2019 APEA Course List

Courses meet daily unless otherwise noted. Full courses at Carnegie Mellon carry 9 to 12 units, corresponding to 3 to 4 credits at other U.S. colleges and universities. Students who reside in university housing must be enrolled in two full courses, while commuter students have the option to enroll in either one or two full courses.

APEA students are limited to enrolling in **23 or fewer units** because all courses in this six-week summer term cover material from the longer fall and spring semesters. We are instituted this policy in 2016 because we found students who enroll in excessive units cannot experience everything APEA has to offer. Students who do enroll in 23 units may be expected to study challenging Carnegie Mellon academic material for at least 57 hours every week. For more information, contact APEA Director Dr. William Alba (alba@cmu.edu, 412-268-7333) or Senior Academic Advisor Veronica Peet (vpeet@andrew.cmu.edu, 412-268-3750).

Newly listed courses for the APEA Program in 2019 include:

06-052 Fundamentals of Chemical Engineering Practice
76-221 Books You Should Have Read By Now: Contemporary Classics
*79-318 Sustainable Social Change
82-119 Arabic Calligraphy Culture & Skills
82-137 Chinese Calligraphy: Culture & Skills
82-279 Anime – Visual Interplay between Japan and the World
88-120 Reason, Passion, and Cognition

This is a course list is dated 4-8-2019. Updates reflected in course list schedule reflected on page 2:

Visit [http://cmu.edu/shs/apea/2019courses.pdf](http://cmu.edu/shs/apea/2019courses.pdf) for up-to-date course availability and class times. Additional courses may be available during the university’s concurrent Summer Session 2 for appropriately prepared students. The faculty member teaching the course and the APEA Director must authorize your choice. For a complete listing of available Summer Session 2 courses, contact Dr. William Alba or Veronica Peet.

Some of the courses in the following list are especially designated for APEA, and some involve a combined population of APEA students with regular degree students. In either case, all courses in the APEA Program offer the same quality of instruction and expectation of work as during the fall or spring at Carnegie Mellon.

After reviewing these course descriptions and, if needed, consulting by phone or email with the APEA Director or Senior Academic Advisor about course choices, select your courses using the APEA Course Request Form in the Pre-College Portal. Students will have access to the form through the portal once they are admitted to APEA.

Courses fill in the order that deposits and forms are received by the university and the order that the course request form is completed. For Computer Science courses that require the completion of an assessment test for placement, the date of completion of that assessment factors into the order in which students are enrolled in those courses.

APEA students do not enroll themselves in courses. They are enrolled based on their course selections on the APEA Course Request forms. Enrollment is subject to completion of any required assessments and meeting required placement scores as well as course availability. To view your course schedule once you are enrolled in classes, visit Student Information Online on the HUB’s website ([www.cmu.edu/hub/sio](http://www.cmu.edu/hub/sio)) using your Carnegie Mellon University Andrew ID and password. Please allow time for the receipt and processing of your deposit and enrollment forms.

Students may request schedule changes until the end of the second day of classes by contacting the APEA Director or Senior Academic Advisor before arrival or by meeting one of them after the program begins. Students and their families are responsible for communicating to each other any changes in their academic plans.

* Students enrolled in this class are eligible for an extended program beyond the 6-week APEA summer session connecting students from the course with ongoing student projects, mentoring, advising, and continued association with Carnegie Mellon Faculty and Staff.
<table>
<thead>
<tr>
<th>Units</th>
<th>Course#</th>
<th>Course Title</th>
<th>Meeting Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>03-121E</td>
<td>Modern Biology</td>
<td>MTWRF 09:00a-10:20a</td>
</tr>
<tr>
<td>9</td>
<td>03-124E</td>
<td>Modern Biology Laboratory</td>
<td>MW 12:00p-12:50p AND MW 01:00p-02:50p</td>
</tr>
<tr>
<td>9</td>
<td>03-132E</td>
<td>Basic Science to Modern Medicine</td>
<td>MTWRF 03:00p-04:20p</td>
</tr>
<tr>
<td>9</td>
<td>03-133E</td>
<td>Neurobiology of Disease</td>
<td>MTWRF 10:30a-11:50a</td>
</tr>
<tr>
<td>9</td>
<td>06-052E</td>
<td>Fundamentals of Chemical Engineering Practice</td>
<td>MWF 09:00a-10:20a AND MW 01:00p-02:50p</td>
</tr>
<tr>
<td>10</td>
<td>09-105E</td>
<td>Introduction to Modern Chemistry I</td>
<td>MTWRF 09:00a-10:20a</td>
</tr>
<tr>
<td>10</td>
<td>15-110E</td>
<td>Principles of Computing</td>
<td>MTWRF 09:00a-10:20a AND MTWRF 04:30p-05:20p</td>
</tr>
<tr>
<td>12</td>
<td>*15-112E</td>
<td>Fundamentals of Programming and Computer Science</td>
<td>MTWRF 09:00a-10:20a AND MTWRF 05:30p-06:20p</td>
</tr>
<tr>
<td>10</td>
<td>21-120F</td>
<td>Differential and Integral Calculus</td>
<td>MTWRF 10:30a-11:50a</td>
</tr>
<tr>
<td>10</td>
<td>21-127E</td>
<td>Concepts of Mathematics</td>
<td>MTWRF 09:00a-10:20a</td>
</tr>
<tr>
<td>9</td>
<td>27-052E</td>
<td>Introduction to NanoScience and Technology</td>
<td>MWF 01:00p-02:50p</td>
</tr>
<tr>
<td>9</td>
<td>33-115E</td>
<td>Physics for Future Presidents</td>
<td>MTWRF 03:00p-04:20p</td>
</tr>
<tr>
<td>9</td>
<td>33-124E</td>
<td>Introduction to Astronomy</td>
<td>MTWRF 01:30p-02:50p</td>
</tr>
<tr>
<td>12</td>
<td>33-141E</td>
<td>Physics I for Engineering Students</td>
<td>MTWRF 12:30p-02:50p</td>
</tr>
<tr>
<td>12</td>
<td>33-142E</td>
<td>Physics II for Engineering and Physics Students</td>
<td>MTWRF 02:00p-04:20p</td>
</tr>
<tr>
<td>9</td>
<td>36-200E</td>
<td>Reasoning with Data</td>
<td>MTWRF 12:00p-01:20p</td>
</tr>
<tr>
<td>9</td>
<td>36-202E</td>
<td>Methods for Statistical Data Science</td>
<td>MTWRF 10:30a-11:50a</td>
</tr>
<tr>
<td>9</td>
<td>57-341E</td>
<td>Sound Recording Workshop</td>
<td>MWF 01:30p-02:50p AND MW 06:30p-07:50p</td>
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<tr>
<td>9</td>
<td>70-122E</td>
<td>Introduction to Accounting</td>
<td>MTWRF 10:30a-11:50a</td>
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<tr>
<td>9</td>
<td>73-102E</td>
<td>Principles of Microeconomics</td>
<td>MTWRF 09:00a-10:20a</td>
</tr>
<tr>
<td>9</td>
<td>73-103E</td>
<td>Principles of Macroeconomics</td>
<td>MTWRF 10:30a-11:50a</td>
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<tr>
<td>9</td>
<td>76-101E</td>
<td>Interpretation and Argument: Smartphones and Society</td>
<td>MW 12:00p-02:20p</td>
</tr>
<tr>
<td>9</td>
<td>76-101F</td>
<td>Interpretation and Argument: Don’t Treat on Me: Publich Health and Social Justice</td>
<td>MTWRF 01:30p-02:50p</td>
</tr>
<tr>
<td>9</td>
<td>76-221E</td>
<td>Books You should Have Read By Now: Contemporary Classics</td>
<td>MWF 09:00a-11:20a</td>
</tr>
<tr>
<td>9</td>
<td>79-104E</td>
<td>Global Histories: The Civil Rights Movementt and the World</td>
<td>MTWRF 10:30a-11:50p</td>
</tr>
<tr>
<td>9</td>
<td>79-318E</td>
<td>Sustainable Social Change: History and Practice</td>
<td>MWF 12:00p-1:20p</td>
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<tr>
<td>9</td>
<td>80-100E</td>
<td>Introduction to Philosophy</td>
<td>MTWRF 01:30p-02:50p</td>
</tr>
<tr>
<td>9</td>
<td>80-135E</td>
<td>Introduction to Political Philosophy</td>
<td>MTWRF 01:30p-02:50p</td>
</tr>
<tr>
<td>9</td>
<td>80-180E</td>
<td>Nature of Language</td>
<td>MTWRF 10:30a-11:50a</td>
</tr>
<tr>
<td>12</td>
<td>82-101E</td>
<td>Elementary French I</td>
<td>MTWRF 09:00a-10:20a</td>
</tr>
<tr>
<td>9</td>
<td>82-119E</td>
<td>Arabic Calligraphy Culture and Skills</td>
<td>MTWRF 03:00p-04:20p</td>
</tr>
<tr>
<td>12</td>
<td>82-131E</td>
<td>Elementary Chinese I</td>
<td>MTWRF 10:30a-11:50a</td>
</tr>
<tr>
<td>9</td>
<td>82-137E</td>
<td>Chinese Calligraphy: Culture and Skills</td>
<td>MTWRF 12:00p-01:20p</td>
</tr>
<tr>
<td>12</td>
<td>82-171E</td>
<td>Elementary Japanese I</td>
<td>MTWRF 09:00a-10:20a</td>
</tr>
<tr>
<td>9</td>
<td>82-273E</td>
<td>Introduction to Japanese Language and Culture</td>
<td>MTWRF 03:00p-04:20p</td>
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<tr>
<td>9</td>
<td>82-279E</td>
<td>Anime - Visual Interplay between Japan and the World</td>
<td>MTWRF 12:00p-01:20p</td>
</tr>
<tr>
<td>9</td>
<td>85-102E</td>
<td>Introduction to Psychology</td>
<td>MTWRF 12:00p-01:20p</td>
</tr>
<tr>
<td>9</td>
<td>85-241E</td>
<td>Social Psychology</td>
<td>MTWRF 01:30p-02:50p</td>
</tr>
<tr>
<td>9</td>
<td>88-120E</td>
<td>Reason, Passion and Cognition</td>
<td>MTWRF 09:00a-10:20p</td>
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</table>

* Placement into 15-112 and 15-122 requires appropriate scoring on the CS Placement test. Details are in course descriptions.
03-121 Modern Biology (9 units)
This is an introductory course that provides the basis for further studies in biochemistry, cell biology, genetics and molecular biology. This course emphasizes the chemical principles underlying biological processes and cell structures as well as the analysis of genetics and heredity from a molecular perspective. This is the introductory biology course for all science and non-science majors. 80-minute daily lecture.

03-124 Modern Biology Laboratory (9 units)
This laboratory is designed to introduce students to modern concepts in the biological sciences. The experiments illustrate many of the principles covered in 03-121 and 03-230. Experimentation using living organisms and/or their tissues, cells or molecules is an essential component of this course. 3-hour laboratory / lecture two times per week.

03-132 Basic Science to Modern Medicine (9 units)
This course will focus on the genetics, cell biology, and developmental biology behind human biology and human disease, as well as the growing opportunities for novel therapeutic options that basic science delivers. This is a topics based course, with topics chosen to cover aspects of human biology and health that students are likely to encounter in their daily lives such as cancer, stem cells, genome sequencing, and the human microbiota. Students will explore these topics from both a basic science and a human health perspective. 80-minute daily lecture.

03-133 Neurobiology of Disease (9 units)
This course will explore the biological basis of several neurological and neuropsychiatric diseases, with an emphasis on medical diagnostic tools and techniques. It will include discussions of the anatomical basis of neurological diseases as well as recent research into understanding the mechanisms of disease. This course is intended to broaden students' understanding of how diseases are diagnosed and studied. Students will also learn how basic neurological and psychiatric evaluations are conducted and gain proficiency in these evaluation techniques. We will begin with a discussion of clinical neuroanatomy to serve as a basis for understanding brain structures and functional alterations in a variety of developmental, degenerative, neurological, and psychiatric disorders. Specific diseases covered may vary from year to year. 80-minute daily lecture.

06-052 Fundamentals of Chemical Engineering Practice (9 units)
This course provides advanced high school students with an introduction to Chemical Engineering practice. The course goals are: (1) to provide students with a broad knowledge of the engineering sciences Chemical Engineers utilize; (2) to increase facility with computational tools used by engineers; and (3) to apply chemical engineering sciences to problems in chemical process and product design. The course will cover a selection of topics, including mass and energy balances, Thermodynamics, Fluid Mechanics, Heat and Mass Transfer, and Unit Operations. Laboratory time will reinforce learning inductively and will feature open-ended problems. 80-minute lecture thrice weekly, 2-hour lab twice weekly.

09-105 Introduction to Modern Chemistry I (10 units)
This course begins with a very brief survey of some fundamental principles of chemistry and a presentation of chemically interesting applications and sophisticated problems. These will form the basis for introducing the relationships between the structure of molecules and their chemical properties and behavior. The subject matter will include principles of atomic structure, chemical bonding, intermolecular interactions and molecular structures of organic and inorganic compounds including some transition metal complexes. Relevant examples will be drawn from such areas as environmental, materials, and biological chemistry. 80-minute daily lecture.
15-110 Principles of Computing (10 units)
A course in fundamental computing principles for students with minimal or no computing background. Programming constructs: sequencing, selection, iteration, and recursion. Data organization: arrays and lists. Use of abstraction in computing: data representation, computer organization, computer networks, functional decomposition, and application programming interfaces. Use of computational principles in problem-solving: divide and conquer, randomness, and concurrency. Classification of computational problems based on complexity, non-computable functions, and using heuristics to find reasonable solutions to complex problems. Social, ethical and legal issues associated with the development of new computational artifacts will also be discussed. 80-minute daily lecture and 50-minute daily recitation.

15112 Fundamentals of Programming and Computer Science (12 units)
A technical introduction to the fundamentals of programming with an emphasis on producing clear, robust, and reasonably efficient code using top-down design, informal analysis, and effective testing and debugging. Starting from first principles, we will cover a large subset of the Python programming language, including its standard libraries and programming paradigms. We will also target numerous deployment scenarios, including standalone programs, shell scripts, and web-based applications. This course assumes no prior programming experience. Even so, it is a fast-paced and rigorous preparation for 15-122. Students seeking a more gentle introduction to computer science should consider first taking 15-110. NOTE: students must achieve a C or better in order to use this course to satisfy the pre-requisite for any subsequent Computer Science course. 80-minute daily lecture and 50-minute daily recitation.

Note on 15-110 vs. 15-112: Both courses are introductory, assuming no prior programming experience. If you are certain at this time that you want to study Electrical and Computer Engineering (ECE) or Computer Science (CS) as a major or minor during college, or if you want to want to devote an immense amount of time during the summer doing programming, you should consider 15-112. On the other hand, if you are exploring the possibility of majoring in CS or ECE, intend to apply CS primarily towards other areas, or want to get a broad sense of computer science and how computer scientists approach problems, 15-110 is much more appropriate for you.

Computer Science Placement Exam: To ensure students are placed in the correct CS courses, APEA students who seek to enroll in 15-112 or in 15-122 must complete a CS placement exam administered by CMU. Information about this exam will be sent to students who have listed 15-112 or 15-122 on their online course request forms. Students will be enrolled in these courses only after their placement exams are scored.

15-122 Principles of Imperative Computation (10 units)
For students with a basic understanding of programming (variables, expressions, loops, arrays, functions). Teaches imperative programming and methods for ensuring the correctness of programs. Students will learn the process and concepts needed to go from high-level descriptions of algorithms to correct imperative implementations, with specific application to basic data structures and algorithms. Much of the course will be conducted in a subset of C amenable to verification, with a transition to full C near the end. This course prepares students for 15-213 and 15-210. NOTE: students must achieve a C or better in order to use this course to satisfy the pre-requisite for any subsequent Computer Science course. Prerequisites: 15-112 or equivalent (such as a 5 on the AP Computer Science exam). All students enrolled in 15-122 must have completed 21-127 (Concepts of Mathematics) previously, or be enrolled in 21-127 this summer. 80-minute daily lecture and 80-minute daily recitation.

Computer Science Placement Exam: To ensure students are placed in the correct CS courses, APEA students who seek to enroll in 15-112 or in 15-122 must complete a CS placement exam administered by CMU. Information about this exam will be sent to students who have listed 15-112 or 15-122 on their online course request forms. Students will be enrolled in these courses only after their placement exams are scored.
**18-100 Introduction to Electrical and Computer Engineering** (12 units)
The goals of this freshman engineering course are: To introduce basic concepts in electrical and computer engineering in an integrated manner; To motivate basic concepts in the context of real applications; To illustrate a logical way of thinking about problems and their solutions, and; To convey the excitement of the profession. These goals are attained through analysis, construction and testing of an electromechanical system (e.g., a robot) that incorporates concepts from a broad range of areas within Electrical and Computer Engineering. Some of the specific topics that will be covered include system decomposition, ideal and real sources, Kirchhoff's Current and Voltage Laws, Ohm's Law, piecewise linear modeling of nonlinear circuit elements, Ideal Op-Amp characteristics, combinational logic circuits, Karnaugh Maps, Flip-Flops, sequential logic circuits, and finite state machines. Prerequisite: high school technical course such as chemistry or physics. NOTE: we will assume students have knowledge of complex numbers in rectangular and polar forms, can convert between the two, and can add, subtract, multiply and divide complex numbers. Junior or senior standing in high school required, senior is preferred. This is the same rigorous course required of entering ECE majors. 80-minute daily lecture, 80-minute recitation thrice weekly and 3-hour laboratory session twice weekly.

**21-120 Differential and Integral Calculus** (10 units)
Functions, limits, derivatives, logarithmic, exponential, and trigonometric functions, inverse functions; L'Hospital's Rule, curve sketching, Mean Value Theorem, related rates, linear and quadratic approximations, maximum-minimum problems, inverse functions, definite and indefinite integrals, and hyperbolic functions; applications of integration, integration by substitution and by parts. Contact the APEA Director or Advisor if you have questions about preparation. This is the first main calculus course at Carnegie Mellon. Students who have successfully completed AP Calculus AB or an equivalent course should enroll in a different mathematic course. 80-minute daily lecture.

**21-127 Concepts of Mathematics** (10 units)
This course introduces the basic concepts, ideas and tools involved in doing mathematics. As such, its main focus is on presenting informal logic, and the methods of mathematical proof. These subjects are closely related to the application of mathematics in many areas, particularly computer science. Topics discussed include a basic introduction to elementary number theory, induction, the algebra of sets, relations, equivalence relations, congruences, partitions, and functions, including injections, surjections, and bijections. A basic introduction to the real numbers, rational and irrational numbers. Supremum and infimum of a set. 80-minute daily lecture.

**27-052 Introduction to NanoScience and Technology** (9 units)
This course is offered within Carnegie Mellon's Advanced Placement Early Admissions (APEA) program. The course is primarily intended to provide an introduction to nanoscience and technology to a wide audience of students at the advanced high school to incoming freshmen level. The course goals are twofold: (1) to provide students with a holistic view of the objectives, opportunities and challenges of the emerging field of nanotechnology and 2) to sensitize students at an early stage of their career to the relevance of the connections among the traditional disciplines as a vital element to the progress in interdisciplinary areas such as nanotechnology. The course will cover: Introduction and fundamental science; Preparation of nanostructures; Characterization of nanostructures; Application examples, Social and ethical aspects of nanotechnology. Admission according to APEA guidelines. 110-minute meetings three times per week.

**33-115 Physics for Future Presidents** (9 units)
Countless topics of social and political importance are intimately related to science in general and physics in particular. Examples include energy production, global warming, radioactivity, terrorism, and space travel. This course aims to provide key bits of knowledge based on which such issues can be discussed in a meaningful way, i.e., on the level of arguments and not just vague beliefs. We will cover an unusually wide range of topics, including energy, heat, gravity, atoms, radioactivity, chain reactions, electricity, magnetism, waves, light, weather, and climate. No calculus or algebra will be required. The course is open for all students at CMU. 80-minute daily lecture.
**33-124 Introduction to Astronomy** (9 units)
Astronomy continues to enjoy a golden age of exploration and discovery. This course presents a broad view of astronomy, straightforwardly descriptive and without any complex mathematics. The goal of the course is to encourage non-technical students to become scientifically literate and to appreciate new developments in the world of science, especially in the rapidly developing field of astronomy. Subjects covered include the solar system, stars, galaxies and the universe as a whole. The student should develop an appreciation of the ever-changing universe and our place within it. Computer laboratory exercises will be used to gain practical experience in astronomical techniques. In addition, small telescopes will be used to study the sky. This course is specifically geared toward non-science/engineering majors. 80-minute daily lecture.

**33-141 Physics I for Engineering Students** (12 units)
This is a first semester, calculus-based introductory physics course. Basic principles of mechanics and thermodynamics are developed. Topics include vectors, displacement, velocity, acceleration, force, equilibrium, mass, Newton's laws, gravitation, work, energy, momentum, impulse, torque and angular momentum, temperature, heat, equations of state, thermodynamic processes, heat engines, refrigerators, first and second laws of thermodynamics, and the kinetic theory of gases. Prerequisites: high school calculus course, concurrent enrollment in 21-120, or a 5 on the AP AB Calculus exam. 80-minute daily lecture and 80-minute daily recitation.

**33-142 Physics II for Engineering and Physics Students** (12 units)
This is the second half of a two-semester calculus-based introductory physics sequence for engineering and physics students. Two fifths of the course covers electricity, including electrostatics and electric fields, Gauss' law, electric potential, and simple circuits. Two fifths cover magnetism, including magnetic forces, magnetic fields, induction and electromagnetic radiation. One fifth of the course covers mechanical waves (including standing and traveling waves, superposition, and beats) and electromagnetic waves (including mode of propagation, speed, and other properties). Prerequisites: A score of 5 on the AP AB or BC Calculus exams. Completion of a physics course in mechanics or equivalent course in high school (5 in AP Physics C: Mechanics) is required. 80-minute daily lecture and 80-minute daily recitation.

**36-200 Reasoning with Data** (9 units)
This course will serve as an introduction to learning how to "reason with data". While still an introductory-level course in the Statistics Department, the focus will be more on thinking about the relationship between the application and the data set and extracting useful statistical information rather than taking primarily a formula-driven approach. There will be an emphasis on thinking through a empirical research problem from beginning to end. Types of data will include continuous and categorical variables, images, text, and networks. Applications will largely drawn from interdisciplinary case studies spanning the humanities, social sciences, and related fields. Methodological topics will include basic exploratory data analysis, elementary probability, hypothesis tests, and empirical research methods. There is no calculus or programming requirement. There will be weekly computer labs for additional hands-on practice. 80-minute daily lecture.

**36-202 Methods for Statistics and Data Science** (9 units)
This course builds on the principles and methods of statistical reasoning developed in 36-200 (or its equivalents). The course covers simple and multiple regression, analysis of variance methods and logistic regression. Other topics may include non-parametric methods and probability models, as time permits. The objectives of this course is to develop the skills of applying the basic principles and methods that underlie statistical practice and empirical research. Learning the Data Analysis Pipeline is strongly emphasized through structured coding and data analysis projects. In addition to three lectures a week, students attend a computer lab twice a week for "hands-on" practice of the material covered in lecture; students will learn the basics of R Markdown and related analytics tools. 80-minute daily lecture.
57-341 Sound Recording Workshop (9 units)
Centers around the new recording studio in the School of Music: how the studio works and how to record various types of music, using the recording studio and the Kresge Recital Hall, which has audio and video links to the recording studio. The method of instruction is to learn by doing, and the goal is to achieve professional-sounding results. Equipment includes a complete 24-track Pro-Tools system, professionally designed control room and an interesting array of microphones. All recording is direct to hard disc. The lecture portion will cover the basics of sound, wave propagation, human hearing, psychoacoustics, transducers (microphones and speakers), mixing consoles, signal processors, digital and analog recording systems and signal flow. There are no specific prerequisites for the course, although reading music and/or playing an instrument is helpful. 80-minute lecture three times per week, 3-hour lab twice weekly.

70-122 Introduction to Accounting (9 units)
This course provides the knowledge and skills necessary for the student to understand financial statements and financial records and to make use of the information for management and investment decisions. Topics include: an overview of financial statements and business decisions; the balance sheet, the income statement, and the cash flow statement; sales revenue, receivables, and cash; cost of goods sold and inventory; long-lived assets and depreciation, and amortization; current and long-term liabilities; owners' equity; investments in other corporations; an introduction to financial statement analysis and international issues dealing with financial statements. 80-minute lecture three times per week, 3-hour lab twice weekly.

73-102 Principles of Microeconomics (9 units)
A one-semester course that teaches the fundamentals of microeconomics. Students will learn how microeconomic analysis can explain market successes, market failures, and how government intervention might improve outcomes. In addition to an investigation of firm behavior and consumer behavior, attention will be paid to: Game Theory, Behavioral Economics, Economics of Time and Risk, Economics of Information, Experimental Economics, and Auctions and Market Design. Students will also learn how to integrate basic data analysis and statistics. 80-minute daily session.

73-103 Principles of Microeconomics (9 units)
A one-semester course that teaches the fundamentals of macroeconomics. Students will learn how macroeconomic analysis can explain national economic activity and how government intervention might stabilize an economy. Topics include: defining and measuring national wealth, economic growth, credit markets, unemployment, interest rates, inflation, and the monetary system. Additional emphasis will be paid to: long-term economic development, political economy, financial crises and topics that are central to contemporary macroeconomic debates such as the impact of technological change, migration, and trade on the macroeconomy. Students will access macroeconomic databases, and then use basic statistics to describe and isolate empirical patterns in macro-data. Prerequisite: A score of 5 on both the AP Microeconomics and AP Macroeconomics exams. 80-minute daily session.

76-101 Interpretation and Argument (9 units)
76-101 introduces first-year students to an advanced, inductive process for writing an argument from sources. Because the course is based upon empirical research about professional academic writers, students will learn expert practices for authoring their own arguments that contribute to an existing community of authors. Because reading and writing are inseparable practices for academic writing, students will read a variety of texts so that they can explore and critically evaluate a single issue from multiple perspectives and from different disciplinary genres. Students will learn methods for summarizing, synthesizing, and analyzing arguments within that issue so that they may contribute an argument of their own. The course is also geared toward helping students understand the requirements of advanced college-level writing. Our students are typically very accomplished readers and writers, and we are eager to push their accomplishments toward greater excellence. For this purpose, students will build upon their composing knowledge by reflecting and thinking strategically as they plan, write, and revise their own texts. Ultimately, they will develop critical reading, rhetorical and linguistic practices for analyzing and producing texts within the context of an academic community. Each
Section E: Smartphones and Society
The course will focus on questions that explore to what extents mobile technology simultaneously connects users across cultures while contributing to a loss of humanity. Students will compare articles across genres that relate to ways in which smartphones both connect and disconnect their users from each other and our world. We will carve research spaces from emerging areas of inquiry and knowledge gaps, including why mobile social media may make us unsocial, how smartphones contribute to both increases in life satisfaction as well as isolation, and in what ways might we leverage smartphones to teach, learn, and train. By the end of the course, students will be able to confidently enter into the argument of how we might more meaningfully bring smartphones out of our pockets and into our world. Students will compose a research proposal and follow-up on it to produce an academic article and present it in a "classroom conference."

Section F: Doctor Who?: Social Justice and Public Health
In 1905, the United States Supreme Court ruled in Jacobson v Massachusetts that states had the authority to enforce mandatory vaccinations when “necessary for public health or safety.” Over the past century, increased public health legislation and policy have fueled the controversy surrounding government-regulated health initiatives. For some, public health policies represent a way to prevent millions of unnecessary deaths and build stronger, healthier communities. Others argue that these policies signal gross intrusions on individual liberties and freedoms. Others still claim that public health policies neglect the unique sociocultural and economic conditions that affect a community’s identity and health practices. This section of 76-101 examines the controversy surrounding public health by tracing the moral, ethical, and sociopolitical implications of public health policies by examining their individual, local, and national implications. Through the critical examination of legislative, popular, and academic texts regarding government-led health initiatives, students will learn and practice the analytical skills necessary for understanding and responsibly contributing to this complex social issue, which affects every one of us. By the time students complete this course, they will be able to analyze the rhetorical structure of multifaceted arguments; synthesize the major perspectives regarding the course topic; and, finally, contribute to the on-going academic conversation by researching and analyzing a public health policy of their choosing. Along with acquiring a robust understanding of the course content, students will end the semester with an inventory of strategies for constructing persuasive, authoritative, and reader-friendly prose.

76-221 Books You Should Have Read By Now – Contemporary Classics (9 units)
In this course, students will engage with several notable works of literature published since the turn of the 21st century. As we read, we will consider: what is the role of the “literary canon,” and how does it relate to questions of representation and cultural politics? Why have so many of these texts been earmarked for canonization? In what ways do these diverse texts capture something important about our contemporary moment, and to what extent is it possible to generalize, critically, about the contemporary drift of popular and literary fiction?

Since 2000, the contemporary novel has continued to explore multicultural and transnational identity and experience, probed the roots of discontent with the neoliberalism through historical fictions set during the late 20th century, and confronted new stark realities of technological change and ecological disaster. Contemporary fiction has also seen a flowering of stylistic combinations as several best-sellers have draw on strands of “genre” fiction (e.g. horror and sci-fi) in service of catastrophic visions of dystopia and apocalypse, while others have tendered new experimental forays into the “literary” that blur the lines between fictional narrative and essayistic reflection, personal memoir and literary theory.
Authors read in the course may include: Zadie Smith, Tom McCarthy, Colson Whitehead, Chimamanda Ngozi Adiche, Viet Thanh Nguyen, Junot Diaz, Rachel Kushner, Tao Lin, Richard Powers and Maggie Nelson. 140 minute sessions 3 days/week.

79-104 Global Histories – The Civil Rights Movement and the World (9 units)
Human activity transcends political, geographical, and cultural boundaries. This course provides students with an opportunity to develop the skills and perspectives needed to understand the contemporary world through investigating its global history. The American civil rights movement was a global phenomenon. Throughout the twentieth century, the fight for racial justice involved multiple areas of conflict that transcended national boundaries. The purpose of this course is to understand how global events and crises influenced the ways in which activists understood political power. How did civil rights activists pioneer a global identity for American blacks and create solidarities with oppressed people worldwide, and how did these solidarities in turn influence activism at home? Answering these questions will require us to analyze various ideologies and political movements and their impact on anti-racist activism within the United States. World historical events, and their impact on the civil rights movement, will cover the 1917 Russian Revolution, the rise of Fascist Europe, the Second World War, the United Nations, the Cold War, and today’s struggle for racial justice. By examining these issues, this class will shed light on the dynamic geo-political and socio-economic conditions that shaped the civil rights movement as well as today’s activism. 80-minute daily session.

79-318 Sustainable Social Change: History and Practice (9 units)
If you wanted to change the world, who would you ask for guidance? Mahatma Gandhi, Martin Luther King, Mother Theresa, Rachel Carson, or Nelson Mandela? In this interdisciplinary course, we will examine the history of efforts to create sustainable social change. Through a series of targeted case studies, we will examine the successes and failures of notable leaders, past and present, who strove to address social problems nonviolently and to create lasting improvements in fields such as education, healthcare, and human rights. In keeping with the example of the people we will be studying, we will bring our questions and our findings out of the classroom through a variety of creative, student-driven experiments in sustainable social change. 80-minute sessions 3 days/week. Students enrolled in this class are eligible for an extended program beyond the 6-week APEA summer session connecting students from the course with ongoing student projects, mentoring, advising, and continued association with Carnegie Mellon Faculty and Staff.

80-100 Introduction to Philosophy (9 units)
In this introductory course we will explore three major areas of Philosophy: Ethics, Metaphysics, and Epistemology. Accordingly the course is divided into three sections. In each section we will read primary sources and discuss some of the main philosophic problems associated with that area. These will include: moral problems (Ethics), problems rising from the debates about free-will, personal identity or intelligence (Metaphysics), and inquiries about the scope and limits of human knowledge (Epistemology). We will then introduce some theories designed to solve such problems, and try to understand the strengths and weaknesses of these theories. We will apply different techniques and theories to issues that we might encounter in the real world. We will use class discussions, homeworks and papers to learn skills for evaluating arguments. These skills include: how to present a philosophic argument, what are the assumptions that justify it, what are its weaknesses and its strengths, whether such weaknesses can be resolved and, if they cannot be resolved, why. 80-minute daily session.

80-135 Introduction to Political Philosophy (9 units)
As an introductory course, we will seek to trace out the historical and philosophical dimensions of the polis from its origins in Ancient Greece to its current manifestation in present-day society. Special emphasis will be placed on the concept and practice of “democracy.” We’ll begin with the history of political philosophy from Plato and Aristotle (two of the early critics of democracy) to the modern period and the arguments in support of “republicanism” as found in the Federalist Papers (Madison, Jay, Hamilton). These historical moments cast light on the philosophy behind the development of the US constitution. Following Ketcham, we’ll discuss the debate between the “ancients and moderns,” enlightenment ideas regarding liberty and equality as well as the distinction between private rights and public goods.
After presenting some fundamental justifications for democracy and our current models of democratic governance, we'll study the basic political frameworks of our day through a thorough-going analytic analysis of the writings and arguments of recent and contemporary political philosophers such as John Rawls, Ronald Dworkin, Robert Nozick, Charles Taylor, Michael Sandel, and Annette Baier. The course will end with a discussion of the theory and practice of deliberative democracy and a chance for students to engage in this model of democracy through the activities of an ersatz "deliberative poll." 80-minute daily session.

**80-180 Nature of Language (9 units)**

Language is used to talk about the world or to describe it, but how do we go about describing language itself? Linguistics is the name given to the science of language, whose task it is to give such a description. The discipline of linguistics has developed novel tools for describing and analyzing language over the last two hundred years and in this course we learn what these tools are and practice applying them. Sub-areas of linguistics which we study include phonetics (the study of speech sounds), phonology (the study of sound systems), morphology (the study of parts of words), and syntax (the study of combinations of words). Beyond this, we look at changes in language over time, and we consider the puzzle of linguistic meaning. The methods of linguistics are useful in the study of particular languages and in the study of language generally, so this course is useful for students of foreign languages as well as those interested in going on to study language acquisition, psycholinguistics, sociolinguistics, philosophy of language, and computer modeling of language. 80-minute daily session.

The following language courses have no prerequisites. Additional Modern Language courses are available at the Elementary, Intermediate, and Advanced levels in French, Spanish, Japanese, Arabic, Chinese, and Italian. If interested, contact Veronica Peet (vpeet@andrew.cmu.edu) or Dr. William Alba (alba@cmu.edu).

**82-101 Elementary French I (12 units)**

This course is for students with no prior experience in French. Using a proficiency-oriented approach, students will develop contextually appropriate interpersonal communication skills in both written and spoken French, develop reading and listening skills through the use of various media, understand fundamental grammar, acquire vocabulary, and gain a basic understanding of French and francophone cultures through class activities. Regular homework, quizzes, tests, presentations, and class participation are mandatory (four in-class hours per week). The elementary level is also designed to help students learn to reflect and draw upon strategies used by good language learners in their second language study. A student with prior experience in French must take the placement exam. 80-minute daily session.

**82-119 Arabic Calligraphy Culture & Skills (9 units)**

This course introduces its participants to historical and cultural contexts and various techniques used to produce Arabic calligraphy works. No previous knowledge of the Arabic script or language is necessary. At the end of the course, participants will demonstrate familiarity and comfort with key movements in the history and art of Arabic calligraphy, and read simple alphabet constructions or words in a variety of styles. Participants will apply proper techniques to producing calligraphy in two of the most commonly used styles, Naskh and Riq'ah, as well as experiment with some modern script styles. The class will use lecture discussions, audio-visual media, projects, guest speakers, and field trips as occasions arise. 80-minute daily session.

**82-131 Elementary Chinese I (12 units)**

This course is for students with no prior experience in Chinese. Using a proficiency-oriented approach, students will develop contextually appropriate interpersonal communication skills in both written and spoken Chinese, develop reading and listening skills through various media, understand fundamental grammar, acquire vocabulary, and gain a basic understanding of Chinese cultures through class and extracurricular activities. Regular homework, quizzes, tests, and participation in class are mandatory (four in-class hours per week). Students will learn the phonetic transcriptions of Chinese (Pinyin) for speaking and listening as well as Chinese characters for reading and writing. The elementary level is also designed to help students learn to reflect and draw upon strategies used by good language learners in their second language study. A student with prior experience in Chinese must take the placement exam. 80-minute daily session.
**82-137 Chinese Calligraphy: Culture and Skills (9 units)**
Chinese calligraphy is a crucial part of Chinese culture and world art. It is also a clear manifestation of Chinese philosophy that has influenced Chinese people for several thousand years. This introductory course on Chinese calligraphy provides students with basic knowledge of Chinese calligraphy and how it mirrors Chinese history, culture, and philosophy. It will also introduce the fundamental characteristics of the Chinese writing system, its cultural content, and principles of formation as well as the skills used in Chinese calligraphy. At the end of the course, students will have a good understanding of Chinese characters and their cultural and philosophical background but also be able to appreciate the art and beauty in Chinese calligraphy. Classes include lectures, movies, discussions, hands-on practice, and projects. Field trips and guest speakers may also be arranged if opportunities should arise. 80-minute daily session.

**82-171 Elementary Japanese I (12 units)**
This course is the first part of a two-semester course sequence (82-171, 82-172) for students with no prior experience in Japanese. It emphasizes the development of communicative language proficiency through oral practice, aural comprehension, reading, writing, and the study of cultural aspects of Japanese society. Regular homework, quizzes, tests, presentations, and class participation are mandatory (four in-class hours per week). The elementary level is also designed to help students learn to reflect and draw upon strategies used by good language learners in their second language study. A student with prior experience in Japanese must take the placement exam. 80-minute daily session.

**82-273 Introduction to Japanese Language and Culture (9 units)**
This course is an introduction to modern Japanese. Given the close link between the Japanese language and culture, the examination of the distinctive characteristics of the Japanese language and its sociocultural context provides important insights into contemporary Japan. This course is taught in English and is intended both for individuals who want to gain a better understanding of modern Japanese society, as well as for students of the Japanese language. 80-minute daily session.

**82-279 Anime - Visual Interplay between Japan and the World (9 units)**
In contemporary Japanese culture, anime plays a vital role, unfolding a wide range of stories with its distinct modes of visual representation and complementing to other forms of culture (e.g., literature, film, and art). This course explores Japanese anime’s appeal to the international viewers today, centering around cultural analyses of anime such as the Studio Ghibli production and Cyberpunk. Equally important are to locate the origin of Japanese animation, which is also investigated through the prewar and postwar works of animation in conjunction with related forms such as manga, or comic strips (e.g., Osamu Tezuka’s works that was initially inspired by Disney) and to discuss the potential of anime as an art form. 80-minute daily session.

**The above language courses have no prerequisites.** Additional Modern Language courses are available at the Elementary, Intermediate, and Advanced levels in French, Spanish, Japanese, Arabic, Chinese, and Italian. If interested, contact Veronica Peet (vpeet@andrew.cmu.edu) or Dr. William Alba (alba@cmu.edu).

**85-102 Introduction to Psychology (9 units)**
This course examines major areas of scientific psychology in some depth, the attempt being to develop basic models of our behavior and thought that explain wide areas of our functioning. The primary focus is on the areas of neural and motivational control of behavior, memory and thought, social interaction, and psychological development. Specific topics within these areas include brain function, motivational control systems, learning, cognitive and perceptual information processing, problem solving, obedience and conformity, social interaction, emotion, attitude consistency and change, how our social, cognitive and language functions develop, the importance of childhood to adult functioning, and psychopathology. In addition to the lecture, the course includes a weekly recitation section meeting and weekly short WEB-based laboratory experiences in which students get to perform actual experiments, interpret real data, and experience many psychological phenomena. 80-minute daily session.
**85-241 Social Psychology** (9 units)
The focus of this course will be on how peoples behavior, feelings and thoughts are influenced or determined by their social environment. The course will begin with lectures and readings on how social psychologists go about studying social behavior. Next, various topics on which social psychologists have done research will be covered. These topics will include: person perception, prejudice and discrimination, the nature of attitudes and how attitudes are formed and changed, interpersonal attraction, conformity, compliance, altruism, aggression, group behavior, and applications of psychology to problems in health care, law, politics, and the environment. Through readings and lectures on these topics, students will also be exposed to social psychological theories. 80-minute daily session.

**88-120 Reason, Passion and Cognition** (9 units)
This course will introduce students to major concepts and theories in the social and decision sciences, focusing in particular on how cognition and emotion shape judgment and choice. We will address such questions as: In what ways do emotions influence judgments and choices? What are some common mistakes in judgment and decision making? Can information shape our choices even if we do not consciously recognize the information? Throughout the course, the emphasis will be on understanding: (1) basic theories and research findings of decision science and psychology, and (2) the relevance of research findings to everyday life. 80-minute daily session.

For the most recent updates to this course list and schedule, see: [http://cmu.edu/shs/apea/2019courses.pdf](http://cmu.edu/shs/apea/2019courses.pdf)

**This is a course list is dated 4-8-2019. Updates reflected in course list schedule reflected on page 2:**

**Course Added:**
76-221 Books You Should Have Read By Now: Contemporary Classics MWF 9:00a-11:20a (Updated 4-8-19)

**Course Cancelled:**
79-201 Introduction to Anthropology MTWR 06:00p-07:50p (Updated 4-8-19)
76-246 Introduction to Shakespeare MWF 12:00p-2:20p (Updated 4-8-19)

**Course Time Change:**
06-052E Fundamentals of Chemical Engineering Practice MWF 09:00a-10:20a AND MW 01:00p-02:50p (Updated 3-1-19)
33-141E Physics I for Engineering Students MTWRF 12:30p-02:50p (Updated 3-15-19)
33-142E Physics II for Engineering and Physics Students MTWRF 02:00p-04:20p (Updated 3-15-19)
03-121E Modern Biology MTWRF 09:00a-10:20a (Updated 3-15-19)
03-133 Neurobiology of Disease MTWRF 10:30-11:50 (Updated 4-8-19)

**Course Description Updated:**
76-101 Interpretation and Argument Section E: Smartphones and Society (Updated 3-15-19)
76-101 Interpretation and Argument Section F: Doctor Who?: Social Justice and Public Health (Updated 3-15-19)

If you have questions about scheduling, please contact:

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OR

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Schedule changes may also be discussed upon your arrival on campus. Course changes become official only after discussion with Dr. Alba or Ms. Peet.

After being accepted to the APEA program, you will be enrolled in courses only after you confirm your attendance by submitting required forms and deposits.

APEA students are enrolled in courses after the university processes your enrollment forms and deposit, and after the APEA Program receives your APEA Course Request Form in the Pre-College Portal.

In addition, students seeking to enroll in 15-112 or 15-122 must have their CMU CS placement exams completed and scored.

**Students will be enrolled in courses in the order that the above information is received.**
The APEA Program will contact you if any courses that you requested are filled.

*The university reserves the right to change or cancel class times and/or course offerings without notice.*