EXPERIMENTAL STUDY GROUP (ES)

ES.7012 Introductory Biology
Prereq: None
U (Fall)
5-0-7 units. BIOLOGY
Credit cannot also be received for 7.012, 7.013, 7.014, 7.015, 7.016, ES.7013
Equivalent to 7.012; see 7.012 for description. Instruction provided through small, interactive classes. Limited to students in ESG.
P. Christie

ES.7013 Introductory Biology
Prereq: None
U (Spring)
5-0-7 units. BIOLOGY
Credit cannot also be received for 7.012, 7.013, 7.014, 7.015, 7.016, ES.7012
Equivalent to 7.013; see 7.013 for description. Instruction provided through small, interactive classes. Limited to students in ESG.
P. Christie

Chemistry

ES.5111 Principles of Chemical Science
Prereq: None
U (Fall, Spring)
5-0-7 units. CHEMISTRY
Credit cannot also be received for 3.091, 5.111, 5.112, CC.5111, ES.5112
Equivalent to 5.111; see 5.112 for description. Instruction provided through small, interactive classes taught by ESG staff. Limited to students in ESG.
N. Boekelheide

ES.5112 Principles of Chemical Science
Prereq: None
U (Fall)
Not offered regularly; consult department
5-0-7 units. CHEMISTRY
Credit cannot also be received for 3.091, 5.111, 5.112, CC.5111, ES.5111
Equivalent to 5.112; see 5.112 for description. Instruction provided through small, interactive classes taught by ESG staff. Limited to students in ESG.

Mathematics

ES.1801 Calculus
Prereq: None
U (Fall)
5-0-7 units. CALC I
Credit cannot also be received for 18.01, 18.01A, CC.1801, ES.181A
Equivalent to 18.01; see 18.01 for description. Instruction provided through small, interactive classes. Limited to students in ESG.
G. Stoy

ES.1802 Calculus
Prereq: Calculus I (GIR)
U (Fall, Spring)
5-0-7 units. CALC II
Credit cannot also be received for 18.02, 18.022, 18.02A, CC.1802, ES.182A
Equivalent to 18.02; see 18.02 for description. Instruction provided through small, interactive classes. Limited to students in ESG.
G. Stoy

ES.1803 Differential Equations
Prereq: None. Coreq: Calculus II (GIR)
U (Fall, Spring)
5-0-7 units. REST
Credit cannot also be received for 18.03, 18.032, CC.1803
Equivalent to 18.03; see 18.03 for description. Instruction provided through small, interactive classes. Limited to students in ESG.
J. Orloff

ES.181A Calculus
Prereq: Knowledge of differentiation and elementary integration
U (Fall; first half of term)
5-0-7 units. CALC I
Credit cannot also be received for 18.01, 18.01A, CC.1801, ES.1801
Equivalent to 18.01A; see 18.01A for description. Instruction provided through small, interactive classes. Limited to students in ESG.
J. Orloff
EXPERIMENTAL STUDY GROUP (ES)

**ES.182A Calculus**  
Prereq: Calculus I (GIR)  
U (Fall, IAP)  
5-0-7 units. CALC II  
Credit cannot also be received for 18.02, 18.022, 18.02A, CC.1802, ES.1802  
Equivalent to 18.02A; see 18.02A for description. Instruction provided through small, interactive classes. Limited to students in ESG.  
J. Orloff

**Physics**

**ES.801 Physics I**  
Prereq: None  
U (Fall)  
5-1-6 units. PHYSICS I  
Credit cannot also be received for 8.01, 8.011, 8.012, 8.01L, ES.8012  
Equivalent to 8.01; see 8.01 for description. Instruction provided through small, interactive classes. Limited to students in ESG.  
A. Barrantes

**ES.8012 Physics I**  
Prereq: None  
U (Fall)  
5-1-6 units. PHYSICS I  
Credit cannot also be received for 8.01, 8.011, 8.012, 8.01L, ES.801  
Equivalent to 8.012; see 8.012 for description. Limited to students in ESG.  
P. Rebusco

**ES.802 Physics II**  
Prereq: Calculus I (GIR) and Physics I (GIR)  
U (Spring)  
5-1-6 units. PHYSICS II  
Credit cannot also be received for 8.02, 8.021, 8.022, ES.8022  
Equivalent to 8.02; see 8.02 for description. Instruction done through small, interactive classes. Limited to students in ESG.  
A. Barrantes

**ES.8022 Physics II**  
Prereq: Physics I (GIR); Coreq: Calculus II (GIR)  
U (Spring)  
5-1-6 units. PHYSICS II  
Credit cannot also be received for 8.02, 8.021, 8.022, ES.802  
Equivalent to 8.022; see 8.022 for description. Students complete group projects. Some content is decided by students. Limited to students in ESG.  
P. Rebusco

**ESG Writing Program**

**ES.729[J] Engineering Communication in Context**  
Same subject as 21W.729[J]  
Prereq: None  
U (Fall)  
Not offered regularly; consult department  
3-1-8 units. HASS-E; CI-H  
Introduces writing, graphics, meetings, reading, oral presentation, collaboration, and design as tools for product development. Students work in teams to conceive, design, prototype, and evaluate energy-related mechanical engineering products. Instruction focuses on communication tasks that are integral to the design process, including design notebooks, email, informal and formal presentations, meeting etiquette, literature searches, white papers, proposals, and reports. Other assignments address the cultural situation of engineers and engineering in the world at large. Limited to 18; preference to ESG students.  
D. Custer

**ESG HASS Subjects**

**ES.112 Philosophy of Love**  
Prereq: None  
U (Spring)  
Not offered regularly; consult department  
4-0-8 units. HASS-H; CI-H  
Credit cannot also be received for ES.9112  
Explores the nature of love through works of philosophy, literature, film, poetry, and individual experience. Investigates the distinction among eros (desiring or appreciative love), philia (mutuality), and agape (love as pure giving). Students discuss ideas of love as a feeling, an action, a species of ‘knowing someone,’ or a way to give or take. Authors include Plato, Kant, Buber, D. H. Lawrence, Rumi, and Aristotle. Preference to students in ESG and Concourse.  
L. Perlman
ES.113 Ancient Greek Philosophy and Mathematics
Prereq: None
U (Spring)
Not offered regularly; consult department
3-0-9 units. HASS-H; CI-H
Explores the relationship between ancient Greek philosophy and mathematics. Investigates how ideas of definition, reason, argument and proof, rationality/irrationality, number, quality and quantity, truth, and even the idea of an idea were shaped by the interplay of philosophic and mathematical inquiry. Examines how discovery of the incommensurability of magnitudes challenged the Greek presumption that the cosmos is fully understandable. Explores the influence of mathematics on ancient Greek ethical theories. Authors: Euclid, Plato, Aristotle, Nicomachus, Theon of Smyrna, Bacon, Descartes, Dedekind, and Newton. Preference to students in Concentus and ESG.
L. Perlman

ES.114 Non-violence as a Way of Life
Prereq: None
U (Fall)
Not offered regularly; consult department
3-0-9 units. HASS-H; CI-H
Credit cannot also be received for ES.9114
Addresses the philosophical question of what a non-violent life entails. Investigates its ethical dimensions and challenges, and considers whether we can derive a comprehensive moral theory from the principle of non-violence. Discusses the issues of lying, the duty to forgive, non-violent communication, the ethics of our relationship to anger, the possibility of loving enemies, and the ethics of punishment and rehabilitation. Includes readings from primary exponents of non-violence, such as Tolstoy, Gandhi and King. Taught inside a secure Massachusetts correctional facility with a mix of MIT students and incarcerated students. Limited to 10.
L. Perlman

ES.9114 Non-violence as a Way of Life - MIT Prison Initiative
Prereq: None
U (Fall)
3-0-9 units. HASS-H; CI-H
Credit cannot also be received for ES.114

ES.92 Authenticity - MIT Prison Initiative
Prereq: None
U (Fall, Spring)
3-0-3 units
Explores the question of how to live an authentic life, through works of western and eastern philosophy and contemporary psychology. Topics include emotions, anger, honesty, forgiveness, non-violent communication, conflict resolution, kindness and cruelty and compassion. Taught inside a secure Massachusetts correctional facility with a mix of MIT students and incarcerated students. Limited to 12.
L. Perlman

ESG Seminars

ES.010 Chemistry of Sports: Understanding How Exercise Affects Your Body
Prereq: None
U (Spring)
2-1-3 units
Students apply chemistry knowledge to physical fitness through the study of three sports: swimming, cycling, and running. Classroom component focuses on nutrition, exercise, anatomy, physiology, and the chemistry of supplements and sports equipment. Laboratory component focuses on training for and completion of triathlon competition. Students may earn up to 2 PE points during the term by attending supervised triathlon training workouts. Preference to students in ESG.
P. Christie, S. Lyons
**ES.011 Kitchen Chemistry**  
Prereq: None  
U (Spring)  
Not offered regularly; consult department  
2-1-3 units  

An experimental and "hands-on" approach to applied chemistry in cooking. Students perform experiments to illustrate chemical principles, such as extraction, denaturation, and phase changes. Preference to students in ESG.  
P. Christie

**ES.100 An Introduction to Maker Skills**  
Prereq: None  
U (Spring)  
1-1-1 units  

Introduction to making and use of MIT's maker spaces intended to build skills needed for designing, conducting, and completing experiments and design projects, such as may be encountered in undergraduate classwork and research activities. Includes maker space training (i.e., wood shop, digital fabrication, and electronics fabrication) and open-ended design projects, with work evenly divided between class, homework, and maker space activities. Limited to 12 by makerspace training and scheduling; priority given to ESG students.  
D. Custer

**ESG Teaching and Research**

**ES.200 ESG Undergraduate Teaching**  
Prereq: Permission of instructor  
U (Fall)  
2-0-4 units  
Can be repeated for credit.  

An opportunity to assist in the teaching of subjects in ESG in biology, chemistry, humanities and social sciences, mathematics, and physics. Student instructors may be involved in grading, running problem solving sessions, or teaching classes depending on experience and interest. Qualified students may also develop and teach undergraduate seminars under the supervision of an appropriate faculty or staff member. Student instructors meet every other week with staff to discuss their teaching and cover a variety of topics related to effective teaching techniques. Limited to students in ESG.  
L. Royden

**ES.201 ESG Undergraduate Teaching**  
Prereq: Permission of instructor  
U (Fall, Spring)  
1-0-2 units  
Can be repeated for credit.  

An opportunity to assist in the teaching of subjects in ESG in biology, chemistry, humanities and social sciences, mathematics, and physics. Student instructors may be involved in grading, running problem solving sessions, or teaching classes depending on experience and interest. Qualified students may also develop and teach undergraduate seminars under the supervision of an appropriate faculty or staff member. Student instructors meet every other week with staff to discuss their teaching and cover a variety of topics related to effective teaching techniques. Limited to students in ESG.  
G. Stoy

**ES.210 ESG Independent Study**  
Prereq: Permission of instructor  
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 a final report. Limited to students in ESG.  
L. Royden

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

For students wishing to pursue undergraduate research opportunities in the Experimental Study Group. Limited to students in ESG.  
L. Royden

**ESG Special Subjects**

**ES.S10 Special Seminar in Science**  
Prereq: None  
U (Spring)  
Not offered regularly; consult department  
Units arranged [P/D/F]  
Can be repeated for credit.  

Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
Staff
**ES.S11 Special Seminar in Science**  
Prereq: None  
U (Spring)  
Not offered regularly; consult department  
Units arranged [P/D/F]  
Can be repeated for credit.  
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
*Staff*

**ES.S20 Special Seminar in Mathematics**  
Prereq: None  
U (Spring)  
Not offered regularly; consult department  
Units arranged [P/D/F]  
Can be repeated for credit.  
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
*Staff*

**ES.S21 Special Seminar in Mathematics**  
Prereq: None  
U (Fall, IAP, Spring)  
Not offered regularly; consult department  
Units arranged [P/D/F]  
Can be repeated for credit.  
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
*Staff*

**ES.S30 Special Seminar in Engineering and Computer Science**  
Prereq: None  
U (Spring)  
Units arranged [P/D/F]  
Can be repeated for credit.  
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
*Staff*

**ES.S31 Special Seminar in Engineering and Computer Science**  
Prereq: None  
U (Fall, IAP, Spring)  
Not offered regularly; consult department  
Units arranged [P/D/F]  
Can be repeated for credit.  
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
*Staff*

**ES.S40 Special Seminar in the Humanities**  
Prereq: None  
U (Spring)  
Units arranged [P/D/F]  
Can be repeated for credit.  
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
*Staff*

**ES.S41 Special Seminar in the Humanities**  
Prereq: None  
U (Fall, Spring)  
Not offered regularly; consult department  
Units arranged  
Can be repeated for credit.  
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
*Staff*

**ES.S42 Special Seminar in the Humanities**  
Prereq: None  
U (Fall, Spring)  
Not offered regularly; consult department  
Units arranged  
Can be repeated for credit.  
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.  
*Staff*
**ES.550 Special Seminar in the Arts**
Prereq: None
U (Fall)
Not offered regularly; consult department
Units arranged [P/D/F]
Can be repeated for credit.
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.

**Staff**

**ES.551 Special Seminar in the Arts**
Prereq: None
U (Fall, IAP, Spring)
Not offered regularly; consult department
Units arranged [P/D/F]
Can be repeated for credit.
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.

**Staff**

**ES.560 Special Seminar in Social Science**
Prereq: None
U (Spring)
Not offered regularly; consult department
Units arranged [P/D/F]
Can be repeated for credit.
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.

**Staff**

**ES.5601 Special Topics in Computer Science**
Prereq: None
U (Fall)
Units arranged
Covers topics not included in the permanent curriculum. Limited to 10. Preference given to ESG students.

*P. Rebusco*

**ES.5602 Special Topics in Computer Science (New)**
Prereq: None
U (Spring)
Units arranged [P/D/F]
Covers topics not included in the permanent curriculum. Preference given to ESG students.

*P. Rebusco*

**ES.561 Special Seminar in Social Science**
Prereq: None
U (Spring)
Not offered regularly; consult department
Units arranged [P/D/F]
Can be repeated for credit.
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.

**Staff**

**ES.570 Special Seminar in Interdisciplinary Studies**
Prereq: None
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit.
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.

**Staff**

**ES.571 Special Seminar in Interdisciplinary Studies**
Prereq: None
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit.
Covers topics not included in the permanent curriculum. May not be used for GIR credit, but may be repeated for credit with permission of instructor. Preference to students in ESG.

**Staff**

**ES.590 Special Studies in the MIT Initiative for Teaching Incarcerated Individuals**
Prereq: None
U (Spring)
Units arranged [P/D/F]
Can be repeated for credit.
Seminar taught inside a secure Massachusetts correctional facility with a mix of MIT students and incarcerated students. Topics vary from year to year. Limited to 10.

**Staff**
**ES.S91 Special Studies in the MIT Initiative for Teaching Incarcerated Individuals**
Prereq: None
U (Spring)
Units arranged [P/D/F]
Can be repeated for credit.

Seminar taught inside a secure Massachusetts correctional facility with a mix of MIT students and incarcerated students. Topics vary from year to year. Limited to 10.

Staff

**ES.S92 Special Studies in the MIT Initiative for Teaching Incarcerated Individuals**
Prereq: None
U (Spring)
Units arranged [P/D/F]

Seminar taught inside a secure Massachusetts correctional facility with a mix of MIT students and incarcerated students. Topics vary from year to year. Limited to 10.

L. Perlman