Princeton International School of Mathematics and Science

Course Catalog 2019-20

last revised, February 5, 2019

Graduation Requirements

Subject Area	Minimum Credits	Comments
Biology	1	All students must successfully complete at least the Honors level of each core science.
Chemistry	1	
Physics	1	
STEM Electives	3	At least one elective must be a science (Biology, Chemistry, Computer Science, or Physics) at the Advanced (AP) level.
Computer Science	1	One year of Computer Science required
Mathematics	4	All students must successfully complete Calculus. Most students are expected to need four years to accomplish this, but if a student completes Calculus earlier, then that student has extra credits available for additional electives in any area.
English	4	Introduction to Literature and Composition; Foundations of Literature; American Literature; AP English Literature and Composition.
History	2	AP World History (10^{th}); APUSH (11^{th})
Humanities Elective	1	
Applied Engineering	2	Applied Engineering 1 (9^{th} grade); Applied Engineering 2 (10^{th} grade)
World Languages	3	Students for whom English is not their primary language may use English for their World Language credits. For that reason, such students may have three additional credits for electives in any area. It is expected, however, that some of these students may use those extra credits, at least in part, for Study Hall(s) due to the extra time required for them to complete their homework, most of which will be in the English language.
Fine Arts	1	Art or Music
Research	2*	BASE Program (9^{th}); 10^{th} grade Applied Engineering; Research 11 and 12
Physical Education	1	To be taken as part of the After School Physical Education Program

Total: 27 credits (1 credit = 2 semesters, i.e. 0.5 credits per semester)

Lowest Science level = Honors Level.

History: A 2 year sequence followed by 1 credit of a Humanities elective.

Research*: BASE Program required in 9^{th} grade. 10^{th} grade Applied Engineering offers research skills in the form of practical problem-solving: design, build and test. Additional Research skills such as statistics, experimental design, literature review, are now incorporated into required 9^{th} and 10^{th} grade science courses (SY 2016-17 and beyond)

Health & Fitness: Students required to take part in After School Physical Activity, therefore more academic time available in school day.

Typical Four Year Sequence

9th Grade	10th Grade	11th Grade	12th Grade
• English 9: Introduction to Literature and Composition[1] • Biology[1] • Applied Engineering 1[1] • Mathematics[2] • Physics or Chemistry[3] • World Language, Study Hall, or Elective[4] • Elective[5]	• Physics or Chemistry[6] • English 10: Foundations of Literature • Applied Engineering 2[7] • Mathematics • AP World History • AP Science[8] • World Language, Study Hall, or Elective[9]	• STEM Research 1 • Mathematics • English 11: American Literature • AP U.S. History • World Language, Study Hall, or Elective[8] • Elective[10] • Elective	• STEM Research 2 • Mathematics • English 12: AP English Literature and Composition • World Language, Study Hall, or Elective[8] • Elective[10] • Elective

1. These three classes together comprise the BASE Program.

2. The level of Math to be taken this year will be determined by a student's math ability, which will be assessed by a math proficiency test administered by the School. If a student completes AP Calculus BC in fewer than 4 years, the student may choose a post-AP mathematics offering or a non-mathematics elective.

3. All students must select either Chemistry or Physics as a second 9th Grade science. If a student chooses Physics, acceptance into this class will depend on their math ability, which will be assessed from a test administered by the School.

4. All students for whom English is their primary language must take three consecutive years of a world language. That requirement may start in 9th grade or 10th grade. If these students choose to begin world language in 10th grade, then they may choose to take an Elective or Study Hall in 9th Grade. For students whose primary language is not English, literature counts as their world language.

5. Students planning to take AP Computer Science in 10th Grade would need to take Principles of Computer Science in 9th Grade. At some time during the 4 years at PRISMS, all students must use one of their Electives to take Principles of Computer Science.

6. All students must take the third Honors-level science in 10th Grade. Whether it is Chemistry or Physics will depend on which course they took in 9th Grade.

7. This course is intended to further prepare all students for substantive research the following year. It replaces the Applied Engineering/Research Skills course from 2015-16 Academic Year. Applied Engineering 2 offers research skills in the form of practical problem-solving: design, build and test. (Additional Research skills such as statistics, experimental design, literature review, are now incorporated into required 9th and 10th grade science courses). The content of this course will be established by collaboration between the lab directors and Executive Principal (as Director of Academics) to include topics such as the following:

- Electronics (analog and digital)
- Microcontroller Applications and programming
- Spatial Visualization/Awareness
- Design and manufacture
- Mechanics
- Robotics

In other words, this course should provide sophomores with skills that are useful not only in Engineering Research but also in all areas of STEM Research.

8. The options available include: AP Biology, AP Chemistry, AP Computer Science, and AP Physics. It is expected that this course would be a stepping stone to post-AP courses in this field and to Research 1 in this field. This is not automatic, however, and students who take a 10th Grade AP Science in one field may choose to conduct 11th Grade STEM Research 1 in a different field, especially if the research project is interdisciplinary in nature and is supported by the material from the 10th Grade AP Science. In such cases, acceptance into the lab would depend on the permission of lab director.

9. As mentioned in #4, students whose primary language is not English are not required to take a World Language, though they may elect to do so.

10. The Research lab director may require students to use an 11th Grade Elective to take a post-AP science course related to the research projects.

Research & Development Program

A core feature of the PRISMS educational experience is a four-year STEM research and development program threaded through our four-year high school curriculum. Our aim is that students begin by learning research skills in order to better prepare them for meaningful STEM research or development projects in grades 11 and 12. In grade 9 all our freshmen take the Bridging the Arts Science and Engineering (BASE) Program. In grade 10 all students are required to take Applied Engineering 2 which builds on the 9th grade Applied Engineering 1 Program by offering research skills in the form of practical problem-solving: design, build and test. Scientific Research skills that build on the BASE Program, skills such as statistics, experimental design, literature review, are incorporated into required 9th and 10th grade science courses.

Core Research Courses

BASE Program (Grade 9)

BASE (Bridging the Arts Sciences and Engineering) is a required program in 9th grade. The BASE Program consists of three distinct disciplines (biology, literature, and applied engineering) which are taught concurrently so that a cohort of students cycle through the same classes, but each class reserves some time to work on a collaborative research project based in biology. Through collaboration on the research project, scientific concepts, language arts, and engineering innovation are woven together in a way that is realistic and relevant to students in the context of the research project. Thus, students learn research skills in a multi-disciplinary context. Collaboration is stressed to prepare students for increased demands by industry for strong interpersonal skills as well as technical competencies. Each BASE team requires the development of a research project designed and conducted by students in small groups. The BASE Program also serves to settle freshmen into the PRISMS community, help them socialize and gain a sense of identity. The BASE Program counts as the first year of a four-year research program.

Applied Engineering 2 (Grade 10)

Applied Engineering 2 is intended to further prepare all students for substantive research the following year. It replaces the Applied Engineering/Research Skills course from 2015-16 Academic Year. Applied Engineering 2 offers research skills in the form of practical problem-solving: design, build and test. (Additional Research skills such as statistics, experimental design, literature review, are now incorporated into required 9th and 10th grade science courses). The content of Applied Engineering 2 will be established by collaboration between the lab directors and Executive Principal (as Director of Academics) to include topics such as the following:

- Electronics (analog and digital)
- Microcontroller Applications and programming
- Spatial Visualization/Awareness
- Design and manufacture
- Mechanics
- Robotics

This course will provide sophomores with skills that are useful not only in Engineering Research but also in all areas of STEM Research.

Research & Development Labs

In grades 11 and 12 (typically after completing the *BASE program, Honors Chemistry, Honors Physics,* and *10th grade Applied Engineering 2),* students can choose a topic in which to conduct research within one of our STEM Research and Development areas. Typically a student will begin working on a project in the 11th grade and continue it into the 12th grade.

Sciences

Core Science Courses

Honors Biology

Honors level freshman Biology course at PRISMS is an intense introductory course that equips students to think seriously about science. The course focuses on cellular processes found in living organisms (cell cycle, cell structure and function, and metabolism), genetics, molecular biology (DNA replication and protein synthesis), the biological basis of evolution, and ecology. Laboratory work is an integral part of this course. Honors Biology requires strong study skills and an ability to work independently and in small study groups. Research skills covered in Honors Biology will include descriptive statistics, basic principles of experimental design (such as randomization, blocking, etc.), and essential lab notebook skills.

Credits: 1.0
Prerequisites: None

The PRISMS BASE Program bridges a common topic of study between the arts, science and engineering. The BASE Program operates through a required three-period block and integrates the instructional objectives of English 9, focusing on the arts, science, focusing on biology and applied engineering. The BASE Program uses a process-oriented approach to help students establish connections across the disciplines and attain the objectives for each course. Student groups learn to collect and analyze data, conduct literature searches, and prepare publications and presentations through long-term independent scientific research.

Honors Chemistry

The Honors level Chemistry course at PRISMS is a study of the structure, behavior and properties of matter. Topics include: dimensional analysis, significant figures, stoichiometry, solutions, gases, thermochemistry, atomic structure and nuclear chemistry, electronic structure and periodicity, chemical bonding and intermolecular forces, basic chemical kinetics and equilibrium, acid-base chemistry, and electrochemistry. Students are expected to have a strong foundation in algebra. Research skills covered in Honors Chemistry include data analysis and graphing, scientific writing, and more advanced aspects of lab notebook completion.

Credits: 1.0
Prerequisites: None

Honors Physics

Honors Physics is a non-calculus based conceptually and mathematically rigorous first year university preparatory course. The course design requires students to develop a solid background in the conceptual basis of physics, as well as strong critical thinking and problem solving skills. The course is a comprehensive treatment of the topics of mechanics, electricity and magnetism, and waves and oscillations. When time allows, other topics in thermodynamics or modern physics may be treated on an instructor-specific basis. Laboratory-centered, the course exposes students to the methods of scientific inquiry. Research skills developing during the class include: basic experimental design, data collection and analysis, error analysis, peer-review system, graphical representation of data, preparing of a basic scientific report, and oral presentations.

Credits: 1.0
Prerequisites: Sufficient score on the math placement test

Elective Science Courses

AP Biology

This college-level course is recommended for students who intend to major in biological sciences such as biochemistry and/or medicine. AP Biology provides students with the conceptual framework, factual knowledge, and analytical skills necessary to critically handle the rapidly changing science of biology. The emphasis of this laboratory course is to develop an understanding of concepts and of science as a process rather than an accumulation of facts.

Credits: 1.0
Prerequisites: Permission from Department Head and Administrative approval. Students admitted will typically have completed Honors Biology (with a grade of B or better) and have completed Honors Chemistry (with a grade of B or better) or are taking it concurrently.

Molecular Biology and Biotechnology

This is an advanced, lab intensive course in which students apply modern molecular biology techniques to explore aspects of cell biology and biotechnology. Students will perform numerous techniques during the course, including PCR, bacterial transformation, gel electrophoresis, SDS-PAGE, Western Blot, protein purification and chromatography, and RNA purification and quantification. The course uses the lab techniques as a means to develop a student's understanding of molecular processes and not simply to learn a given lab technique.

Credits: 1.0
Prerequisites: AP Biology, or with permission from Department Head and Administrative approval.

Advanced Topics in Molecular Biology

This is a seminar style course where students will explore advanced topics in molecular biology through reading the primary literature as well as creating and carrying out exploratory lab exercises (when applicable). Specific topics to be covered will be determined with student input. Class time will focus on the detailed review of a given paper(s) and class discussions will be led by the students.

Credits: 0.50
Grades: 11, 12
Prerequisites: AP Biology with a grade of B or better.

AP Chemistry

This course is structured around the six big ideas (BI) in the AP Chemistry Curriculum Framework and is designed for students who have completed one-year of high school chemistry and have a strong foundation in math (the College Board recommends that students have successfully completed two years of algebra, e.g., Algebra 1 and Algebra 2). Overall, this course differs from Honors Chemistry in the breadth and depth of topics covered, textbook, emphasis on mathematical relationships and formulation, nature and variety of laboratory coursework, pacing, and time required by the students. It is assumed students have a thorough knowledge of the topics covered in the first year course; these topics are reviewed in-depth in a summer homework assignment and briefly in class so that more time can be spent deepening and extending the students' understanding of chemistry.

Credits: 1.0
Prerequisites: Honors Chemistry (B minimum) and completion or concurrent enrollment in Advanced Algebra.

Organic Chemistry & Biochemistry

An introduction to the principles of organic chemistry and biochemistry, including the relationship between structure, properties, and reactivity of organic compounds including amino acids and carbohydrates.. Examples of organic chemistry in biology, medicine, and industry will be presented for discussion. Typical laboratory techniques for the synthesis, isolation, purification and identification of organic compounds will be taught. Recommended for students with an interest in studying biology or chemistry in college.

Credits: 1.0
Prerequisites: AP Chemistry or with permission from Department Head and Administrative approval

Inorganic & Analytical Chemistry

This course is a year-long intensive post-AP elective in PRISMS with two parts of main contents, inorganic chemistry and analytical chemistry. In the first semester, a comprehensive and contemporary introduction of the diverse and fascinating discipline of inorganic chemistry is provided. It covers advanced atomic structure and bonding theory, acid-base chemistry, crystalline solid state, descriptive chemistry of main group elements, coordination chemistry, and organometallic chemistry, as well as the development and perspective of inorganic research. Examples taken from recent publications and seminar talks presented by students during the semester will be discussed. In the second semester, an introduction to analytical chemistry, including topics such as data handling and analysis, volumetric titrations (acid-base, redox, precipitation, and complex), separation techniques, molecular spectroscopy (including UV-visible spectroscopy, molecular fluorescence, and infrared analysis) as well as sample preparation is covered.

Credits: 1.0
Prerequisites: One year of AP Chemistry or the equivalent, with grades of B+ or better. Students without adequate background may not be able to keep up with the course.

AP Environmental Science

Environmental science is an interdisciplinary science. The goal of the AP Environmental Science course is to provide students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving or preventing them. The AP Environmental Science course will include a strong laboratory and field investigation component. The goal of this component is to complement the classroom portion of the course by allowing students to learn about the environment through firsthand observation. Experiences both in the laboratory and in the field, provide students with important opportunities to test concepts and principles that are introduced in the classroom, explore specific problems with a depth not easily achieved otherwise, and gain an awareness of the importance of confounding variables that exist in the "real world".

Credits: 1.0
Prerequisites: Honors Biology (B minimum) and Honors Chemistry (B minimum)

AP Physics C

Students study a mathematically substantial formulation of Newtonian mechanics (first semester) and electricity and magnetism (second semester), including vector and calculus-based treatment of particle kinematics (motion), energy, linear momentum, angular momentum, systems of particles, oscillators, and Newtonian gravity in the first semester. Topics covered in the second semester include electromagnetic fields, superposition, electrostatics, magnetostatics, induction, electric currents and elementary circuits, Maxwell's equations in integral form and the Lorentz force law. Students are thoroughly prepared to take both the Mechanics and Electricity and Magnetism sections of the Advanced Placement Physics C examination.

Credits: 1.0
Prerequisites: Honors Physics or with permission from Department Head and Administrative approval. AP Calculus is strongly recommended but can be taken concurrently.

Introduction to Optics

In this course, the students will conduct a series of laboratories, each to cover a 2 week period, that will immerse the students in traditional and novel methods in optics and opto-electronics technology.

The areas of optics to cover include:

A. Imaging - First Order Optics
B. Aberrations - Optical Lens Design Fundamentals
C. Interferometry - Optical Testing
D. Holography - Optical Linear Systems
E. Waveguides - Optical Fibers
F. Memory - Optical Disks and Chips
G. Lasers - Optical Resonators
H. Parametric Generators, Nonlinear Optics

Credits: 0.5
Prerequisites: Honors Physics
(Offered in Fall 2019)

Quantum Mechanics

The course covers fundamental concepts of quantum mechanics. Beginning with a classical description of electromagnetic theory, the course introduces quantum mechanical concepts by way of the key experiments whose results could no longer be explained by the classical theory. Such experiments include the Photoelectric effect, electron diffraction, and the which-way interferometer. After introducing the QM concepts, the mathematical framework of QM is developed using the Schrödinger equation and a progressively more accurate and complex model of the potential energy function, beginning with a 1-D cartesian coordinate system and a square well potential, and evolving to a 3-D spherical coordinate system with a Coulomb potential energy function. In addition, the course covers other QM concepts such as the Heisenberg uncertainty principle, wave functions, quantum states, operators, measurements, spin, entanglement, and tunneling. A connection between theoretical, experimental and computational physics will be emphasized.

Credits: 1.0
Prerequisites: Calculus BC and AP Physics C (minimum grade of B)

Data Science I

Data Science I is designed to teach students how to analyze data using the R language, as well as how to present results from data analysis. In the modern world, data are coming from different sources and in different formats: sensors, surveys, databases, or downloaded from the internet. Often these data will have a "messy" structure or will be missing values, and thus present a unique challenge to data analysis. Students will learn how to access data from various sources and to reshape, organize and clean it. Basic statistical information and plots will be employed for initial exploratory analysis. We shall also cover techniques for creation of highly customized, professionally looking data plots. Students will learn how to create interactive plots and interactive web applications (using R Shiny) and how to present data visually to a wide audience. Linear models will be used to perform a basic modeling. This class involves a lot of coding and practical exercises in R.

Credits: 0.5
Prerequisites: Advanced Algebra with a grade of B- or better.

Data Science II

Data Science II will cover selected topics of machine learning. When data are cleaned and properly analyzed (topics covered in Data Science I), it is possible to create a "prediction" model to perform such tasks as the prediction of a projected salary, classifying emails to spam or ham, find "clusters" of friends on Facebook, or detect a fraud transaction on a credit card. Students will obtain skills in doing regression, classification, clustering and anomaly detection. The following algorithms will be covered: k-nearest neighborhoods, linear model, logistic regression, LDA, QDA, polynomial regression, splines, GAMs, tree-based methods, SVM. The coverage will include resampling methods, regularization, principal components, and text mining.

Credits: 0.5
Prerequisites: Advanced Algebra (with a minimum grade of B-) and Data Science I (with a minimum grade of B).

Applied Engineering & Computer Science

Our Foundational Program is known as BASE (Bridging the Arts, Science and Engineering). Our aim is to give all our freshman a common experience where they not only learn important foundational content in Biology, Literature, and Applied Engineering, but they also learn about the multi-disciplinary nature of research, collaboration, cooperation and are introduced to important research skills like: Forming a valid question, reviewing and evaluating research literature, designing an experiment, analyzing data, communicating research or development findings.

Core Engineering Courses

Applied Engineering 1

Applied Engineering 1 (AE1) introduces students to the technical application of engineering disciplines through the use of the engineering design process and a highly technical laboratory environment. This course serves as the cornerstone of the PRISMS Engineering program as it engages students in the physical application of complex theoretical topics including basic electronics, engineering design, prototyping, robotics and engineering research. In addition, AE1 is an integral part to the PRISMS BASE program, which bridges a common topic of study between the Arts, Science and Engineering. Within the BASE program, AE1 students will work in teams to research, design, construct and test a sensing device to support a scientific study.

Credits: 1.0
Prerequisites: None.

Applied Engineering 2

Applied Engineering (AE2) continues engineering based exploration through a series of problem based labs that focus on 3 core engineering disciplines: Aerospace, Electrical & Mechanical. Throughout the year, students will work in both classroom and laboratory settings to study circuit design, microcontroller programming, data acquisition, prototyping, and robotics. In Addition, students will conduct a cumulative research project to demonstrate their newfound skills. This project will be based on topics pertaining to one of the engineering disciplines mentioned and will be featured in an exhibition at the end of course.

Credits: 1.0
Prerequisites: Applied Engineering 1

Elective Engineering Courses

Advanced Robotics

Advanced Robotics is a problem-based course that explores methods in which higher level spatial awareness and control algorithms are applied to complex robotic systems. Within the course, students will learn about closed loop systems, sensing and navigation, multi-method locomotion, kinematic design and analysis, wireless control methods and data integrity, industry-standard solid modeling software, 8-bit and 32-bit mobile computing platforms, programming and manufacturing. These concepts will then be applied through the implementation of the Engineering Design Process to the design and construction of multiple robotic systems.

Grades: 11, 12
Credits: 0.5
Prerequisites: Applied Engineering 2

Industrial Design

Industrial Design bridges the gap between Computer Aided Design and Prototype Manufacturing. Throughout the course, students will solve technical problems by combining human factors with the Engineering Design Process to produce creative and unique solutions. Students will investigate multiple materials and processes through the use of sketching techniques, industry standard solid modeling software, "blueprint" layout, CNC machining, woodworking, metalworking, plastic forming, screen printing and multi-material 3D printing. The course will conclude with the production of a technical portfolio detailing the Design Process of each design.

Grades: 11, 12
Credits: 0.5
Prerequisites: Applied Engineering 2

Core Computer Science Course

Principles of Computer Science

This entry-level course prepares students with essential knowledge and skills in computer science. It is designed to cover basic concepts of computer science, information flow, World Wide Web, several programming languages and robots, and ethics of using technologies. Students will develop computational thinking skills vital for success across all disciplines. Students are encouraged to apply creative processes when developing computational artifacts and to think creatively while using computer software and other technology to explore questions that interest them. They will also develop effective communication and collaboration skills, working individually and collaboratively to solve problems, and discussing and writing about the importance of these problems and the impacts to their community, society, and the world.

Credits: 1.0
Prerequisites: None

Elective Computer Science Courses

AP Computer Science A

The purpose of this course is to prepare students for the Advanced Placement Computer Science A examination, for which college credit and/or placement may be given, if a qualifying score is achieved. Content of this college-level course corresponds to the syllabus of the College Board Advanced Placement Program for Computer Science A. Students will design software to solve problems iteratively or recursively, and use data structures, such as arrays, lists, stacks, and queues, to represent information within a program. Students will also gain a working knowledge of the major hardware and software components of computer systems. Java is the main vehicle for implementing solutions to problems. All students are required to take the Advanced Placement exam.

Credits: 1.0
Prerequisites: Principles of Computer Science or by permission of instructor with Head of Department and Administrative approval

Artificial Intelligence

Students study Artificial Intelligence (AI) topics in a variety of contexts with an emphasis on understanding the status of this field, hands-on experiments, and its current and future impact. Activities include studying the evolution of AI, practicing the common approaches, comparing different approaches for knowledge representation, examining search-select algorithms, following the major players and their main projects, investigating the acceptable predictions, considering the relationships with other disciplines, and discussing the impact to the future of our society. Programming and research assignment examples: Calculus problem solver, self-guided EV3 rover, smart Alice actors, learning process in Virtual Reality, AI methods comparison, and human-machine interaction with NAO robot.

Credits: 1.0
Prerequisites: AP Computer Science A

Mathematics

Core Mathematics Courses

Foundations of Mathematical Thinking (FMT)

This original, newly designed course at PRISMS is created to give freshmen the broadest overview of mathematics. It offers students strong core knowledge of mathematics, as it explores connections between different mathematical disciplines. This course involves the study of the techniques and language of mathematics that are essential for students to comprehend and solve real world situations. FMT encompasses numerous mathematics fields, merging the traditional Algebra 1 and Geometry courses into one, and is taught at a faster pace and in more detail than a standard freshman (9^{th} grade) mathematics course. The FMT course is open to students who are starting their first year in PRISMS.

Credits: 1.0
Prerequisites: None

Advanced Algebra

Advanced Algebra is the second course in PRISMS sequence. Having covered the foundational algebra topics in FMT course, students are now able to move on to a more rigorous study of algebra. This course emphasizes the thorough study of functions, focusing on function properties, behavior, graphs and applications. Advanced Algebra also covers polynomials, including operations on polynomials, factoring and solving for roots. Combinatorics is introduced by Pascal's triangle and the explicit and recursive formulas for sequences are studied. Emphasis is placed on nurturing analytical and problem-solving skills and students are encouraged throughout the course to think independently.

Credits: 1.0
Prerequisites: Foundations of Mathematical Thinking.

Pre-Calculus

Pre-Calculus builds upon the knowledge of functions and problems solving techniques introduced in Advanced Algebra, and prepares the student for the challenges of Calculus. The course begins with a study of functions from a Calculus perspective. We explore such topics as continuity, end behavior, extrema, and average rates of change. We then partake in a thorough study of trigonometry, including definitions, laws, proofs, graphs, and applications to triangles and the unit circle. As an extension, we investigate the polar coordinate system, conic sections, vectors, and complex numbers. Additionally, we investigate matrices and their applications, as well as an introduction to the basic calculus concepts of derivatives and integrals.

Credits: 1.0
Prerequisites: Advanced Algebra

AP Calculus AB

This course is a standard Calculus course. An initial study of functions and limits leads to the study of the derivative and differentiation techniques. The relationship between a function and its derivative is carefully developed. Applications of the derivative include local and absolute extreme values. The concepts of the antiderivative and slope fields are introduced. The concept of the integral is formally defined and elementary techniques of integration are studied. The Fundamental Theorem of Calculus is explored and applied. The applications of definite integrals are studied, including finding volumes, and average values of functions.

Credits: 1.0
Prerequisites: Pre-Calculus

AP Calculus BC

This is a standard, college level calculus course, in which we will convey the excitement of the new concepts one can learn from this branch of mathematics. In this course, students study functions, limits, derivatives, integrals, and infinite series. Calculus helps scientists, engineers, and financial analysts understand the complex relationships behind real-world phenomena. Students in this course learn to evaluate the effectiveness of proposed solutions and apply mathematical reasoning to real-world models. Students also learn to understand change geometrically and visually (by studying graphs of curves), analytically (by studying and working with calculus formulas), numerically (by seeing pattern and convergence property of series), and verbally. By learning this course, students can prepare for the AP Calculus BC Exam and further studies in mathematics, science, and engineering.

Credits: 1.0
Prerequisites: Pre-Calculus, or with permission from Department Head and Administrative approval

Elective Mathematics Courses

AP Statistics

AP Statistics involves the study of four main areas: 1. Exploring Data: Describing patterns and departures from patterns; 2. Sampling and Experimentation: Planning and conducting a study; 3. Anticipating Patterns: Exploring random phenomena using probability and simulation; 4. Statistical Inference: Estimating population parameters and testing hypotheses. This AP Statistics course is taught as an activity-based course in which students actively construct their own understanding of the concepts and techniques of statistics.

Credits: 1.0
Prerequisites: AP calculus, or with permission from Department Head and Administrative approval

Linear Algebra

This college-level course will introduce the matrix theory and basic knowledge of linear algebra, including the study of systems of linear equations, Gaussian elimination, the basic knowledge of vector spaces, linear dependence, linear transformations and matrix representation, the study of matrices, orthogonal reduction, determinants, eigenvectors and eigenvalues, and a variety of applications.

Credits: 1.0
Prerequisites: AP Calculus

Humanities and World Languages

Core Humanities Courses

English 9: Introduction to Literature and Composition (Integrated with BASE: Bridging the Arts, Science and Applied Engineering)

The first–year required English course exposes students to various forms of literature that encourage them to make discoveries about themselves and the world around them. Students read and analyze a variety of literary works and explore the characteristics of different forms and techniques authors use. Through studying models of different writing genres, students sharpen their writing skills by producing their own analytic, creative, and scientific writings. Additionally, students apply their understanding of grammar, mechanics and usage, sentence structure, and paragraphing to varied and frequent writing assignments. Through analytical writing, students build on their understanding of writing as a process of prewriting, drafting, and revising. In the research process, students find, evaluate, and select appropriate sources to access information to create a research paper. They also develop communication skills through listening to and practicing oral presentations.

Introduction to Literature and Composition is integral to The BASE Program, which bridges a common topic of study among the arts, science and engineering. The BASE Program uses a process–oriented approach to help students establish connections across the disciplines. Student groups learn to collect and analyze data, conduct literature searches, and prepare publications and presentations through long-term independent scientific research. A separate grade is awarded for the BASE Program.

Grade level: 9
Credits: 1.0
Requirement for graduation: Yes

English 10: Foundations of Literature

During the second year of English, students study literary masterpieces in poetry and prose and investigate how authors express and articulate the human condition. The texts featured in the course come from the Ancient and Classical periods through the early Renaissance (ca. 2500 B.C.E.–1600 C.E.) though additional texts may also include modern resonances. Students practice writing in various modes, both creative and critical, that connect form to meaning and lay a foundation for the practice of clear, effective written expression. Additionally, in anticipation of English 11 and English 12, the AP course, students build their knowledge of literary terms as they develop their ability to speak meaningfully and effectively about literary texts.

Grade level: 10
Credits: 1.0
Requirement for graduation: Yes

English 11: American Literature

In the third year of required English, American Literature introduces students to a variety of texts from major literary movements and historical periods such as Colonial literature, American Romanticism, Transcendentalism, Realism, Naturalism, Modernism, and contemporary literature. Through writing and class discussions, the students practice close textual analysis that deepens their skills in the interpretation of literary techniques and rhetorical strategies. Where possible, this course integrates by content, theme, and through projects and assignments with AP US History.

Grade level: 11
Credits: 1.0
Requirement for graduation: Yes

English 12: AP Literature and Composition

"The AP English Literature and Composition course aligns to an introductory college–level literary analysis course. The course engages students in the close reading and critical analysis of imaginative literature to deepen their understanding of the ways writers use language to provide both meaning and pleasure. As they read, students consider a work's structure, style, and themes, as well as its use of figurative language, imagery, symbolism, and tone. Writing assignments include expository, analytical, and argumentative essays that require students to analyze and interpret literary works." (From The College Board) The course prepares students for the AP Literature and Composition examination.

Grade level: 12
Credits: 1.0
Requirement for graduation: Yes

AP World History

"The AP World History course focuses on developing students' understanding of world history from approximately 8000 B.C.E. to the present. The course has students investigate the content of world history for significant events, individuals, developments, and processes in six historical periods, and develop and use the same thinking skills and methods (analyzing primary and secondary sources, making historical comparisons, chronological reasoning, and argumentation) employed by historians when they study the past. The course also provides five themes (interaction between humans and the environment; development and interaction of cultures; state building, expansion, and conflict; creation, expansion, and interaction of economic systems; and development and transformation of social structures) that students explore throughout the course in order to make connections among historical developments in different times and places encompassing the five major geographical regions of the globe: Africa, the Americas, Asia, Europe, and Oceania." (From The College Board) The course prepares students for the AP World History examination.

Grade level: 10
Credits: 1.0
Requirement for graduation: Yes

AP United States History

"AP U.S. History is designed to be the equivalent of a two-semester introductory college or university U.S. history course. In AP U.S. History students investigate significant events, individuals, developments, and processes in nine historical periods from approximately 1491 to the present. Students develop and use the same skills, practices, and methods employed by historians: analyzing primary and secondary sources; developing historical arguments; making historical comparisons; and utilizing reasoning about contextualization, causation, and continuity and change over time. The course also provides seven themes that students explore throughout the course in order to make connections among historical developments in different times and places: American and national identity; migration and settlement; politics and power; work, exchange, and technology; America in the world; geography and the environment; and culture and society." (From The College Board) The course prepares students for the AP United States History Examination.

Grade level: 11
Credits: 1.0
Requirement for graduation: Yes

Humanities Elective Courses

Note: One year of humanities is required for graduation.

AP Comparative Government and Politics

"The AP course in Comparative Government and Politics introduces students to fundamental concepts used by political scientists to study the processes and outcomes of politics in a variety of country settings. The course aims to illustrate the rich diversity of political life, to show available institutional alternatives, to explain differences in processes and policy outcomes, and to communicate to students the importance of global political and economic changes. Comparison assists both in identifying problems and in analyzing policymaking. Six countries form the core of the AP Comparative Government and Politics course: China, Great Britain, Iran, Mexico, Nigeria, and Russia." (From The College Board) The course prepares students for the AP Comparative Government and Politics examination.

Grade levels: 10, 11, 12
Credits: 0.5
(Offered in Spring 2020)

AP United States Government and Politics

“AP United States Government and Politics introduces students to key political ideas, institutions, policies, interactions, roles, and behaviors that characterize the political culture of the United States. The course examines politically significant concepts and themes, through which students learn to apply disciplinary reasoning assess causes and consequences of political events, and interpret data to develop evidence-based arguments.” (From The College Board) The course prepares students for the AP United States Government and Politics examination.

Grade level: 10, 11, 12
Credits: 0.5
(Offered in Fall 2019)

Chinese Culture & History

The People's Republic of China is the world's most populous state as well as the second largest state by land area. Geographically diverse, China's landscape contains deserts, tropical forests, vast mountain ranges, and mighty rivers. The Chinese people have adapted to any environment, from the Tibetan Plateau, one of the least habitable environments, to Shanghai, Chengdu, and Beijing, among the most densely populated and technologically advanced cities in the world. Known as "the cradle of civilization," China is one of the world's oldest cultures and has impacted the world in countless ways through its language, philosophies, politics, and art. This course will explore the scope of the Chinese society and culture through its history, geography, philosophy and religion, literature and the arts, science, technology, agriculture, medicine, economy and politics, role in world events, ethnicities and cultures, and the role of gender and the family. Students in the course will be encouraged to compare cultures in the pursuit of deepened understanding of our world's diversity.

Grade Level: 9, 10, 11, 12
Credits: 0.5
(Offered in Spring 2020)

World Languages

Note: Languages at PRISMS are taught at three levels: first–year, second–year, and advanced, wherein students beyond the second–year are grouped in one class. Regarding Advanced Placement instruction: teachers prepare students interested in taking the AP examination by integrating their AP preparation into the classwork of the advanced level courses. International students are exempt from the language requirement. American students are required to take three years of a language as a requirement for graduation.

Mandarin Chinese

The Mandarin Chinese program instructs students in mastering the five goals of the American Council on the Teaching of Foreign Languages of communication, cultures, connections, comparisons, and communities in their listening, speaking, reading and writing at each level of Mandarin study. Students will learn how to communicate effectively through vocabulary acquisition and usage, as well as apply proper diction when speaking to different audiences and in different situations. Students will also gain knowledge and deepen their understanding of the variety of Chinese cultures. Students will connect the language learning with other subjects' content by learning through topics and themes, and start to develop their trans-lingual and transcultural awareness. By studying comparisons and contrasts within the language, students develop insight into the nature of the language and culture and learn the power of multiple perspectives. Together, these elements will enable students to participate in multilingual communities at home, in their communities, and throughout the world in a variety of contexts and in culturally appropriate ways.

Credits: 1.0
Prerequisites: Level will depend on language competency as determined by the instructor and Head of Department

French

Students will develop the four skills in mastering the language—listening, speaking, reading, and writing—through a communicative approach, which encourages oral participation by each student. In doing so, students focus on correct pronunciation of French words and sentences. In time, students will be able to create lengthy, coherent paragraphs and dialogues by applying increasingly advanced vocabulary and grammar. French classes will also include lessons in and projects on French culture.

Credits: 1.0
Prerequisites: Level will depend on language competency as determined by the instructor and Head of Department

Spanish

In their Spanish courses, students acquire an understanding of both the Spanish language and culture. The main objective of the Spanish curriculum is to create a solid foundation from level I through Advanced and onto the Advanced Placement level when recommended. To accomplish this objective, students at every level are exposed to and participate in using the language's various means of communication including speaking, listening, reading, and writing. Students augment their understanding of the language by doing projects that help them explore the diverse Latin cultures, as well as find their own individual identities as citizens of the world.

Credits: 1.0
Prerequisites: Level will depend on language competency as determined by the instructor and Head of Department

Music and Art

Art 1

In Art 1, students will work to master the basic techniques, tools, and ways of thinking about and seeing art. While Art is strongly rooted in basic techniques and fundamentals, we will also include innovative elements, such as a rotating schedule of visiting artists from a variety of artistic backgrounds, as well as studio, gallery or museum visits to New York City. The classroom is intended to be a laboratory of creative inspiration. The class will include traditional as well as non-traditional and unconventional approaches to art. So that each students can develop his or her style, the class will offer wide variation in creative assignments, according to students' needs and interests; students will also learn through direct demonstrations, slide/PowerPoint presentations, group and individual critiques, and reading and discussing artistic/aesthetic/theoretic readings and art articles.
Through Art 1, students will learn the basic elements and principles of drawing/painting, understand the basic principles of linear perspective, develop an understanding of contour drawing, depth, value and form of two-dimensional surfaces, demonstrate a basic understanding of chiaroscuro, develop the ability to effectively communicate about drawing/painting ideas and processes, and learn the fundamentals of art history.

Credits: 0.5
Prerequisites: None

Art 2

The advanced course will build on the knowledge and skills students learn in Art 1, while also engaging more fully in project-based learning and self-directed study. Each student will conceive of, research, propose and execute a major project, to be displayed in a school-wide exhibition at the end of the year. Students will choose and execute the subject, medium, style, and other aspects of the project, under the guidance of the instructor. In Art 1, students will further develop knowledge and skills gained from the Basic Visual Arts course, develop the ability to express via digital imagery knowledge of an important idea or theme by creating a short video for school-wide presentation, further develop teamwork and collaboration skills by participating in a group project, further develop analytic thinking and the creative process through researching the life and work of a professional artist, further develop research, analytic, art history and studio skills by conceiving of, researching, and creating an independent project on a subject that reflects PRISMS' core curriculum.

Credits: 0.5
Prerequisites: Art 1

AP Visual Arts Studio

The AP Visual Arts Studio course will be a year-long class offered to students who are seriously interested in the practical application of art. Students will work with diverse media, styles, subjects, and content. Students will be evaluated on the year-long portfolio, submitted at the end of the year. The course consists of three possible portfolios: Two-Dimensional Design, Three-Dimensional Design, or Drawing, corresponding to the most common college foundation courses. Students' work will be informed and guided by observation, research, experimentation, discussion, critical analysis, and reflection, relating individual practices to the art world. Students will be asked to document their artistic ideas and practices to demonstrate conceptual and technical development over time. AP Studio Visual Art will support students in becoming inventive artistic scholars who contribute to visual culture through art making.

Credits: 1.0
Prerequisites: Art 1 and Art 2

Music Theory

Music is a living language, and in this class we will cover the basics of musical notation and literacy. Topics covered will include pitch, rhythm, scales, modes, time signatures, intervals, chords, harmony, and tonality. Our approach will be both practical and theoretical; we will first learn conceptual topics, and then put them into practice through basic performance and composition. For example our study of scales and chord progressions will be reinforced by practice at the keyboard. Additionally, we will integrate a variety of topics by composing short phrases, melodies, and songs. Our goal is to become more literate and sensitive musicians.

Credits: 0.5
Prerequisites: Evaluation by Instructor

Introduction to Musical Composition

Everyone has the potential to be musically creative, and this class is designed to help students discover and nurture their own musical creativity. In this class, we will engage in a variety of diverse musical activities and games that cultivate our ability to improvise. Together we will also explore more formal methods for creating original music. Students will also learn music software that will enable the creation of musical scores. Ultimately, students will be required to write a series of short musical compositions that will be shared in class electronically or through live performance. In order to enroll in the class, students must demonstrate a basic level of musical literacy and proficiency, as determined by the instructor.

Credits: 0.5
Prerequisites: Evaluation by Instructor.

Physical Exercise Requirement

In line with our belief that a healthy body promotes a healthy mind, all boarding students are required to take part in our after school Physical Activity Program from 4:15 – 5:00 each afternoon (Monday - Friday). Day students are also required to participate if they remain on-site after the end of the academic day. After school activities include: P.E., basketball, soccer, running, cycling, tennis and table tennis, frisbee, etc.