Exploring S.T.E.M. at St. Paul

Opportunities in <u>Science</u> (3 credits required, 8.5 credits offered)

Biology, 1 credit, offered at three academic levels, required of all 9th grade students

Biology is a comprehensive course that provides in-depth knowledge of biological theory and the critical thinking and reasoning skills that will be the foundation for further study, but paced to give students a greater opportunity to master topics introduced in class and increase their knowledge of the content. All major concepts of biology will surround the concept of homeostasis and using the scientific method to answer the many questions about life. The topics covered in this course include ecology, cells, heredity, DNA, photosynthesis, cellular respiration, adaptation, evolution and current topics in life sciences. Laboratory work will be a part of the learning experience.

Chemistry, 1 credit elective, offered at two academic levels, grades 10, 11, 12

Chemistry is the science of the composition, structure, properties, and reactions of matter, especially of atomic and molecular systems. The nature, composition and structure of atomic particles, atoms and molecules, and their interaction with each other during chemical reactions are examined in a logical, scientific, progressive study. Laboratory work is an important aspect of the course allowing students to apply and test chemical principles through the scientific method of discovery.

Physics, 1 credit elective, offered at two academic levels, grade 12

Physics covers such topics as mechanics, conservation laws, wave theory, thermodynamics, electricity, magnetism, optics, nuclear physics, and relativity. Problem-solving techniques are stressed rigorously and made an integral part of the course. Laboratory experiments follow and corroborate classroom topics. Students interested in a career in mathematics, science, or engineering and those interested in an extension of their scientific background should select this course. Students are expected to bring a scientific calculator to class daily.

UConn ECE Physics, 1 credit elective, grade 12

This course will be offered as part of the University of Connecticut's *Early College Experience* Program (ECE) and is the equivalent to PHYS 1201Q: General Physics I and PHYS 1202Q: General Physics II. UConn Physics covers mechanics, conservation laws, wave theory, thermodynamics, hydrodynamics, electricity, magnetism, electronics, optics, nuclear physics, and relativity. Problem-solving techniques are stressed rigorously and made an integral part of the course. Laboratory experiments follow classroom topics. Lab reports require organizational skills and analytical thinking. This course is more demanding than Honors Physics in terms of depth of study, pacing, difficulty of problems, and math aptitude required. Students are expected to bring a scientific calculator to class. Students who qualify may earn eight UConn credits. To satisfy the lab requirements of a college-level lab science, students in UConn Physics are required to spend significant time (at least two hours per week) beyond the scheduled class time working in the Physics Lab.

Human Anatomy & Physiology, 1 credit elective, offered at two academic levels, grades 11 and 12
Human Anatomy and Physiology is an advanced life science course designed for college-bound students with a sincere interest in the medical and health sciences. The course will include a comprehensive study of the structures and functions of the human body at both the microscopic and gross anatomical levels. A prior understanding of basic biology and chemistry is required. Laboratory work will play an integral role in the learning experience, with a strong emphasis on the dissection of fresh and preserved specimens of organs from representative animals.

Introduction to Genetics, 0.5 credit elective, grades 10, 11, 12
Introduction to Genetics is designed to cover the basics of classical and molecular genetics. It presents an integrated approach to the study of genes (genotypes) and how mutations (alterations) can have profound effects on cells and proteins (phenotypes). This course will also include investigations into human diseases from a genetic/molecular view.

Honors Introduction to Organic Chemistry, 0.5 credit elective, grades 11 and 12
Honors Introduction to Organic Chemistry focuses on the "chemistry" of covalently bonded carbon-chain compounds. The course begins with an overview of aliphatic and aromatic hydrocarbons – structure and naming, isomerism, unique reactions, and common use and application. Additionally, the chemistry of plastics, petroleum, drugs, fertilizer, and food additives are common topics further pursued. Potentially, his course could be a useful "leg-up" to anyone considering the petrochemical industry; medical, pharmaceutical, or health field; environmental or forensics careers.

Honors Introduction to Biochemistry, 0.5 credit elective, grades 11 and 12
Honors Introduction to Biochemistry focuses on the specific organic chemistry of living things. It examines the chemistry of the major food groups; hormones and enzymes; digestion and synthesis; glycolysis, protein synthesis and the process of biological energy production, use and storage. This course starts with a rapid review of the fundamental nature and structure of covalent carbon-chain molecules, recognizable organic groups and their reaction, and then shows that these same principles apply to larger, more complex biological chemicals and systems. This course could be an excellent complement to many advanced Biology courses and a useful topics introduction for anyone considering the medical, pharmaceutical or health fields.

Environmental Studies, 0.5 credit elective, grades 10, 11 and 12
Environmental Studies will provide students with 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 and/or preventing them. The current popularity of concern over climate, energy consumption, alternative energy sources, and global issues will be discussed.

Comparative Animal Biology, 0.5 credit elective, grades 10, 11 and 12
Comparative Animal Biology is a course in which various activities and dissections will be performed to gain a better understanding of the evolution, characteristics, structures and functions of animals. Students will learn how the events involved in the formation of earth and time periods played an integral role in the development of animals. Examination of cladograms, dichotomous keys, and animal body systems are also an integral part of the course.

Forensic Science, 0.5 credit/1 credit electives, grades 11 and 12
Forensic Science I introduces topics based on specific types of evidence and the techniques used to collect and analyze the evidence. As students progress through the course, they will apply these techniques to other areas of study. The topics covered in this course include crime scene investigation, eyewitness testimony, the collection, handling, and examination of trace evidence, blood spatter examination, DNA, and handwriting analysis. Analysis of current and past cases are also included in this course. Forensic Science II will continue to explain the scientific techniques used in forensics, but it will broach topics that were not introduced in Forensics I such as determining *post mortem* interval, impressions, forensic entomology, ballistics, forensic anthropology, glass analysis and other higher-level topics and cases involving forensic science. Students will also solve simulated crime scenes and will have to learn the roles of different types of forensic investigators in order to gather their evidence and present their findings to the class.

Opportunities in Technology (1 credit required, 3.5 credits available)

Digital Literacy, 0.5 credit, required for all new students
This course will address the key issues of internet safety, privacy and security, reliability of online sources, cyberbullying, information literacy, online communication and self-identity, digital footprint and reputation, and intellectual property in the digital age. Students will develop and apply advanced skills in word processing, spreadsheets, and presentations. Students will gain a working knowledge of Microsoft Word, Excel, and PowerPoint. In addition, this course will introduce students to web applications provided through Google Apps. At the end of this course, students will know how to harness the power of technology safely, responsibly and effectively to enhance their own learning experience and productivity.

Introduction to Coding, 0.5 credit, required for all students not choosing HTML/Java Programming or Computer-Aided Design I)
This course is intended as a beginner course for students being introduced to foundational principles of computer programming for the first time. Block programming including exposure to the Alice, Scratch and SWIFT program languages will be introduced.

HTML/JAVA Programming, 1 credit elective, available all four years
First-year programming students will learn object-oriented programming concepts using the Java programming language. They will apply these concepts to the development of static and dynamic Web pages, Web services, and other client- and server-side applications. Upon completion of this course, students will have a working knowledge of technical vocabulary and common language constructs. Languages that will be covered include Java, HTML, CSS, and Java Script.

Honors iPad Action Game Programming, 0.5 credit elective, grades 10, 11, 12
Millions of people enjoy playing games on-the-go using their mobile iOS devices. This course will allow students to create their own action-packed games for the iPad. Students will learn the fundamentals of using Utility iOS, Wings3D and SWIFT while also learning valuable programming and game design skills in the process.

AP Computer Science A, 1 credit elective, grades 11 and 12
AP Computer Science A emphasizes object-oriented programming methodology with a concentration on problem solving and algorithm development and is meant to be the equivalent of a first-semester college-level course in Computer Science. It also includes the study of data structures, design, and abstraction.

Opportunities in <u>E</u>ngineering & Robotics (4 elective credits available)

Computer-Aided Design I (CAD), 1 credit elective, all grades
Computer-Aided Design I introduces the student to a technological means of generating mechanical engineering and architectural designs through automation. The class will participate in guided discussions and hands-on projects using *Turbo Cad* software to design various elements. Students will learn traditional drafting techniques to create floor plans of residential homes. Furthermore, students will draw, design, and construct useful products, and they will determine schedules for cost specifications. Other software applications used in this design class are *Incredible Machine* and *Chief Architect*.

Computer-Aided Design II (CAD), 1 credit elective, grades 10, 11, 12
Computer-Aided Design II is the advanced level of computer design. The course concentrates on the use of *Turbo Cad* and other software to design and create mechanical products and architecture. The course will incorporate electronic software to design and create simple circuitry. Advanced drafting techniques will involve hand drawings of front elevations, mechanical drawings, and wall sections. The emphasis of the class will be on three-dimensional design and multi-view drawing.

Computer-Aided Design III (CAD), 1 credit elective, grades 11 and 12
Independent CAD provides for individualized learning under the guidance of an instructor. Application of advanced CAD techniques are applied to projects related to an area of specialization or field of choice such as mechanical engineering and structural or architectural design. It allows a student to pursue a special concentration in engineering or design. Projects are assembly-based and a portfolio is required for year-end assessment.

Architecture, 0.5 credit elective, grades 10, 11 and 12
Architecture is designed to build a foundation into residential design and construction. Students will be introduced to many facets of construction and floor planning as well as interior design. Students will use a CAD system to design floor plans and elevations. They will also construct a scaled 3-dimensional model of a house. Upon completion of the class, the expectation will be for them to have produced a near full set of plans that could be used to build a house.

Robotics, 0.5 credit elective, grades 10, 11, 12
This class is a hands-on, learn-by-doing class in which participants design, build, and program robots. From the student's perspective, the goal of the class is to design robotic machines that will be able to navigate their way around different surfaces and successfully interact with objects while performing specific tasks. The machines built by students are real robots. They are fully autonomous entities, operating under their own battery power with a microprocessor in control. They operate without human intervention. The design of a robot is a complex task because the robot must be designed intelligently with respect to mechanical, electronic, and control factors.

Opportunities in <u>Math</u> (4 credits required, 4 elective credits available)

Algebra I, 1 credit, offered at three academic levels, grade 9
The skills of algebra are taught within an integrated context involving applications, geometry, statistics, data analysis, etc. Particular stress is given to manipulation of variable expressions, the concepts of relation and function, and the analytical geometry of linear functions. Additional topics include quadratic functions, polynomials, exponential functions, radical equations, and rational functions.

Geometry, 1 credit, offered at three academic levels, grades 9, 10, 11
The standard geometric concepts of angle relationships, similarity, congruence, area, volume, properties of circles, and transformations are presented. They allow for a visual component to the students' introduction to proofs and the logical structure of mathematics. Honors Geometry students will be expected to write complicated two-column proofs. Many of the geometric problems also integrate algebraic skills and concepts covered in Algebra I.

Algebra II, 1 credit, offered at three academic levels, grades 10, 11 12
This course builds upon the foundations established in Algebra I. Topics covered are: quadratic, exponential and logarithmic functions, arithmetic sequences and series, as well as conic sections. Applications in statistics, data analysis, and geometry will continue to be integrated into the material. Application of computer software will supplement traditional seatwork and will be a part of the learning and assessment of some topics.

Pre-Calculus, 1 credit elective, offered at two academic levels, grades 11 or 12
The standard pre-calculus topics of: relation and function, polynomial and rational functions, the analytical geometry of conics, exponential and logarithmic functions, trigonometry, and sequences and series are all covered. These concepts are used in applications throughout the course. There is a strong emphasis on the use of the graphing calculator in all types of problem solving.

Honors Calculus, 1 credit elective, grade 12
This course covers differential and integral calculus of functions of one variable. The basic approach includes independent study and standard lecture periods.

AP Calculus AB, 1 credit elective, grade 12
This course is primarily concerned with developing the students' understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multi-representational approach to calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally. The connections among these representations also are important. Broad concepts and widely applicable methods are emphasized. The focus of the courses is neither manipulation nor memorization of an extensive taxonomy of functions, curves, theorems, or problem types. The basic approach includes independent study and standard lecture periods.

Honors Statistics, 1 credit elective, grade 12
This course covers data analysis, elementary probability theory, distributions, estimation, regression, correlation, and statistical inference. The course will focus on applications, problem solving, and interpretation with calculations on the computer or graphing calculator. Both individual and group project work will be a significant part of the course.

Data Analysis, 1 credit elective, grade 12
Introduction to Data Analysis will emphasize the process, but not the theory, of data analysis. This course will be computationally intensive. Students will learn sampling techniques, numerical and graphical summaries of data, regression, confidence intervals, and hypothesis testing. Upon completion of this course, students should be able to think critically about data, to create graphical and numerical summaries, to apply standard statistical inference procedures, and to draw conclusions from such analyses. Students will use graphing calculators and Microsoft Excel as analytical tools. Microsoft Excel will also be utilized to create data presentations. This course will be evaluated mainly through performance-based assessment.