improve wheelchair technology in developing countries by applying sound engineering practices to create appropriate devices. Lectures focus on wheelchair usage, social stigmas, and manufacturing constraints. Includes lectures by third-world community partners, US wheelchair organizations, and MIT faculty. Multidisciplinary student teams conduct term-long wheelchair projects relating to hardware design, manufacturing optimization, biomechanics modeling, and business plan development. Funded opportunities are available for travel to implement class projects at wheelchair workshops in the field.
V. Grau-Serrat

EC.722 Prosthetics for the Developing World
Prereq: None
U (Fall)
2-2-5 units
Introduces the fundamentals of human walking. Provides an overview of different types of gait disabilities and the available technologies that address them. Presents patient perspective as well as current areas of research. Topics focus on lower-limb disabilities, such as polio and above- and below-knee amputation. Covers both developed and developing world techniques for overcoming these disabilities. Includes a term project in which teams of 3 to 5 students manufacture a prototype. Teams meet outside of class and work with a TA (project mentor) to research, design, prototype, and test a solution. Projects focus on low-cost orthotic and prosthetic knee designs for the developing world, as specified by partner organizations in India and Guatemala.
V. Grau-Serrat

EC.723 D-Lab: Cycle Ventures
Prereq: None
U (Fall)
1-2-3 units
Explores bicycle technology as a way to provide human power for an array of purposes in underserved communities. Presents an historical perspective on bicycle technology via lectures, guest speakers, and laboratory exercises. Students work as a group on a joint design and fabrication project; they then form project teams to take on design challenges from community organizations that work with bicycle-based technologies around the world. Optional January travel to partner communities.
G. Jones

EC.729[J] D-Lab: Design for Scale
Same subject as 2.729[J]
Prereq: Permission of instructor
U (Fall)
3-2-7 units
Focuses on product development of technologies for people in less industrialized markets. Students work in interdisciplinary teams to develop previously established prototypes or technologies towards manufacturing-ready product designs. Topics are presented within the context of the developing world and include technology feasibility and scalability assessment; value chain analysis; product specification; design for affordability, manufacturability, usability, and desirability; and product testing and manufacturing at various scales. Lessons are experiential and case study-based; taught by instructors with field experience and by industry experts from product development consulting firms and the consumer electronics industry.
E. Reynolds, M. Yang, H. Quintus-Bosz

EC.731[J] Development Ventures
Same subject as 15.375[J], MAS.665[J]
Prereq: Permission of instructor
G (Fall)
3-0-9 units
See description under subject MAS.665[J].
J. Bonsen, A. Pentland

EC.733[J] D-Lab: Supply Chains
Same subject as 15.772[J]
Prereq: None
U (Fall)
2-2-5 units
See description under subject 15.772[J].
S. C. Graves
EC.743 An Introduction to Green Woodworking
Prereq: None
U (Spring)
1-3-2 units

Students with little or no previous woodworking experience design and build a post and rung stool. Starting with a green (not dried) oak log and using only hand tools, students learn material properties and tool capabilities in the historical context of a 17th-century New England woodworker. Provides the experience of creating a functional stool from basic raw materials as well as insight on life and work in 17th-century New England.

K. Stone

EC.770 D-Lab: Independent Project
Prereq: Permission of instructor
U (IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit.

Opportunity for independent study under regular supervision by a staff member. Projects require prior approval, as well as a written proposal and final report. Students work with international community partners to continue developing projects, focusing on one or more issues in education, design, or public service. Final presentations and written reflection required. May be repeated for credit for a maximum of 12 units.

V. Grau-Serrat

EC.780 D-Lab: Independent Project
Prereq: None
G (IAP, Spring)
Units arranged
Can be repeated for credit.

Opportunity for independent study under regular supervision by a staff member. Projects require prior approval, as well as a written proposal and final report. Students work with international community partners to continue developing projects, focusing on one or more issues in education, design, or public service. Final presentations and written reflection required. May be repeated for credit for a maximum of 12 units.

V. Grau-Serrat

EC.781[J] D-Lab: Development
Same subject as 11.472[J]
Subject meets with 11.025[J], EC.701[J]
Prereq: None
G (Fall)
3-2-7 units

Issues in international development, appropriate technology and project implementation addressed through lectures, case studies, guest speakers and laboratory exercises. Students form project teams to partner with community organizations in developing countries, and formulate plans for an optional IAP site visit. (Previous field sites include Ghana, Brazil, Honduras and India.) Recitation sections focus on specific project implementation, and include cultural, social, political, environmental and economic overviews of the target countries as well as an introduction to the local languages.

S. L. Hsu, A. B. Smith, B. Sanyal

EC.782 D-Lab: Information and Communication Technologies for Development (ICT)
Subject meets with EC.712
Prereq: None
G (Fall)
Not offered regularly; consult department
2-2-8 units

Explores the use of information and communication technologies (ICT) to address specific needs in developing countries. Establishes knowledge and engineering skills needed to successfully deploy an ICT project, with a focus on appropriateness, transferability, and long-term sustainability. The first half of term presents an introduction to communication hardware, including antenna design, RFID, Bluetooth, Wi-Fi, and low-power sensors. Second half covers development of mobile phone applications and server communications, as well as system architecture for data collection and mapping. Students work in multidisciplinary teams, collaborating with local community partners. Culminates in a final project to be deployed in the field. Students taking graduate version complete additional assignment related to the term project.

R. Fletcher, A. Smith
**EC.786 D-Lab: Waste**
Subject meets with EC.716
Prereq: None
G (Fall)
3-2-4 units

Provides a multidisciplinary approach to managing waste in low- and middle-income countries with strategies that diminish greenhouse gas emissions and provide enterprise opportunities for marginalized populations. Studies waste management strategies in cities in Africa, India, and Latin America; examines case studies of collection, recycling, and waste-to-energy businesses developed in low-income settings; and researches public policy that supports sustainable, integrated, solid waste management systems. Student teams develop waste management strategies that culminate in a two-week IAP trip to Nicaragua where students will work with a local NGO and the municipality to assist in the implementation of waste management initiatives. Includes guest speakers and field trips.

Students taking graduate version complete additional assignments.

*P. Reynolds-Cuellar*

**EC.788 D-Lab: Field Research**
Prereq: Permission of instructor
G (Fall)
3-0-9 units

Combines hands-on methods for conducting field research with exploration of questions that continue to challenge practitioners, donors, policymakers and researchers in international development. Designed for students preparing to conduct field-based research for theses, product design project, or development ventures. Practices key research skills particularly applicable to conducting research involving people and communities in the context of development.

*V. Grau-Serrat, E. Moreno*

**EC.790 D-Lab: Field Study**
Prereq: One D-Lab subject, permission of instructor
G (IAP)

Units arranged
Can be repeated for credit.

Provides the opportunity to gain direct fieldwork experience in a global context. Subject spans three-four weeks in which students continue work from a prior D-Lab subject. Students work directly with international community partners to find solutions to real world problems, focusing on one or more issues in education, design, or public service. Group presentations and written reflection required.

*A. B. Smith*

**EC.791 D-Lab: Energy**
Subject meets with 2.651[J], EC.711[J]
Prereq: None
G (Spring)
3-3-6 units

Provides a project-based approach that engages students in understanding and addressing the applications of alternative energy technology in developing countries. Focuses on compact, robust, low-cost systems for generating electrical power. Includes projects such as micro-hydro, solar, or wind turbine generators along with theoretical analysis, design, prototype construction, evaluation and implementation. Students will have the opportunity for an optional spring break site visit to identify and implement projects. Students taking graduate version complete additional assignments.

*S. L. Hsu*

**EC.792[J] Cross-Cultural Investigations: Technology and Development**
Same subject as 21A.839[J], STS.481[J]
Subject meets with EC.702[J], 21A.801[J], STS.071[J]
Prereq: None
G (Spring)
3-0-9 units

See description under subject 21A.839[J].

*C. Walley*

**Teaching, UROP, Independent Study**

**EC.900 Independent Study**
Prereq: None
U (Fall, IAP, Spring, Summer)

Units arranged [P/D/F]
Can be repeated for credit.

Opportunity for independent study under regular supervision by a staff member. Projects require prior approval, as well as a written proposal and final report.

*Staff*

**EC.910 Edgerton Center Undergraduate Teaching**
Prereq: None
U (Fall, Spring, Summer)

Units arranged [P/D/F]
Can be repeated for credit.

An opportunity for undergraduates to participate in teaching and tutoring Center subjects and seminars. Students develop one-on-one teaching skills under the supervision of an Edgerton Center instructor.

*J. K. Vandiver*
**EC.980 Edgerton Center Independent Study - Graduate**
Prereq: None
G (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit.

Opportunity for independent study under regular supervision by a staff member. Projects require prior approval, as well as a written proposal and final report.

*J. Kim Vandiver*

**EC.990 Edgerton Center Graduate Teaching**
Prereq: None
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

An opportunity for graduate students to participate in teaching and tutoring Edgerton Center subjects and seminars. Permission of Edgerton Center staff required.

*Staff*

**EC.UR Undergraduate Research**
Prereq: None
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

**EC.URG Undergraduate Research**
Prereq: None
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit.

Undergraduate research opportunities in the Edgerton Center.

*J. K. Vandiver*

**Special Subjects**

**EC.S00-EC.S05 Special Subject at the Edgerton Center**
Prereq: None
U (Fall, IAP, Spring)
Not offered regularly; consult department
Units arranged [P/D/F]
Can be repeated for credit.

**EC.S06-EC.S10 Special Subject at the Edgerton Center**
Prereq: None
U (Fall, IAP, Spring)
Not offered regularly; consult department
Units arranged
Can be repeated for credit.

**EC.S11 Special Subject at the Edgerton Center**
Prereq: None
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit.

Seminar combining lectures and lab run by students and academic staff at the Edgerton Center. Students explore specialized electronics, robotics, or mechanical design and fabrication topics not offered in the regular curriculum; classes range from beginner level to more advanced. Some offerings may be taught in an intensive fashion (meeting for up to several times a week for four weeks). Up to three sequential seminars may be offered per semester, covering a different topic each time. Students can take one or all of the seminars.

*J. K. Vandiver*