CREC
Capitol Region Education Council

Greater Hartford Academy of Mathematics & Science

at The Learning Corridor, Established 2000

Program of Studies

Curriculum & Course Description Catalog

2011-2012

GHAMAS Program of Studies 2011-2012 Version #1 2011-4-28

Greater Hartford Academy of Mathematics & Science
at The Learning Corridor

School Mission

The Greater Hartford Academy of Mathematics and Science is a half-day high school program focusing on science, math and technology, with an emphasis on inquiry-based research programs. Students take humanities courses at their home high schools, while studying with professional scientists, engineers and mathematicians in college preparatory, honors and advanced placement courses at the academy. The academy also offers professional development services for educators and student outreach programs statewide.

GHAMAS:

- Provides a sound foundation in science, mathematics and technology to a diverse population
- Integrates and applies science, mathematics and technology in an enriched educational environment
- Emphasizes problem solving, inquiry and creative thinking approaches to teaching and learning
- Provides faculty development resources and opportunities for all educational levels
- Develops collaborative partnerships and mentoring programs among schools, communities, businesses, and industries

Overarching Goals

1. High academic achievement. Foremost are learning opportunities with an unwavering emphasis on the pursuit of academic excellence. Students and teachers are challenged to strive for the highest and best achievement in everything they do — every lesson, every conversation, every report, and every project reflects the highest level of effort and attainment.

2. Diversity of student backgrounds and learning opportunities. The Academy accepts the challenge to create a community of learners within a school made up of interested and motivated students representative of the participating school districts. The world of science, mathematics and technology accepts no limitations on opportunities to open the mind. Dedication to excellence is expected regardless of personal backgrounds, external social influences or physical constraints. Commitment to high achievement builds on the strengths of diversity within the school community as students interact with others who may be different from them in some ways, but who share common interests and academic goals. Teachers and the methods they use recognize that different people learn in different ways.

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Active Learner

General Course Information

Course Numbering

Course numbers are provided in the program of studies to help students make appropriate course selection based on grade level.

100 level:	Grade 9 Courses
200 level:	Grade 10 Courses
300 level:	Grade 11 and 12 Courses – these are mathematics and science courses open to both Juniors and Seniors.
400 level:	Grade 12 Courses – these are courses are primarily intended to be Senior level courses, although they are open to all students that meet all prerequisites and have instructor consent.
500 level:	Independent Study/Research Courses

Course Designations

Course level designations are provided as a general guideline to help students select courses of the appropriate level. Most courses offered at the Academy are offered at the honors level and there are no courses offered below the college preparatory level.

College Preparatory:	Courses designated as College Preparatory are those courses that would normally be included in this level for the appropriate grade at most high schools. These courses provide the general skill and knowledge framework need for success at college.
Honors:	Courses designated as Honors are conducted with the higher level of intensity, course load and rigor than college preparatory courses. These specialized courses go beyond the normal material covered by similar courses at that grade level in scope or rigor. This includes some courses that are equal to the rigor of advanced placement courses, but for which an AP assessment does not exist.
Advanced Placement:	Courses at the Academy that complete the standard nationally recognized AP curriculum are designated as AP level. These are college level courses and demand students have the skills and motivation to manage a fast paced and demanding workload. Students are expected to be active learners that take responsibility and ownership for their own learning.

Advanced Placement

Courses at the Academy range from Honors to College-level in terms of intensity, course load and assessment. Students interested in taking advanced placement exams should select the following courses.

Science Courses

Biology:	AP Biology
Chemistry:	AP Chemistry
Physics:	Classical Mechanics (AP Physics C)
	Electricity and Magnetism (AP Physics C)

Mathematics Courses

Statistics:	AP Statistics
Calculus AB:	AB Calculus
Calculus BC:	BC Calculus
Computer Science:	AP Computer Science

Credit and Level Recommendations

GHAMAS is an extension of the high school that sends students to the Academy. GHAMAS makes recommendations concerning course level and credits to the student's home high school. The home school may determine and award credit and level for the courses taken at GHAMAS in accordance with each of their school district's policies. We offer our recommendation for credit award and level based on course curriculum, rigor and student expectations for performance.

Course Selection & Faculty Advisement

Ninth and tenth grade students have limited choices for course selection. Students in the ninth and tenth grade take foundational classes in order to prepare them for advanced electives in the eleventh and twelfth grades.

Faculty is available for course selection advisement for all elective classes. Students should consult with their teachers for course selection. Students should discuss course selection with their current math and science teachers for and math teachers will provide recommendations for mathematics course selection.

Eleventh and twelfth grade students are able to choose their program of study for math and science programs from an extensive list of electives. It is preferable and highly recommended that upon entrance into the 11th grade students plan their two-year Program of Study.

Course Placement

Course placement for incoming students is based on placement testing. All incoming students are required to take a placement test that includes a math placement test and a Degrees of Reading Power test. In addition, students enrolling beyond the ninth grade will also be placed based on a review of their high school transcripts. Math placement for current students will be based on the placement recommendation from the student's current math teacher.

Grade Level Promotion

Ninth and tenth grade students take math and science courses during the morning session from 7:30 to 10:30 a.m. eleventh and twelfth grade students take math and science courses during the afternoon session from 12:30 to 4:00 p.m. Promotion from the morning to the afternoon program is based on successful completion of the foundational math and science courses and the availability of appropriate courses for the students academic development. Students need to have passed a minimum of Honors Biology, Algebra I, and one physical science course (Physics, Chemistry, or Earth Science) in the morning program to advance to the afternoon program of studies. Students who do not meet these criteria will continue in the morning math and science program.

Grade Level Program of Studies

GHAMAS has two distinct programs, the morning program for grades nine and ten and the afternoon program for grades eleven and twelve. The morning program provides foundational courses in math and science and runs from 7:30 to 10:30 a.m. Students typically take two science courses and one math course during the morning session.

The afternoon for grades eleven and twelve provides advanced math and science electives from 12:30 to 4:00 p.m. There are four periods in the afternoon program and students typically take three elective courses. The fourth period can be used for independent research, additional courses, or individual or group study.

The general program of studies by grade level is provided below. Students actual course of studies will vary based on individual student needs and successful advancement.

Morning Program Requirements

Foundations in Science and Mathematics is the grade 9 and 10 curriculum. This curriculum requires a student to complete a full year of earth science, physics, biology and chemistry and two full years of mathematics. This provides the student with a broad foundation in the

physical sciences, biological sciences and mathematics, allowing them individual choice of their advanced studies in the 11th and 12th grades.

- Grades 9 and 10 are required to take three courses per year: two sciences courses and one course in mathematics. All courses run from September to June

Grade 9 Curriculum

- Foundations in Physics
- Foundations in Earth Science
- Mathematics (Algebra 1, Geometry, or Algebra 2)

Grade 10 Curriculum

- Foundations in Biology
- Foundations in Chemistry
- Mathematics (Geometry, Algebra 2, or Precalculus)

Afternoon Program Requirements

The afternoon curriculum allows students the flexibility to choose a course of study based on their interests and abilities. Students select from a wide variety of elective courses. Afternoon courses include both full year and semester

- Juniors and seniors are required to take 3 GHAMAS classes per semester.
- Students must take a minimum of one full year (1 full year or 2 semesters) of mathematics per year.
- **Students are permitted early release for ONE SEMESTER PER SCHOOL YEAR. This provision is to support our students in participation of after-school sports and activities. There are no exceptions to this policy.**

Grade 11 Curriculum

- Mathematics
- Science Elective
- Math or Science Elective

Grade 12 Curriculum

- Mathematics
- Science Elective
- Math or Science Elective

Greater Hartford Academy of Mathematics and Science Curriculum Map

Grade	Mathematics	Science	Math/Science
Freshman (Morning)	Mathematics	Foundations in Earth Science	Foundations in Physics
Sophomore (Morning)	Mathematics	Foundations in Biology	Foundations in Chemistry
Junior (Afternoon)	Mathematics	Science Elective	Math or Science Elective
Senior (Afternoon)	Mathematics	Science Elective	Math or Science Elective

Course Descriptions

Not all courses are offered every semester or every year. Please consult the Course Selection Form for the year in question to determine what is offered that year.

BIOLOGY

BIO 201
Foundations in Biology + Health in the 21st Century

1.25 Credit
Honors

Prerequisite: None
Foundations in Biology is a course designed to develop a comprehensive understanding of fundamental concepts and principles in the life sciences. Students will explore topics at the molecular, cellular, systemic, and organismal levels. Students will be required to apply their understanding of biological systems to pertinent questions in the Life Sciences. Topics that will be covered include; the origin of life, cellular physiology, cellular interaction and organ system physiology, molecular and evolutionary genetics, organismal interactions and environmental biology. This course will have a strong experimental laboratory component and will be integrated with the Foundations in Chemistry course when covering the fundamentals of biochemistry. Health in the 21st Century is a course that is interwoven into the biology curriculum in the second semester. This course meets all district and state requirements for health credit.

BIO 301
Molecular and Cellular Biology

0.625 Credit
Honors

Prerequisite: General Biology
Molecular and Cell biology integrates the disciplines of cytology, biochemistry, and genetics to understand how cells live and reproduce. Students in this course will study cell structure and function, emphasizing the molecular components, metabolism, organelles, motility, growth and division. The molecular biology of cells and the regulation of cellular processes are emphasized. A strong emphasis will be placed on student developed laboratory research projects. Laboratory research will include the study of enzyme kinetics, protein structure, quantitative analysis of biomacromolecules, microscopy and cell culturing.

BIO 302
AP Biology

1.25 Credit
Advanced Placement

Prerequisite: General Biology
This course will cover the advanced placement curriculum in biology from atoms to zoology. Students will study general chemistry as it relates to macromolecules and apply this to an understanding of structural features and metabolism in cells. With this as a foundation to build on, they will explore genetics and biotechnology, anatomy and physiology in organs and organ systems, the phylogeny and evolution of organisms, and interactions between organisms and their environment.

BIO 311
Botany

0.625 Credit
Honors

Prerequisite: General Biology
Offered as a course for independent study. This course will provide a foundation for understanding the biology of plants. Through a combination of readings and laboratory investigations, the student will explore the phylogeny and physiological adaptations of plants. They will also explore the important role plants have played in providing a context for evolution of life on earth, including the evolution of complex human societies.

BIO 321
Molecular and Mendelian Genetics

0.625 Credit
Honors

Prerequisite: General Biology
Co requisite: Precalculus
Molecular and Mendelian Genetics integrates modern genetic and genomic sciences with classical organismal genetics and patterns of inheritance. Students will study the basic principles of molecular genetics including the transmission and organization of the genetic material in prokaryotes and eukaryotes, the molecular biology of nucleic acids and information transfer, mutation and mutagenesis, and gene regulation. The study of Mendelian Genetics will include the analysis of mechanisms of inheritance with emphasis on the nature of the gene, gene regulation and expression, and genetic changes in populations. Laboratory research in this course will include DNA isolation and analysis, gel electrophoresis, RFLP and PCR analysis, bacterial transformation, and mathematical modeling of gene regulation and inheritance.

BIO 331
Biodiversity

0.625 Credit
Honors

Prerequisite: General Biology
Offered as a course for independent study. Life is a continuum, from the simplest bacterial cells to the most complex multi-cellular bodies of plants and animals. This great diversity of forms is the product of natural selection and other evolutionary mechanisms operating during the last 3.8 million years of earth's history. Students will explore the unfolding of earth's biological history from the humble origins of life to its current diversity in light of the combination of geological events and evolutionary mechanisms that produced it. Students will also explore the field of conservation biology as its tools become ever more important in preserving the diversity of life.

BIO 341
Evolutionary Biology

0.625 Credit
Honors

Prerequisite: General Biology
Offered as a course for independent study. While evolutionary theories predate Darwin, this field found in the mechanism that he proposed the seeds for a program of scientific research which has been enormously productive. This mechanism, natural selection, is still the best scientific explanation for the emergence of the most complex of biological structures. In the century and a half that has passed since Darwin, additional mechanisms have been discovered

and new revisions to evolutionary theory have occurred and are occurring. Evolutionary biology offers a scientific approach for addressing some of the most pressing questions of our time from why we get sick to how we behave. Students in this course will explore the intersection between ecology and evolutionary biology using tools from both fields. Topics that will be addressed in this course include population genetics, levels of selection, game theory, behavioral ecology, the origins of morality and culture, cognitive science, evolutionary psychology, social dominance theory, and life history theory.

BIO 351
Human Evolution

0.625 Credit
Honors

Prerequisite: General Biology
The combined work of primatologists, geneticists, paleontologists, physical anthropologists and other specialists have greatly expanded our understanding of human origins. In this course, students will explore human history from the origin of our primate ancestors to the emergence of fully modern *Homo sapiens*. They will learn about our anatomical and physiological evolution, including the development of complex brains and the implications this had for living in large cooperative societies.

BIO 361
Biology Seminar I

0.625 Credit
Honors

Prerequisite: General Biology
This course is intended for students who wish to extend their knowledge of special topics in biology with readings and discussions. The focus of this year's seminar will be on developing a logical framework for understanding psychological adaptations as well as disease and disorders from an evolutionary perspective. These are the goals of the rapidly growing field of Darwinian Medicine whose practitioners hope to improve health practices and interventions as a result of taking our evolutionary past into account.

BIO 366
Biology Seminar II

0.625 Credit
Honors

Prerequisite: General Biology
This course is intended for students who wish to extend their knowledge of special topics in biology with readings and discussions. Topics will vary and be determined by the interest of students and instructors.

BIO 371
Biotechnology and Bioengineering

0.625 Credit
Honors

Prerequisite: General Biology and Chemistry
This course will introduce students to the theoretical aspects of Biotechnology & Bioengineering and societal issues arising from this new technology. Students will review primary research literature to explore new aspects of biotechnology and bioengineering. Students will have the opportunity to investigate an area of their own interest utilizing various

biotechnologies. Hands on laboratory activities will reinforce theoretical information and teach lab safety, data analysis, the scientific method, and related computer skills.

BIO 381
Anatomy and Physiology I

0.625 Credit
Honors

Prerequisite: one course each in biology and chemistry
This course is designed for students interested in biomedical research or the medical field. Students will learn about the structural organization of the human body and the underlying physiological processes that are essential for maintaining homeostasis. In the first part of this course, students will learn the organization of the human body and histology, and review basic biology and biochemistry (e.g. cells, cellular respiration, molecular bonding). Organ systems will be covered in depth, and extended into discussion of medical conditions and diseases. Systems to be covered will include the integumentary system, skeletal system, muscular system and nervous system. Laboratory experiments will involve measurement of oxygen consumption, membrane potentials, muscular movement and dissection of preserved organs and/or animals.

BIO 391
Anatomy and Physiology II

0.625 Credit
Honors

Prerequisite: one course each in biology and chemistry, anatomy and physiology I
This course will be a continuation of Anatomy and Physiology I. This is designed for students interested in biomedical research or medical field. Students will apply material regarding connective tissue and histology to learning about various organs systems and the physiological processes that maintain homeostasis. Organ systems will be covered in depth, and extended into discussion of medical conditions and diseases. Systems to be covered will include the cardiovascular system, respiratory system, digestive system, urinary system, endocrine system, and lymphatic (immune) system. Laboratory experiments will involve osmoregulation (kidney function), blood pressure, electrocardiogram (EKG), blood circulation and dissection of preserved animals and/or organs. **NOTE: Students who are interested in enrolling in Anat/Phys II without Ant/Phys I may enroll on a case by case basis with the consent of the instructor.**

CHEMISTRY

CHEM 201
Foundations in Chemistry & Material Science

1.25 Credit
Honors

Prerequisites: Algebra II (may be taken concurrently)
The Foundations in Chemistry course is designed to provide students with an understanding of general chemistry concepts and principles as well as an initial look at organic chemistry. Topics include atomic structure, periodicity and basic quantum mechanics, bonding theories and molecular shapes, solutions, compositional and reaction stoichiometry, gas laws, energy

relationships in reactions, acid-base and oxidation-reduction reactions, and basic organic chemistry. This course emphasizes theoretical and conceptual aspects of chemistry and includes inquiry-based laboratory activities. In addition, students are introduced and have the opportunity to use state of the art instrumentation. Special attention is placed on how the bonding and molecular structures impact the properties of different materials and the application of these materials to different engineering applications.

CHEM 301
Chemical Structures and Interactions

1.25 Credit
Honors

Prerequisites: Algebra II (may be taken concurrently)
The focus of this course is to understand the qualitative and quantitative means used to describe matter and the changes it undergoes. Chemical principles such as states of matter, atomic structure, nomenclature, stoichiometry, aqueous reactions, and bonding theory will be the focus. Additional topics may include: electron structure, thermochemistry, periodicity and acid-base theory. Inquiry-based laboratory activities will be conducted and will involve the use of the state-of-the-art instrumentation available.

CHEM 322
AP Chemistry

1.25 Credit
Advanced Placement

Prerequisites: Algebra II, 1 year of general or honors chemistry
The first semester of this course will focus on atomic structure, stoichiometry, aqueous reactions and solution stoichiometry, electronic structure and quantum theory, periodic relationships, bonding theory, molecular geometry and gas laws. (During the first semester only, students must be free either during gamma block OR the delta block, as extra class sessions meet during those times every week.) The second semester will focus on intermolecular forces, properties of solutions, kinetics, equilibrium, acids and bases, thermodynamics, electrochemistry and nuclear chemistry. Much of the course will be inquiry-based laboratory experiences that are designed to enhance the understanding of the core topics and prepare students to take the AP exam. **Student should expect to cover additional topics on their own time in preparation for the AP Chemistry Exam.**

COMPUTER SCIENCE

CS 311
Introduction to Computer Science

0.625 Credit
Honors

Prerequisites: Algebra II or equivalent
Entry-level computer science course focused on the JAVA programming language. The course starts with an early introduction to objects and GUI. The course introduces basic data types, user-defined data types, control structures, simple data structures (arrays), and basic input and output (both console and graphical interfaces). Inquiry-based laboratory activities are used to enhance the understanding of core concepts.

CS 312
AP Computer Science

1.25 Credit
Advanced Placement

Prerequisites: Algebra II or equivalent
This course will cover the AP Computer Science curriculum. It is focused on the JAVA programming language. The course starts with an early introduction to objects and GUI. The course introduces basic data types, user-defined data types, control structures, and basic input and output (both console and graphical interfaces). The course will introduce the analysis and implementation of simple data structures (Arrays and Arraylists), searching and sorting, recursion, inheritance and polymorphism. Inquiry-based laboratory activities are used to enhance the understanding of core concepts.

CS 322
AP Computer Science and Data Structures

1.25 Credit
Advanced Placement

Prerequisite: Algebra II or equivalent
This course will cover the AP Computer Science curriculum. It is focused on the JAVA programming language. The course starts with an early introduction to objects and GUI. The course introduces basic data types, user-defined data types, control structures, and basic input and output (both console and graphical interfaces). It emphasizes the organization of information; the implementation of common data structures such as lists, stacks, queues, trees, maps and sets; and the techniques of data abstraction (including encapsulation and inheritance). Searching, sorting and recursion will be explored. Students will be expected to apply theory, implement, and analyze algorithms and data structures. Inquiry-based laboratory activities are used to enhance the understanding of core concepts.

EARTH, SPACE AND ENVIRONMENTAL SCIENCE

ESCI 101
Foundations in Earth/Space Science

1.25 Credit
Honors

Foundations in Earth/Space Science is a course designed to develop a comprehensive understanding of the fundamental concepts and principles in the fields of geology, meteorology and oceanography. Students will explore the applications of physics, chemistry, environmental science and biology to each of these areas. Topics will include mineralogy, the carbon and nitrogen cycle, plate tectonics, volcanism/earthquakes, climatology, atmospheric thermodynamics, physical and chemical oceanography. The course will emphasize mathematical connections throughout. This course will have a strong laboratory base where students will learn the fundamentals of science instrumentation and research techniques. All students will be required to participate in research projects.

ESCI 301
River Ecology

0.625 Credit
Honors

Prerequisite: General Earth Science, Biology and Chemistry
This course is a student research based course; giving students the opportunity to design, perform, analyze and present both laboratory and field based environmental research. The course will emphasize water qualities where students will work in collaboration with the Department of Environmental Protection (DEP) in Connecticut. Students will use up-to-date field and lab equipment to monitor the biological physical and chemical aspects of the Trout Brook River. They will collect and analyze the data over the semester and complete a report for the DEP in Connecticut.

ESCI 311
Environmental Science

0.625 Credit
Honors

Prerequisites: General Earth Science, Biology, and Chemistry
This inquiry-based course will 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. Student research projects will be required to have a literature, laboratory and field research component. Through teamwork, students will use laboratory and field-based work to study and learn the content and skills needed to understand these interrelationships in the natural world.

ESCI 321
Advanced Astronomy A: Physical Astronomy

0.625 Credit
Honors

Prerequisite: General Earth Science and algebra
This course will combine laboratory work, research, and inquiry-based learning in order to examine the history of modern astronomy , how astronomers chart the sky, radiation, spectroscopy, today and future's telescopes. The course involves quantitative and qualitative aspects of astronomy and physics.

ESCI 331
Advanced Astronomy B: The Cosmos

0.625 Credit
Honors

Prerequisite: General Earth Science and algebra
This course will combine laboratory work, research, and inquiry-based learning in order to examine properties of stars and stellar evolution, the physical and chemical properties of our sun, red and blue giants, supernovae, galaxies, black holes, quasars, pulsars and other deep space objects and phenomena. The course involves quantitative and qualitative aspects of astronomy and physics. Astronomy B can be taken without having had Astronomy A.

ESCI 341
Geohazards

0.625 Credit
Honors

Prerequisites: General Earth Science, Biology, and Chemistry
A course that explains and deals with the consequences of a natural hazard (*e.g.* volcanic eruption, earthquake, landslide or forest fire) which affect human activities. Human vulnerability, exacerbated by the lack of planning or appropriate emergency management, leads to financial, environmental or human losses. Long-lasting effects are linked to the resilience of the population. "Disasters occur when hazards meets vulnerability".

ESCI 351
The Geology of National Parks

0.625 Credit
Honors

Prerequisites: General Earth Science, Biology, and Chemistry
There are many reasons that you should find this class appealing. You will gain an understanding of why landscapes and rocks in a given park are similar yet differ, why the preservation of geologic features within National Parks is important to appreciating natural science and how it relates to society and the environment. To understand how the spectacular scenery of our National Parks formed. You will have a better understanding of how the natural world around us works; i.e., why do earthquakes and volcanoes occur where they do? Why are there mountains on both coasts of the U.S., but not in the middle? Why are the western mountains so much higher than those in the east? The National Parks class will also help you to appreciate the delicate balance between nature and humankind. Every rock has a story to tell that every geologist must try to reveal.
The Badlands terrain is beautiful and desolate; fascinating, yet formidable. Early settlers avoided this land because it was poor for farming and a barrier to travel.
Yet, from this hostile terrain has come much of what we know about North America's "Golden Age of Mammals" in the Oligocene Epoch. The strange bones in the walls of the canyons and cliffs and along stream banks aroused the curiosity of nineteenth-century naturalists. As it turned out, this region was probably the richest storehouse of vertebrate fossils in all of North America.

ESCI 361
Meteorology

0.625 Credit
Honors

Prerequisites: General Earth Science, Biology, and Chemistry
Have you wondered how the swirling atmospheric maps on TV spell out where a storm is going or how much snow is going to fall? Meteorology (Weather, Climate and the Atmosphere) affect our lives every day, from our normal daily activities to where we choose to go on vacation. Weather affects our economy, and even how we fight wars. This course focuses on introducing the student to basic concepts involved in the analysis of weather phenomena on a global and local scale. Major topics include heat balance, atmospheric stability, precipitation processes, cyclonic activity, severe weather, weather analysis, and weather forecasting techniques.

ESCI 371
Oceanography

0.625 Credit
Honors

Prerequisites: General Earth Science, Biology, and Chemistry
Oceanography is the branch of earth science that studies the ocean, covering a wide range of related topics including marine organisms and ecosystem dynamics; ocean currents, waves and geophysical fluid dynamics; plate tectonics and the geology of the seafloor; chemical fluxes and physical properties within the ocean and across its boundaries. These diverse topics reflect multiple disciplines which oceanographers blend to further knowledge of the World Ocean and understanding of the processes within it.

INDEPENDENT STUDY & RESEARCH

RES 501
Independent Study

0.625 Credit
Honors

Prerequisite: Approval of Director and Research Advisor
The independent study program offers students the opportunity to work for one semester on a project that has been approved by their Independent Study Advisor. This is often a way students can gain the necessary background information and techniques to move onto an Honors in Research Project but may also be a self-contained exploration of an area of interest. All students in this program will be required to keep a Journal and Portfolio that shows the time, effort and products of the work involved in the project as well as produce a final product approved by their advisor.

RES 502
Honors in Research

1.25 Credit
Advanced Placement Weighting

Prerequisite: Approval of Director and Research Advisor
Research conducted over a minimum of 2 semesters may be considered for honors research credit. This will require completion of a thesis, faculty committee approval of the work, and a final presentation to the afternoon session student body at the close of the school year. Opportunities of attendance to regional scientific symposiums are encouraged and supported by arrangement.

INTERDISCIPLINARY SCIENCES

INS 301
Forensic Science

0.625 Credit
Honors

Prerequisite: one course each in biology, chemistry and physics
This course is an interdisciplinary course that applies the principles of physics, chemistry, molecular genetics and biology to forensic science and the law. Students will utilize advanced equipment in Instrumentation Lab in applying modern techniques of chemical analysis to forensic science. Students will work in teams and be expected to research various concepts and apply them to the analysis of physical evidence. Students will produce evidence reports and be

asked to defend and effectively communicate their findings. Topics will include: trace evidence; hair; fibers; DNA; immunology; serology; toxicology; drugs fingerprints; firearms; impressions; and document analysis.

INS 311
Ethical Issues-Science, Technology, and Society

0.625 Credit
Honors

This seminar course promotes students' understanding of the interrelated concerns of society and the sciences. Science and technology related issues will be examined in light of social and government-policy decisions stemming from those issues. Students will assess underlying scientific foundations and evaluate ethical, social, and political implications of various issues. A basic theme is the fact that on-going developments in science and technology continually present medicine, engineering, and society with new moral and legal challenges. Topics may include issues such as research programs involving human subjects and/or animals, start of life and end of life decisions, cloning, sponsored research, and intellectual property.

INS 321
Interdisciplinary Science Seminar

0.625 Credit
Honors

Prerequisite: General Biology, Physics, Chemistry
This course is intended for students who wish to extend their knowledge of special topics within Biology, Chemistry, Physics and Psychology with readings and discussions. Topics will vary and be determined by the interest of students and instructors.

INS 401
Leadership in Science, Engineering, and Medicine

0.625 Credit
Honors

Business enterprises specializing in the sciences, engineering, and medicine share similar processes and organizational structures to enable efficient, effective, and profitable operations. This survey course will expose students to the business and technical processes associated with each of the functional disciplines in these types of organizations. Industry leaders will present guest lectures that will supplement the regular class instruction schedule. Each topic will be viewed through the lens of the fundamental math, science, and leadership attributes that characterize the particular functional area. Topics will include: research, design & development, human resources, production, finance, marketing, ethics, information systems, and quality assurance.

MATHEMATICS

MATH 111
Algebra I

1.25 Credit
Honors

Prerequisite: Math Placement Test Score
Based on a discovery approach (learn by doing), this course is designed so that students will discover important algebraic principles blended with geometry, data analysis, discrete mathematics and statistics. This investigative approach, driven by a strong emphasis on conceptual understanding and mathematical relationships, reflects national and state standards. Within the context of real-world data and cooperative learning groups, students will create an algebraic vocabulary; continue to develop oral and written expression; explore graphs and statistical methods to represent and interpret data; extend work with proportions and percents to rates and variation; graph and write linear equations; connect linear equations to parallel and perpendicular lines; solve systems of linear equations; investigate exponential growth and properties of exponents; describe functions and function notation; and model quadratics and find their roots. Active learning will be enhanced with technology-rich instruction including computer software applications, graphing calculator exploration and use of the Geometer's Sketchpad. A TI-83 or TI-84 graphing calculator is required.

MATH 120
Geometry

1.25 Credit
College Preparatory

Prerequisite: Algebra I
Based on a discovery approach (learn by doing), this course is designed so that students will acquire concepts visually, explore ideas analytically, and reason inductively and deductively. This investigative approach reflects national and state standards and supports ongoing preparations for CAPT and SAT. Within the context of real-world data and cooperative learning groups, students will create a common vocabulary using the building blocks of geometry; develop written mathematical representation; use a variety of tools for geometric constructions; discover properties and relationships of lines, angles, polygons and circles; apply formulas for area, surface area and volume; explore congruence and similarity; and apply the Pythagorean Theorem and basic right triangle trigonometry. Active learning will be enhanced with technology-rich instruction including computer software applications, graphing calculator exploration and use of the Geometer's Sketchpad. TI-83 or TI-84 graphing calculator is required.

MATH 121
Proof Based Geometry

1.25 Credit
Honors

Prerequisites: Algebra I and Math Placement Test or Consent of Instructor
MATH 121 emphasizes advanced geometry including axiomatic foundations of the deductive process. The course integrates different elements of three-dimensional figures and algebraic/graphical representation of geometric principles. Problem solving will include the use of graphing calculators. This course develops a structured mathematical system employing both deductive and inductive reasoning. It includes plane, coordinate, and transformational geometry. Proof is developed and the concepts of congruence and similarity are investigated and applied. Algebraic methods are employed to solve problems involving geometric principles. While Euclidian geometry is the basis of most of the course some non-

Euclidian geometries are investigated. When appropriate, portions of MATH 121 will be applied to Foundations in Science courses.

MATH 200
Algebra II

1.25 Credit
College Preparatory

Prerequisites: Algebra I and Geometry
Algebra II is a course intended for students who possess a strong foundation in geometry and algebra. It is designed to challenge students and provide depth commonly found in collegiate level courses. Students will gain experience with algebraic equations and inequalities, functions (linear, polynomial, rational, irrational), graphs, systems of equations and inequalities, linear programming, matrices and determinants. The use of graphing calculators will be incorporated where appropriate.

MATH 201
Algebra II

1.25 Credit
Honors

Prerequisites: Algebra I and Proof Based Geometry or Consent of Instructor
Algebra II is a course intended for students who possess a strong foundation in geometry and algebra. It is designed to challenge students and provide depth commonly found in collegiate level courses. Students will gain experience with algebraic equations and inequalities, functions (linear, polynomial, rational, irrational), graphs, systems of equations and inequalities, linear programming, matrices and determinants. The use of graphing calculators will be incorporated where appropriate.

MATH 300
Pre-Calculus

1.25 Credit
College Preparatory

Prerequisites: Algebra I, Geometry and Algebra II
Pre-Calculus at the college preparatory level is a study of the Real number system, linear equations, graphical transformations, polynomials, functions (rational, power, and root), inverse functions in general with the exponential and logarithmic functions investigated in detail, trigonometric functions and trigonometric identities. Applications, common relationships, and graphing are stressed throughout the course topics. This course will give students both a detailed review of the algebraic foundation of mathematics and a preparation for further study of the mathematics necessary for additional scientific investigation and study.

MATH 301
Pre-Calculus

1.25 Credit
Honors

Prerequisites: Algebra I, Proof Based Geometry, and Algebra II (MATH 201 or equivalent)
This course is a rigorous study of functions and their properties. Trigonometric, polynomial, rational, radical, and exponential mathematical functions are studied in detail as well as sequences and series, vectors, parametric, and polar coordinates. Development of integrated mathematical tools for applications to science will include more advanced levels of mathematical modeling. This course provides a strong foundation in functions and equations

as they apply to both mathematical functions and models of science while preparing students to pursue calculus.

MATH 302
AP Statistics

1.25 Credit
Advanced Placement

Prerequisites: PreCalculus
This course provides an in-depth study of applied statistics. The focus is on four major areas of statistical analysis:
1. Exploratory data analysis;
2. Planning a statistical study (including experimental design and sampling theory);
3. Probability modeling and simulation;
4. Statistical inference.

This course should be particularly valuable to students with interests in mathematics, engineering, life sciences, environmental science, and medicine. As part of the course work, each student will plan and conduct a substantial statistical study in an area of his or her interest. Students who successfully complete the course will be prepared to take the AP Statistics exam in May.

MATH 412
AB Level Calculus

1.25 Credit
Advanced Placement

Prerequisite: Pre-Calculus Honors (MATH 301 or Equivalent)
This calculus course will provide students with all of the elements required for pursuing further collegiate study of calculus. The course is designed to prepare students for successful performance on the advanced placement exam at the AB level. Concepts presented will include use of graphical, numerical and symbolic representations and other materials usually required for the completion of at least one semester of college level calculus. Applications from biology, chemistry, physics as well as engineering are studied in the context of calculus. Technology is used where appropriate throughout the course. Students completing this course are prepared for successful completion of the calculus Advanced Placement exam (level AB).

MATH 422
BC Level Calculus

1.25 Credit
Advanced Placement

Prerequisites: Pre-Calculus Honors (MATH 301 or Equivalent) and Teacher Recommendation
BC Calculus is designed for the most advanced mathematics students interested in pursuing more intense mathematics at the college level. All course topics completed in AB Calculus will be covered at an accelerated rate. In addition, the course will include topics from areas of applied mathematics necessary to study concepts and principles underlying the physical sciences and engineering. Some of the advanced topics are polynomial approximations, infinite series, convergence and error bounds. Technology is used where appropriate throughout the course. Students completing BC Calculus are prepared for successful completion of the calculus Advanced Placement exam at the BC level.

MATH 431
Multivariable Calculus

0.625 Credit
Honors

Prerequisites: AP Calculus (BC), Linear Algebra, and Consent of Instructor
A college level introduction to multivariable calculus, topics covered include: vectors and vector functions; partial differentiation; multiple integrals; line integrals; surface area and volume; Green's theorem; Stoke's Theorem; the Divergence Theorem; and applications in the physical sciences and engineering. The MAPLE computer algebra system will be used throughout the course.

MATH 441
Intro to Differential Equations

0.625 Credit
Honors

Prerequisites: AP Calculus (BC), Linear Algebra, and Consent of Instructor
A college level introduction to differential equations, topics covered include: linear differential equations; equations of vibrational models; equations with variable coefficients; power series solutions and Bessel functions; Laplace transforms; systems of linear differential equations; numerical solutions; and applications in the physical sciences and engineering. The MAPLE computer algebra system will be used throughout the course.

MATH 451
Linear Algebra

0.625 Credit
Honors

Prerequisites or Co-requisite: AP Calculus (BC)
A college level introduction to linear algebra and matrix theory, topics covered include: vectors and vector geometry; linear systems; matrix operations and algorithms; eigenvalues and eigenvectors; orthogonality; and symmetric matrices and quadratic forms. The methods of linear algebra will be applied to problems in science, engineering, computer science, statistics, and other branches of mathematics. Linear algebra is sometimes called the "arithmetic of higher mathematics". It provides a solid foundation for advanced studies in mathematics, science, and engineering. Students planning to take Multivariable Calculus or Intro to Differential Equations in the senior year should take Linear Algebra concurrently with AP Calculus (BC).

MATH 461
Discrete Mathematics

0.625 Credit
Honors

Prerequisite: Pre Calculus
Co-requisites: AP Calculus (AB or BC) and AP Computer Science
A college level introduction to discrete mathematics as the mathematical foundation for computer science. The emphasis throughout the course will be on the connections between logic, proof, and algorithmic thinking. Topics covered include: algorithms; sets, relations, and functions; integers and modular arithmetic; combinatorics; and graph theory. Depending on time and student interest, additional topics may be selected from: advanced graph algorithms; flows in networks; recurrence relations and generating functions; finite state machines and formal languages. Key data structures and algorithms will be studied in the JAVA programming language.

PHYSICS

PHYS 101
Foundations in Physics and Engineering

1.25 Credit
Honors

Prerequisites: None
Foundations in Physics is a course designed to develop a comprehensive understanding of the fundamental concepts and principles in the field of physics. Students will explore the theories and applications of topics such as motion, energy, waves, electricity, magnetism, and light. This course will stress the integration of physics into other scientific disciplines including earth/space science and chemistry. A strong connection to mathematics will be emphasized throughout the course. This course will have a strong laboratory base where students will learn the fundamentals of science instrumentation and research techniques. Engineering applications of physical principles are emphasized, including electrical circuits, motors, forces, energy, and photonics.

PHYS 301
Photonics

0.625 Credit
Honors

Prerequisites: Introductory Physics
Photonics is a laboratory course that starts with the basic principles of light, color, photometry, radiometry, and geometric optics. The course then proceeds into the theory, design and practical applications of fiber optics. After that the course explores advanced topics in light including wave optics, lasers, interferometry and holography.

PHYS 311
Robotics

0.625 Credit
Honors

Prerequisites: Introductory Physics
Robotics is a project based course that starts with the basics of electricity, mechanics and software design and then proceeds into the theory, practical use and application of microprocessors, sensors, interfaces and motor controllers in order to read sensors, light LEDs, display alphanumeric information, make music, control motors and interface with other devices. Students will devise and construct real functioning Robots and Robotic systems of their own design.

PHYS 321
Electronics

0.625 Credit
Honors

Prerequisites: Introductory Physics
Electronics is a project based course that starts with the basic concepts of electricity and advances into the theory, practical use and application of analog and digital solid-state components. Students will have hands-on experience using the latest electronic diagnostic equipment such as multimeters, function generators, digital logic probes and oscilloscopes. Students will also use a computerized CAD/CAM system to design and make printed circuit boards for their own projects.

PHYS 331
Materials Science and Engineering

0.625 Credit
Honors

Prerequisites: Algebra II, Introductory Physics

Materials Science and Engineering is a laboratory-based physics course that is an introduction to understanding the properties, structures and uses of engineering materials, including metals, ceramics, polymers and composites. The course is designed to teach the fundamental principles of material science so that the student can better understand material behavior and the impact of material selection and material performance on the performance of a structure or mechanism due to the relationship between macroscopic properties and microscopic causes.

PHYS 341
Fluids and Thermodynamics

0.625 Credit
Honors

Prerequisites: Algebra II, Introductory Physics
Fluids and thermodynamics is a laboratory-based physics course that extends basic fluid and thermodynamic concepts to more complex applications. This course, designed for students who already have taken introductory physics, will go into areas and depth not normally addressed in high school classes. Topics will include: kinetic molecular theory; laws of thermodynamics; heat transfer; heat engines; entropy; buoyancy; viscosity; laminar and turbulent flow; fluid friction; and piping system analysis.

PHYS 351
Nuclear Physics & Chemistry

0.625 Credit
Honors

Prerequisites: Algebra II, Introductory Physics
Nuclear science is a laboratory-based physics course that is an introduction to understanding the nucleus of the atom.
This course, designed for students who already have taken introductory physics, will go into areas and depth not normally addressed in high school classes.
Topics will include: radiation detection; nuclear stability; unstable nuclei and radioactive decay; environmental radiation; radiation absorption and interactions with matter; radiation biology; nuclear reactions; and nuclear power and energy.

PHYS 402
Classical Mechanics

1.25 Credit
Advanced Placement

Prerequisites: Concurrent Placement in Pre-Calculus or Calculus
Classical Mechanics is a problem solving-based and laboratory intensive physics course that extends basic mechanics concepts to more complex applications. The curriculum follows the AP Physics C curriculum and includes an introduction to applied derivative and integral calculus. This course, designed for students who already have taken some introductory physics, will go into areas and depth not normally addressed in high school classes. Topics will include: motion in one and two dimensions; vectors; coordinate and velocity transformations; Newton's Laws; work and energy; conservation of energy and momentum; systems of particles; gravity and Kepler's laws; rotations; oscillations and waves.

PHYS 412
Electricity and Magnetism

0.625 Credit
Advanced Placement

Prerequisites: Introductory Physics; Concurrent Placement in Calculus
Electricity and Magnetism is based on the AP curriculum that covers the range of topics from the theories of electromagnetic fields and potential to the explanations and practical applications of the phenomena of resistance, capacitance, impedance and electromagnetic induction.

Active Learning at GHAMAS

GHAMAS students are expected to be active participants in the learning process. Students and staff work together cooperatively to foster student growth and to help students progress towards becoming active learners. The components of being an active and life long learner are outlined below. Students will be given opportunities to develop these skills across the curriculum.

ATTITUDES AND BELIEFS

- Is intrinsically motivated
- Takes risks
- Has a consistent work ethic
- Approaches learning as an ongoing process

SELF-KNOWLEDGE

- Recognizes strengths and weaknesses
- Capitalizes on strengths
- Works to improve weaknesses
- Incorporates prior knowledge and experiences

PROBLEM SOLVING

- Identifies the problem
- Collects and evaluates information
- Formulates and implements a plan of action
- Monitors progress and adjusts accordingly
- Analyzes results and draws conclusions
- Communicates conclusions effectively

MONITORING AND ADJUSTING

- Perseveres
- Brainstorms creative solutions to find alternate paths
- Views a temporary setback as a doorway to new learning

COMMUNICATION

- Uses appropriate terminology
- Makes information/ideas accessible to others
- Articulates proficiently

SOURCES

- Seeks out variety
- Evaluates validity of each source using established criteria