

## EXPERIMENTAL STUDY GROUP (ES)

### ESG Science Subjects

#### Biology

##### ES.7012 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.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)

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 5.111 for description. Instruction provided through small, interactive classes taught by ESG staff. Limited to students in ESG.

*P. Christie*

##### 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.

*N. Boekelheide*

#### 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, 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*

### **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 (Fall, 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 Concourse 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.

*L. Perlman***ES.9112 Philosophy of Love - MIT Prison Initiative**

Prereq: None

U (Spring)

3-0-9 units. HASS-H; CI-H

Credit cannot also be received for ES.112

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. 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

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.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 problemsolving 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 weekly with staff to discuss their teaching and cover a variety of topics related to effective teaching techniques. Limited to students in ESG.

*P. Christie*

### **ES.201 ESG Undergraduate Teaching**

Prereq: Permission of instructor

U (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.S50 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.S51 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.S60 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.S601 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.S602 Special Topics in Computer Science**

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.S61 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.S70 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.S71 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.S90 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*