SHENANDOAH VALLEY
GOVERNOR'S SCHOOL

COURSE REGISTRATION FOR 2020-21

1. Please review the tentative math, science and technology course offerings for SVGS Seniors 2020-21 listed below.

2. Complete the CAREER INTEREST INVENTORY at https://Elevate.themyersbriggs.com/Respondent/ReturningUser?tokenId=9685387e-4e48-ea11-a1cc-000d3a3243bb

   You will register then log-in. You may enter the school's phone number as your 540-245-5088 instead of yours if you wish.

3. Complete the preliminary COURSE REGISTRATION survey https://docs.google.com/forms/d/e/1FAIpQLSfD56PSd1Rar2Q4ypU_rWPAUOcaIb658wCd7Mjr2hnU-bjT5A/viewform regarding your interests, future plans and tentative SVGS course selections for next year no later than Feb. 8.

4. Once you have completed your career assessment and tentative course registration, I will meet with each of you individually to finalize your course selections and complete your course registration form.

   After we meet, you need to return the course request form with parent signature. *Note: Some courses do have limited enrollment. Enrollment will be based on a "first come, first serve basis" from returned forms.* All forms need to be returned by Feb. 28.

Shenandoah Valley Governor's School offers students many different options in addition to the variety of courses available at their home high school. It is important that you be well informed about your academic options and how they relate to various career paths. Academic choices should reflect 1) *graduation requirements*; 2) *program requirements*; 3) *academic and career preparation*; and 4) *personal and/or career interests.*

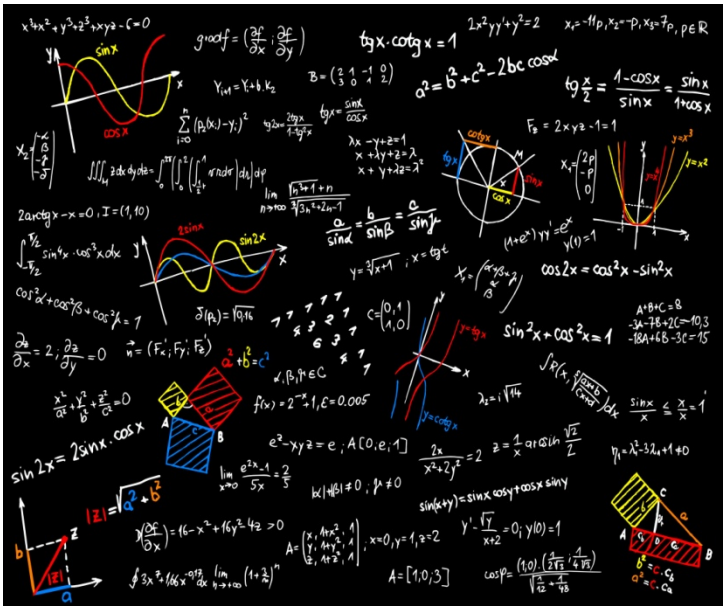
See chart to on the next page regarding recommendations for course selections as preparation for various career fields.

All returning seniors will complete a senior capstone. To fulfill this requirement, students may choose the senior capstone class (independent project work/mentorship) OR one of the other classes listed below as a 4th class:

1. Senior Capstone (not weighted, independent)
2. Advanced Environmental Science
3. Advanced Research
4. Engineering II
5. Machine Learning
6. Math Modeling

Focus Area	Strand	Senior Year
Computer Science	*Technology*	Cyber Security & Software Operations
	Science	AP Computer Science (Programming)
	Mathematics	*Choose one:* Calculus (AP or DE) Adv. Calculus – Multivariable Discrete Math (DE) Math Modeling Machine Learning
Engineering	*Technology*	*Choose one:* Engineering II AP Computer Science (Programming) Cyber Security & Software Operations Geospatial Information Systems (DE) Machine Learning
	Science	*Choose one:* AP Chemistry Advanced Environmental Science Aquatic Ecology Molecular Biology (DE) Modern Physics
	Mathematics	*Choose one:* Calculus (AP or DE) Adv. Calculus – Multivariable Math Modeling Machine Learning Statistics (DE)
Life Sciences, Health/Medical Sciences	*Technology*	*Choose one:* Advanced Research (Independent) Extra Science Elective AP Computer Science (Programming) Geospatial Information Systems (DE)
	Science	*Choose one:* AP Chemistry Advanced Environmental Science Molecular Biology (DE)
	Mathematics	Calculus (AP or DE) Statistics (DE)
General Math, Science & Technology	*Technology*	*Choose one:* Advanced Research (Independent) AP Computer Science (Programming) Cyber Security & Software Operations Engineering II Geospatial Information Systems (DE) Machine Learning Extra Mathematics Elective Extra Science Elective
	Science	AP Chemistry Advanced Environmental Science Aquatic Ecology Molecular Biology (DE) Modern Physics
	Mathematics	*Choose one:* Calculus (AP or DE) Adv. Calculus – Multivariable Statistics (DE) Discrete Math (DE) Math Modeling Machine Learning

MATHEMATICS COURSES:



Calculus (DE3231) – Students become proficient with limits, the derivative and differentiation techniques, the integral and integration techniques, basic applications of differentiation and integration, and infinite series, including Taylor Series. Students explore the fundamental relationship between the derivative, the integral, and the Riemann Sum. Students begin their study of multidimensional calculus including vectors and parametric equations. Students enhance their learning through computer-based activities utilizing *Maple* and *Excel.*

Students may take this class for dual enrollment credit (BRCC Math 173-174, 5 credits each) at their own expense.

Prerequisite: Pre-Calculus AND a QUALIFYING SCORE on BRCC MATH PLACEMENT TEST

AP Calculus BC (3177) – Students master limits, derivatives and anti-derivatives of polynomial, exponential and trigonometric functions and their inverses, as well as parametric, polar and vector functions for planar curves; techniques of differentiation and anti-differentiation; continuity of functions and the Intermediate Value Theorem and Mean Value Theorem; Fundamental Theorem of Calculus; physical applications of derivatives and anti-derivatives; series of constants and tests for convergence of series; Taylor's series approximations of functions with radii of convergence and error bounding. Students actively participate in class discussions, which are supplemented by graphing calculator and computer activities. Students become proficient with *Maple* and *Excel.* This course prepares students to take the BC version of the Advanced Placement Calculus test and is equivalent to two semesters of college calculus.

Pre-requisite: SVGS Pre-Calculus (grade of A- or better)

Advanced Calculus: Multivariate Calculus* - Concepts learned during the first year of calculus are generalized to advanced problems in multi-dimensional analysis. Topics include rectangular, spherical and cylindrical coordinates, three-dimensional vectors, partial differentiation, multiple integrals and matrices. Computer visualization techniques will aid students' understanding of multi-dimensional mathematics. This course is designed for students who have exceptional math skills.

Pre-requisite: Any Advanced Placement or dual-enrollment Calculus (grade of A- or better).

** Course offering is dependent on student interest, sufficient enrollment and staffing.*

Statistics (DE) (3192) - Students become proficient with the major concepts and tools for collecting, analyzing, and drawing conclusions from data. Four broad themes woven throughout the course are experimental design, measures of central tendency, anticipating patterns, mathematic modeling and statistical inference. Students enhance their understanding through the use of computer software packages such as *Excel* and *JMP*, which are used extensively to analyze, display and aide in the interpretation of data. This course prepares students to take the Advanced Placement Statistics test, which is a required activity.

Students may take this class for dual enrollment credit (BRCC Math 245-246, 3 credits each) at their own expense.

Pre-requisite: QUALIFYING SCORE on BRCC MATH PLACEMENT TEST, DE Calculus or AP Calculus Exam score of 3 or better

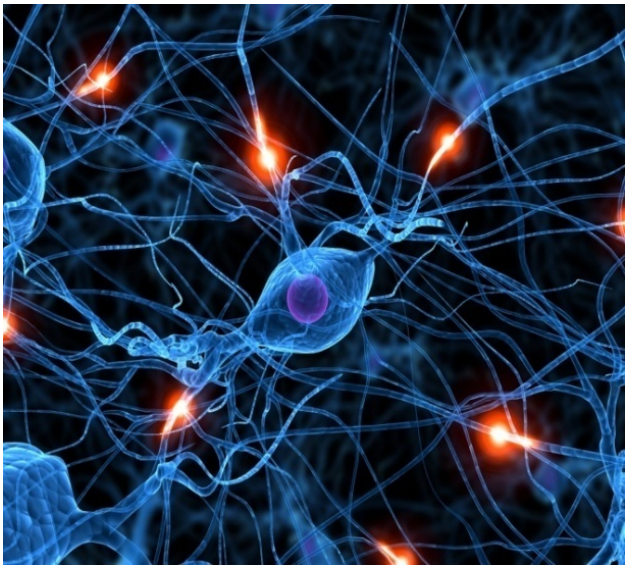
Discrete Mathematics (DE3232) - Discrete Mathematics is the branch of mathematics dealing with objects that can assume only distinct, separated values. This course offers a nice counterpoint to the study of continuous mathematics that students pursue in calculus. Students will study logic, set theory, and matrices. Students will understand elementary number theory, the basic techniques of proof, and the basics of counting including combinatorics and probability. The ideas of discrete mathematics inform the study of computer science and this course will emphasize the connections between them. **Students may take this course for dual-enrollment credit through JMU (Math/CS 227) at their own expense**

Pre-requisite: Any Advanced Placement or dual-enrollment Calculus (grade of A- or better).

** Course offering is dependent on student interest, sufficient enrollment and staffing.*

Mathematical Modeling – Mathematical modeling is an area of applied mathematics that uses mathematical tools for exploring and studying real-world problems. It is the process of applying mathematical reasoning to understand aspects of our physical, biological, social and economic environment. Students will study and create models, analyze assumptions used in forming those models, and test the models against real world data using a variety of mathematics (calculus, statistics, geometry, etc.).

Pre-requisite: Any Advanced Placement or dual-enrollment Calculus (grade of A- or better) or permission of the Director.



SCIENCE COURSES:

Note: All SVGS STEM students must have completed Chemistry and Physics prior to graduation.

AP Chemistry* - Students explore structure and states of matter, reaction and descriptive chemistry. Students enhance their learning through the use of simulations and models, and the use of technology to analyze and present data and intensive laboratory experiences. Students are prepared to take the Advanced Placement Chemistry test.

Pre-requisites: Chemistry. This is intended to be an advanced Chemistry course for students already completing Chemistry.

Advanced Scientific Research* – Students extend their study of research methods through independent research and requires work with a scientific mentor outside of SVGS (i.e.university professor, professional in the field) in addition to supervision by a SVGS staff member. Students apply principles of the natural sciences and applied statistics in solving research and engineering problems. Students complete an individual research project, write a scientific paper, and submit their results for presentation at various venues, including the SVGS Research Symposium (participation is required), science fairs, and paper submission to student research journals for publication. They make use of on-line libraries and scholarly scientific resources. *THIS IS AN INDEPENDENT STUDY. Participation in the regional science fair in March is required (poster, paper and presentation) is required. *Pre-requisites: Scientific research or director approval.*

Advanced Environmental Science - Students will examine the diversity of local ecosystems and how these ecosystems are affected by land-use, energy use, waste management, water quality, recycling, conservation, restoration, and geology. Students will use this information to develop an independent research project. **Students may opt to take the class for JMU credit (ISAT 112, 3 credits) at their own expense.**

Pre-requisites: Biology, Chemistry, Physics and Pre-Calculus, completion of Earth Science is strongly recommended.

** New Course offering for 2020-21*

Aquatic Ecology - Students will investigate the physical, chemical, and biological processes occurring in aquatic ecosystems such as rivers, streams, lakes and wetlands while becoming familiar with the techniques used for researching these ecosystems. They will study the properties of water, stream flow, types of aquatic systems, nutrient cycling, and organisms as a part of the overall ecosystems including productivity and interactions. *Pre-requisites: Strong performance (grade of A- or better) in Biology, Chemistry, Physics, Earth Science required. A strong interest in pursuing a career in environmental science or related field.*

** New Course offering for 2020-21*

Environmental Chemistry - Students master basic principles of chemistry and statistical analysis in the context of the chemical and physical characteristics of water, soils, rocks, the atmosphere and natural fuels. Students conduct extensive laboratory analysis and field sampling utilizing EPA methods where feasible. Students investigate anthropogenic influences on natural materials cycles from the viewpoint of the classical chemist. Students enhance their learning through the use of instrumental analysis, which supplements traditional micro and wet chemistry methods. Students will demonstrate mastery of computerized data recording, calculation and analysis; graphical presentation; researching primary and popular literature; and formal report writing and scientific presentation. **Students may opt to take the class for JMU credit (ISAT 112, 3 credits) at their own expense.**

****THIS CLASS IS INTENDED FOR STUDENTS WHO HAVE NOT TAKEN CHEMISTRY** or have a strong interest in the environmental sciences.*

Molecular and Microbiology – Students investigate fundamental life processes through the use and study of rapidly developing technologies such as genetic engineering, pharmaceutical developments, and treatment and prevention of infectious diseases. Students conduct extensive laboratory investigations on DNA extraction, gel electrophoresis, culture and identification of microbial organisms, and biochemistry. Students enhance their understanding of biological molecules through the use of mechanical and computer molecular modeling. Students become proficient in the use of technology to analyze and present data. **Students may opt to take this class for dual enrollment credit with James Madison University at their own expense (ISAT 113, 3 credits).**

Pre-requisites: Biology, Chemistry, Physics and Pre-Calculus.

Modern Physics* – Students explore the theoretical study of Special Relativity and Quantum Mechanics with an emphasis on computer models of the processes involved. Topics covered include Special Relativity, the Schrödinger equation, tunneling phenomena, General Relativity, Elementary Particle Physics, and the Hydrogen Atom. Students enhance their learning through extensive laboratory investigations and simulations. Students become proficient in the use of technology to analyze and present data.

Pre-requisites: Physics, Calculus or permission of the Director.

* Course offering is dependent on student interest, sufficient enrollment and staffing.

TECHNOLOGY COURSES:

AP Computer Science - Students design, implement and interpret computer-based solutions to problems in several application areas using *Java.* Students become knowledgeable about programming concepts, algorithm designs, and documentation of the computer solution and proficient at writing and debugging code. The course material emphasizes those concepts outlined by the College Board and prepares students to take the Advanced Placement Computer Science test.

CyberSecurity - Students are provides instruction in the basics of computer networking, operating systems, system administration and network security. Course content includes a overview of networking, operating systems and other software applications, learning to perform common administrative functions in scripting environments. Students will examine PHP and PERL in the context of an Apache webserver, and use GNU BASH and Microsoft Powershell scripting from the command line to complete every day administrative functions. Course content also includes risk management, network security policy, security training, security keys, confidentiality, integrity, acess, accountability, and audit ability. Participation in various industry sponsored contests *such as Cyber Challenge and other "hacking" contests"* are expected

Engineering II - Students develop the "thought-work" behind applying concepts of multi-disciplinary engineering methods. Students are immediately immersed in advanced tenements of: static and dynamic equilibrium of particles, tools, and complex elements (like the human body); use of Computer Aided Design in basic engineering modeling; test and evaluation concepts; evaluation of structural and mechanical relationships; evaluation and application of problem design criteria, design for failure concepts, precision and safety-factors mark some but are not inclusive of all the principals touched-on during the course. Engineering Methodology combines mathematics and the physical sciences to resolve problems and reverse engineer solutions. Students complete a dozen team Design Projects and solutions are presented via CAD, schematics, and detailed technical write-ups. Individuals improve math, physics and material science skills by combining them to resolve problems.

Pre-requisites: Engineering I or permission of director

Geospatial Systems - Students will develop the skills and knowledge necessary to make use of geographic technologies such as geospatial information systems (GIS), global positioning systems (GPS), and remote sensing. The class will focus on applying GIS technology to different fields, such as environmental science, city planning, ecology and many others. Students will work with a variety of data sets, collect data, and develop their own GIS research project. **Students in this class must enroll for dual enrollment credit with James Madison University at their expense (GEOG 161, 3 credits).**

Machine Learning – Students will study how computers are used to extract knowledge from data. The class will combine statistics, artificial intelligence, and computer science to solve problems in a number of different commercial and research fields such as medical diagnosis and treatment, movie recommendations, or playing chess. Students will solve problems by programing their own machine learning algorithms using the Python programing language and current industry standard techniques. Using common machine learning algorithms, students will analyze the classes of problems that can be solved, develop strategies for testing what the computer has learned, and apply these techniques to real world data. Supervised and unsupervised learning algorithms will be addressed along with more specialized systems (neural networks, computer vision, natural language processing, recommendation systems, etc.). The class is appropriate for students with some experience in coding.

** New Course offering for 2020-21*