CBGS COURSE DESCRIPTIONS

Students selected to attend CBGS must complete the VPT (Virginia Placement Test.) In order to receive dual enrollment credit for CBGS courses, the student must meet the scoring guidelines for the VPT set forth by the Virginia Community College System (VCCS) and Rappahannock Community College (RCC).

BIOLOGY

RCC BIO 101/102 4 credits/semester (total 8 credits)

The biology course taught to the Chesapeake Bay Governor's School sophomores will focus on those major concepts or themes deemed to be essential to an understanding of life processes. Throughout the year, science as a process will be emphasized as students conduct laboratory studies to support classroom information, use inductive reasoning to discover key concepts, study the history of the development of our present understanding of biological concepts, and learn how to conduct their own research. Other major themes to be emphasized are genetics, evolution, energy transfer, the relationship between structure and function, ecological interrelationships, the regulation of processes at many levels, and the impact of science and technology on our society. These concepts are all encompassing as well as recurring in all topics that will be covered throughout the year. This course, in conjunction with the topics course, will adequately prepare our students to succeed in their next two years at CBGS, in college, and in their future endeavors, as they will learn to focus their efforts and master essential study skills. CBGS Biology students will also be able to succeed on the Virginia Standards of Learning End of Course Biology Exam.

CHEMISTRY

RCC 111/112 4 credits/semester (total 8 credits)

Students taking Chemistry at the Governor's School will come from a variety of high school backgrounds. Although no prior chemistry is necessary and all of the Virginia Standards of Learning for the basic high school chemistry curriculum are covered, the college level of this course requires that students process information at a faster pace and cover the principles in much greater depth. This course explores the fundamental laws, theories, and mathematical concepts of chemistry and will cover the structure of matter, the characteristics of the states of matter, types of reactions, thermodynamics, chemical kinetics, equilibrium, and electrochemistry. The lab component of the course, which counts approximately twenty percent of the overall grade, will focus on qualitative and quantitative support of the general chemistry concepts.

PHYSICS

RCC PHYS 201/202 4 credits/semester (total 8 credits)

This is a 2 semester, college level, laboratory Physics course taught in the senior year, covering fundamental Physics principles, and their qualitative and quantitative applications. Topics include: mechanics; harmonic and wave motion; sound; optics; electromagnetism; thermodynamics; nature of matter; nuclear and quantum physics and relativity. Additional topics may be pursued depending upon time and interest. In addition to qualitative and quantitative understanding of topics, students will be required to use them for problem solving in laboratory applications. Strong mathematical skills are essential, particularly in Algebra and Trigonometry. In addition to strong math skills, the ability to handle independent reading and study is crucial. Pre-Calculus is a pre-requisite for this course. Calculus is a co-requisite, taken during this year, and may help with quantitative conceptualization.

COLLEGE ALGEBRA

RCC MTH 158 1 semester (total 3 credits)

This course covers the structure of complex number systems, polynomials, rational expressions, graphing, systems of equations and inequalities and functions, quadratic and rational equations and inequalities. The course is designed for sophomores. Students will typically take College Algebra in the fall semester of their sophomore year and MTH 163 Pre-Calculus in the spring semester.

PRE-CALCULUS I

RCC MTH 163 1 semester (total 3 credits)

This Pre-Calculus I course is taught during the spring semester of the sophomore year after taking College Algebra (MTH 158) in the fall semester. The course presumes a mastery of the material covered in MTH 115/116 (or its equivalent). During the course, students will discuss polynomial and rational functions; exponential and logarithmic functions; systems of equations, inequalities, and linear programming; matrices and determinants; and conic sections with analytic geometry.

PRE-CALCULUS II

RCC MTH 164 1 semester (total 3 credits)

This course will focus heavily on trigonometry, combining skills from both Geometry and Algebra. Topics will include evaluating trigonometric expressions (using both right triangle trigonometry and the unit circle), graphs of trigonometric functions, trigonometric identities, polar and parametric equations, and mathematical induction. Students will typically take Pre-Calculus II in their junior year.

STATISTICS

RCC MTH 240 1 semester (total 3 credits)

The Statistic course, typically taken in the junior year, will cover one semester and will present an overview of statistics, including descriptive statistics, elementary probability, probability distributions, estimation, hypothesis testing, and correlation and regression. Students will apply statistical methods to their two-year research paper.

CALCULUS with ANALYTIC GEOMETRY I

RCC MTH 173 2 Semesters (total 5 credits)

This yearlong course presents analytic geometry and the calculus of algebraic and transcendental functions including the study of limits, derivatives, differentials, and introduction to integration along with their applications. Designed for mathematical, physical and engineering science programs. Most CBGS students will take MTH 173 in their senior year.

STATISTICS I

RCC MTH 241 1 semester (total 3 credits)

This course covers descriptive statistics, elementary probability, probability distributions, estimation, and hypothesis testing. Statistics I provides the student with the necessary abilities in statistics and probability to understand the results of statistical studies and to perform descriptive and basic inferential statistical studies within their areas of interest.

STATISTICS II

RCC MTH 242 1 semester (total 3 credits)

This course continues the study of estimation and hypothesis testing with emphasis on correlation and regression, analysis of variance, chi-square tests, and non-parametric methods. Statistics I provides the student with the necessary abilities in statistics and probability to understand the results of statistical studies and to perform descriptive and basic inferential statistical studies within their areas of interest

APPLIED CALCULUS

RCC MTH 270 (total 3 credits)

This course introduces limits, continuity, differentiation and integration of algebraic and transcendental functions, techniques of integration, and partial differentiation. This course prepares students for the application of calculus in a variety of fields.

FOUNDATIONS IN SCIENCE

RCC SCT 111/112 8 credits

This course introduces the basic sciences which describe our physical environment, including the fundamentals of geology, meteorology, physics, chemistry, and biology. Students will explore scientific principles through data acquisition and analysis with a focus on the Chesapeake Bay Watershed and human impacts on the environment.

OUTDOOR ADVENTURES

RCC PED 183 2 credits

Outdoor Adventures introduces outdoor activities with an emphasis on basic skills, preparation, personal and group safety, equipment selection and use. Over the three years at CBGS students will explore the ecology of the Chesapeake Bay watershed while camping, kayaking, and hiking on three overnight trips and several day trips. In addition, students will be required to keep a journal of their field experiences. ***Students must attend all 3 major field trips.***

MARINE & ENVIRONMENTAL SCIENCE I & II

RCC MAR 201-202 & 101-102 4 credits/semester (total 16 credits)

A two-year lab and field science course for juniors & seniors designed to provide thematic unity to the CBGS program and immerse students in rich experiential learning. Students will explore the principles of general ecology, evolutionary biology, environmental science, and oceanography, with special emphasis on the natural history and ecology of the Chesapeake Bay and its watershed as well as the Atlantic Ocean and east coast. The entire two-year course is interdisciplinary in spirit, stressing the importance of chemical, physical, and geological oceanography for understanding marine life and aquatic ecosystems, while making frequent connections to the mathematics and general sciences that students are learning in other CBGS courses. The curriculum will largely be driven by the data and investigations of real scientists, and students will design and conduct their own scientific research. In order to provoke critical thinking and creativity, the course will be organized around a set of abstract unifying concepts, vivid discovery experiences that require students to interpret their own careful observations, extended problem-solving missions, independent projects and presentations, and thorny environmental issues that compel thoughtful evaluation. ***A two–year research project will be required of all Chesapeake Bay Governor's School students***

RESEARCH PROJECT

Timeline

Fall Semester, Junior Year

- Students learn elements of scientific research:
  - Research method
  - Experimental design
  - Graphical and statistical analysis

- Students gain practice by conducting several cycles of actual research as an entire class in the lab and on field trips:
  - Generation of null and alternate hypotheses
  - Lab and field practices for collecting data, including random sampling
  - Graphing and statistical testing of actual data

- Students read, discuss, and evaluate scientific papers:
  - Primary literature
  - Projects by previous CBGS students

- Students propose a research question related to marine and/or environmental science that they wish to tackle through individual or small group research, along with a brief discussion of relevant theory and a review of primary literature (December)
  - Workshop on locating appropriate literature sources
  - Assignment of faculty advisors
  - Faculty feedback and streamlining of proposals

Spring Semester, Junior Year

- Students observe and critique Senior research presentations at the annual *CBGS Marine & Environmental Science Symposium* (early March)

- Students submit formal Prospectus for research to be approved by CBGS faculty before data collection begins (final copy due prior to Spring Break)
  - Introduction with literature review
  - Null and alternate hypotheses
  - Materials and methods, including identification of variables, constants, treatments, and controls
  - Analysis, including statistical test(s) to be employed

- Students start data collection after Spring Break

Summer Break and Fall Semester, Senior Year

- Students complete experiments and data collection
  - Submission of raw data by mid-September for preliminary evaluation and troubleshooting
  - Completion of all data collection by end of October

- Students analyze data graphically and statistically (October/November)

- Students write a formal scientific paper summarizing and discussing their research (November/December)
  - Workshop on technical writing and scientific paper format: Abstract, Introduction, Literature Review, Materials and Methods, Results, and Discussion
  - First draft submitted by Thanksgiving with a cycle of faculty feedback
  - Final draft submitted by mid-January
  - Students may enter papers in the *Virginia Junior Academy of Sciences* competition in the spring

Spring Semester, Senior Year

- Students publicly present research at annual *CBGS Marine & Environmental Science Symposium* (all sites together, early March)
  - Workshop on public presentations, including use of PowerPoint and graphics
  - Practice session with faculty for coaching and feedback
  - Faculty and guest judges evaluate presentations and choose award-winners in each category