SCIENCE DEPARTMENT

All students are required to take and pass three years of science. In addition, all students are required to pass a Massachusetts Comprehensive Assessment System (MCAS) examination in one science subject area (Biology, Chemistry, or Engineering and Technology) in order to graduate. All lab sciences require completion of lab reports, which demonstrates an understanding of the scientific method and the ability to think critically and solve problems.

Traditional College and Career			**Pre-Engineering Technology College and Career**	
9th Grade: Life Science (CP1)	CP1 Biology **MCAS**	Honors Biology **MCAS**	Engineering and Technology I	Honors Engineering and Technology **MCAS**
10th Grade: CP1 Biology **MCAS**	CP1 Chemistry	Honors Chemistry	Engineering and Technology II **MCAS**	Honors Biology Or Physics of Robotics
11th Grade: CP1 Chemistry	CP1 Physics	Physics, AP courses	Physics of Robotics Or Electives	Adv. Physics of Robotics or Physics
10th - 12th Grade: Electives • Marine Biology • Ecology • A & P • Ocean Studies • Astronomy • Forensics • Eng., Man. & Design • Biotechnology	Electives	AP courses Electives	Advanced Physics of Robotics Or Electives	Advanced Physics of Robotics Or Electives

ENGINEERING AND TECHNOLOGY I (Lab) **5 Credits * Full Year * CP1 * Grade 9**
(Course Number 311-B)

Prerequisite: Concurrent enrollment or prior completion of Algebra 1.

This course introduces students to "Classical" Newtonian Physics. Students will learn about forces, motion, and energy. They will explore velocity, acceleration, free-fall, momentum, work, power, simple machines, sound, light, fluids, gas laws and electricity. This class is recommended for students in grade 9 who are following the college preparatory sequence or vocational career path. Students will take the Engineering and Technology MCAS in their sophomore year. Students who successfully complete this class should go on to Engineering and Technology II.

HONORS ENGINEERING AND TECHNOLOGY (Lab) **5 Credits * Full Year * Honors * Grade 9**
(Course Number 311-D)

Prerequisite: 9th grade only; proficiency demonstrated on previous MCAS assessments

Honors Engineering and Technology is an advanced level course designed for self -motivated students interested in pursuing degrees and careers in the fields of technology and engineering. Through the use of lectures, demonstrations, projects and weekly hands-on laboratory experiences students will gain knowledge in the following areas: engineering design, marketing, research and development, time management, leadership, product testing drafting and presentation. Students will develop an understanding of mechanics, fluid dynamics, electricity, forces and construction. Students will be required to read independently and conduct research for projects outside of school time. *The class is designed to prepare students to pass the Engineering and Technology MCAS Test their freshman year.*

LIFE SCIENCE (Lab) (Course Number 304) **5 Credits * Full Year * CP1* Grade 9 only**

Prerequisite: 9th grade only

This course is the study of life and living things. Topics include but are not limited to: biomes, populations, communities, cells, genetics, evolution, ecology, inquiry, behavioral patterns and human biology. A variety of teaching strategies and techniques will be used including laboratory techniques. Students completing this course will go on to CP1 Biology and take the Biology MCAS exam during 10th grade.

BIOLOGY (Lab) (Course Number 322) **5 Credits * Full Year * CP1* Grade 9-10**

College Prep Biology is a course intended for college bound students. This lab-oriented class will explore the science of life through a molecular and cellular approach. This course covers the same curriculum as Honors Biology. Students enrolled in this course will take the Biology MCAS exam.

BIOLOGY (Lab) (Course Number 321) **5 Credits * Full Year * Honors * Grade 9-10**

Honors Biology is an intensive course designed for motivated students. This lab-oriented class will explore the science of life through a molecular and cellular approach. Topics covered include biochemistry, cell structure and function, bioenergetics, origin of life and evolution, genetics, ecology and the human body. Laboratory activities will result in written lab reports. Individual research projects will be assigned each term. Students enrolled in this course will complete the Biology MCAS.

ENGINEERING AND TECHNOLOGY II (Lab) **5 Credits * Full Year * CP1 * Grade 10-11**
(Course Number 311-C)

Prerequisite: Passing grade in Engineering and Technology I
This class is open to 10th grade students or upperclassmen who have yet to pass the science MCAS.

Engineering and Technology is designed for students interested in a college/career pathway, with a focus on technology and engineering. Students will gain knowledge in the following areas: engineering design, marketing, research and development, time management, leadership, product testing drafting and presentation. Students will develop an understanding of mechanics, fluid dynamics, electricity, forces and construction. The class is designed to prepare students to pass the Engineering and Technology MCAS Test.

CHEMISTRY (Lab) (Course Number 332) **5 Credits * Full Year * CP1 * Grades 10-12**

Prerequisite: A passing grade in Biology or Engineering and Technology. Concurrent enrollment in Geometry or higher

Chemistry is intended to provide a solid foundation for college bound students pursuing a career in science or medicine and also as a general background for students planning non-science careers. As a lab course this course deals with the concepts of mass, matter, and energy, modern atomic and nuclear theory, the nature of chemical bonds, chemical reaction systems, chemical calculations, and general laboratory methods and techniques. Grades are based on lab reports, regular homework, tests, and two semester final exams.

CHEMISTRY (Lab) (Course Number 331) **5 Credits * Full Year * Honors * Grades 10-12**

Prerequisite: A passing grade of a B or better in Biology or Applied Technology II. Completed or concurrently enrolled in Algebra II

This is an accelerated and expanded version of Chemistry 332. All usual topics, including oxidation, reduction, nuclear chemistry, pH as well as an introduction to organic and biochemistry will be explored in depth. This course is intended for motivated students.

PHYSICS of ROBOTICS (Lab) (Course Number 343) **5 Credits * Full Year * CPI * Grades 11-12**

Prerequisite: Students must have a passing grade in a Science MCAS Test. A passing grade in at least Algebra I is recommended.

This course will introduce students to robotics and cover a gamut of topics such as "C" Programming Language, Autonomous Programming, Physics, Applied Mathematics, Robotic Theory and Logic. Concepts covered will be: engineering notebooks, robotic system design, torque, power, forces, sound, mechanics, electronics, electromagnetic waves, sensors, gear trains and Classical Newtonian Physics. Students will spend considerable time on PID (proportional, integral, derivative) control. This will be a hands-on Lab course for students interested in engineering and or a technical college. Students will design, build and program, from concept to completion a remote controlled vehicle. This course is for serious students and requires considerable on-line study and testing outside of the classroom. *This class cannot be taken as a MCAS preparatory course.*

ADVANCED PHYSICS of ROBOTICS (Lab) **5 Credits * Full Year * Honors * Grades 11-12**
(Course Number 343-H)

Prerequisite: Juniors and Seniors only. Students must have a passing Science MCAS score, as well as a passing grade in or concurrently taking Algebra II.

In this course students will be engrossed into engineering. This course is perfect for the home hobbyist. Topics covered but limited to are: electronics, mechanics, advanced "C" language programming, schematics, bread boarding, prototyping, logic, autonomous control, robotic integration, data filtering, CAD (SolidWorks). Students will use 3D scanners as well as different types of 3D printers and printing material. This course is designed for independent, motivated learners who are passionate in design and building technology. *This class cannot be taken as a MCAS preparatory course.*

PHYSICS (Lab) (Course Number 342) **5 Credits * Full Year * CPI * Grades 11-12**

Prerequisite: Passing grade in or concurrently taking Trigonometry & Pre-Calculus

This course is an intensive application of physics; and is designed for students who are planning to attend a four-year college, especially those interested in majoring in Engineering. This physics class is highly kinesthetic; students will work in teams to achieve greater understanding of concepts, with an emphasis on problem solving. Topics covered include: Newtonian physics, projectile motion, thermodynamics, electricity, electronics, relativity and quantum mechanics. Students will be assessed on their labor intensive Labs as well as their ability to work in teams.

PHYSICS (Lab) (Course Number 341) **5 Credits * Full Year * Honors * Grades 11-12**

Prerequisite: "C" or better in Trigonometry & Pre-Calculus

This class recommended for students entering a STEM related field. Physics Honors is an intensive course introducing students to topics in mechanics, thermodynamics, wave phenomena, electricity and magnetism, as well as modern physics. Emphasis is on the application of intermediate mathematics to problem solving, and the practical applications of ideas to real world situations.

ADVANCED PLACEMENT ® BIOLOGY (Lab) **10 Credits * Full Year * AP * Grades 11-12**
(Course Number 320)

Prerequisite: Grade of "B" or better in Chemistry and Biology and teacher recommendation

This course is designed to be the equivalent of a college introductory biology course usually taken by biology majors during their first year. With appropriate test scores, some AP students may be allowed to take an upper level Bio as their first Biology course in college. This course will involve extensive outside reading, laboratory investigations, individual research and field studies. Guided and independent laboratory work will be and integral part of the course. Selected topics include the four big ideas of biology: evolution, energy, genetics, and interaction.

ADVANCED PLACEMENT ® CHEMISTRY (Lab) **10 Credits * Full Year * AP * Grades 11-12**
(Course Number 335)

Prerequisite: "B" or better in Biology, Chemistry and Algebra II and teacher recommendation

AP Chemistry provides the equivalent to a college level course in chemistry. The course will expand on topics covered in the first year of chemistry as well as focus on fundamental particles, matter and its physical and chemical properties and the changes it undergoes, stoichiometry, kinetics, thermochemistry, equilibrium, electrochemistry, bonding and intermolecular forces, and introductory organic chemistry. There will be substantial laboratory work. Completion of a summer assignment is required and attendance at summer sessions is highly recommended.

ADVANCED PLACEMENT ® PHYSICS (Lab) **10 Credits * Full Year * AP * Grades 11-12**
(Course Number 336)

Prerequisite: Successful completion of or concurrent enrollment in Calculus and teacher recommendation

This course is intended to prepare students to pursue studies in science related major at the college level. The course has earned the College Board's designation for Physics C, which covers an area of physics called mechanics, and is intended to prepare students to be successful on the AP exam. Topics include two- and three-dimensional motion, forces, work and energy, linear and angular momentum, gravitation, and oscillations. Attendance at summer sessions and completion of summer assignments is required.

ENGINEERING, MANUFACTURING & DESIGN (Lab) **5 Credits * Full Year * Honors * Grades 10-12**
(Course Number 330)

Prerequisite: Students must have a passing Science MCAS score

Engineering, Manufacturing & Design is a (Science Technology, Engineering and Manufacturing) S.T.E.M. course that is open to and relevant for all learners, especially those interested in engineering. Students will have extensive CAD modeling time utilizing the industry standard, "SolidWorks". Students will be entrenched in the engineering design process, producing prototypes and finished solutions that will meet the student's need / problem. Students will be utilizing modern design, analysis and fabrication techniques. Through application of quantitative and qualitative options students will justify and defend their decisions throughout their educational journey. Students will engage in science by designing and carrying out investigations of real world questions and explore the meanings of disciplinary core ideas. They will use crosscutting concepts to meet performance expectations and to produce successful personalized and relevant projects.

This Project Based Science class will include experience with the following: 3D printing using different materials, 3D scanning, Quad Copter Drone design, electronics, build and programing, Unmanned Aerial System (AUS) laws and safety, flight simulator time and outdoor flight time.

ANATOMY & PHYSIOLOGY (Lab) (Course Number 345) **5 Credits * Full Year * CP1 * Grades 11-12**

Prerequisite: Passing grade in Biology; Chemistry recommended

This course will explore the biology of the human body. It examines the structure of cells, tissues, and organs that make up our bodies, and will examine how these components function. Basic biological and chemical principles vital to the understanding of the human organism will be introduced, followed by an introduction to the study of the structures and functions of the human body. Systems covered will be the skeletal, muscular, nervous, endocrine, cardiovascular, respiratory, immune, digestive, urinary, and reproductive systems. Related topics such as diseases and clinical problems will be integrated where applicable.

ANATOMY & PHYSIOLOGY (Lab) (Course Number 345H) **5 Credits * Full Year * Honors * Grades 11-12**

Prerequisite: Grade of "C" or higher in Biology and Chemistry

Honors Anatomy & Physiology is an intensive, advanced level course designed for self-motivated students. This course will explore the biology of the human body. It examines the structure of cells, tissues, and organs that make up our bodies, and will examine how these components function. Basic biological and chemical principles vital to the understanding of the human organism will be introduced, followed by an introduction to the study of the structures and functions of the human body. Students will understand the skeletal, muscular, nervous, endocrine, cardiovascular, respiratory, immune, digestive, urinary, and reproductive systems. Related topics such as diseases and clinical problems will be integrated where applicable.

ASTRONOMY (Course Number 363) **2.5 Credits * One Semester * CP1 * Grade 11-12**

Prerequisite: Grade of "C" or higher in Algebra II

This course will cover the history of astronomy from Aristotle until today; the development and use of telescopes and other tools of astronomers; the formation and current state of the solar system; basic astrophysics including planetary motion, Newton's law of gravitation, and Kepler's Laws; stellar evolution. Also covered is the electromagnetic spectrum and its use in studying celestial objects. The course will conclude with exciting contemporary topics such as black holes, the expansion of the universe and the search for extraterrestrial life.

ECOLOGY (Course Number 362) **2.5 Credits * One Semester * CP1* Grades 10-12**

Prerequisite: Passing grade in ninth grade science

This course is designed to build a student's appreciation of the delicate balance of nature through the study of contrasting environments such as desert, forest, tundra, grasslands, and wetlands. Emphasis will be placed on plant and animal adaptations as well as predatory/prey relationships. Man's effect on nature will also be researched through discussion on current environmental issues.

MARINE BIOLOGY (Lab) (Course Number 352) **2.5 Credits * One Semester * CP1* Grades 10-12**

Prerequisite: Passing grade in ninth grade science

Marine Biology is an introduction to the biology of marine organisms. Selected organisms will be used to develop an understanding of the biological principles common to marine organisms. The taxonomy, evolution, ecology, behavior, and physiology of marine life will be discussed. Lectures, demonstrations, videos, and local field trips will stress the identification of local marine forms.

FORENSIC SCIENCE (Lab) (Course Number 365) **2.5 Credits * One Semester * CP1* Grades 10-12**

Prerequisite: Passing grade in 9th grade science; recommendation of science teacher; passing grade in science MCAS

Students will use CSI-type laboratory techniques to explore the science behind crime scene investigation and evidence examination. Units of study include hair, soil and fiber analysis; fingerprinting techniques and analysis; blood and blood splatter patterns; dental, footwear and tire impressions; and DNA fingerprinting. Students will be expected to complete labs, reports, and demonstrate proficiency in exams and a capstone project. Due to the mature subject matter of this course and the equipment and supplies utilized, students must have the ability to work safely and independently in a lab. As the subject matter can be disturbing at times, parental consent is required to take this course.

BIOTECHNOLOGY **2.5 Credits * One Semester * CP1* Grades 10-12**
(Course Number 326)

Prerequisite: Passing grade in Chemistry or currently enrolled in Chemistry with passing grade in Biology

This course provides an introduction to current biotechnology practices. The theory of biotechnology, along with hands-on laboratory experience, provides the student with a general background of the biotechnology industry. Biotechnology companies follow current good manufacturing practices (cGMP), which are regulated by the Food and Drug Administration (FDA). CGMP details quality management, buildings and design, equipment and personnel requirements, facility and equipment cleaning, production and process controls, packaging, labeling, complaint handling, and record keeping. Along with the theory and government regulations are general laboratory skills. These skills include preparation of solutions, pH measurements, microbiological techniques, spectroscopy, protein determination, and separation techniques (filtration, centrifugation, chromatography, and/or electrophoresis). In addition, students learn what job opportunities are available with a biotechnology education. Different careers offered in biotechnology companies are positions in manufacturing, Quality Control (QC), Quality Assurance (QA), Regulatory and /or Research and Development (R&D).

OCEAN STUDIES (Course Number 347) **5.0 Credits * Full Year * CP1 * Grades 10-12**

Prerequisite: Passing grade in Biology

This class will concentrate on the physical, chemical, geological, and biological aspects of the ocean. Students will gain an appreciation of the ocean and the role it plays in making life on Earth possible. Topics covered consist of: introductory oceanography topics, like water chemistry, topography, waves and tides. Other topics covered include: marine ecology, habitats, animal adaptations, and marine sustainability. The course will also incorporate a section of maritime and boat building.

PRINCIPLES OF TECHNOLOGY (Course Number 922) **5 credits * Full Year * Core Focus * Grades 9-11**

Prerequisite: Recommendation of the GHS Special Education Department

This class is only open to students by decision of the Special Needs department and is designed for students requiring specifically designed instruction and who are interested in the fields of technology and engineering. The course will use demonstrations, projects and hands-on laboratory experiences to reinforce the understanding of force, motion, energy, velocity, acceleration, momentum, work, power, simple machines, sound, light, and electricity. Students will prepare to take the Engineering and technology MCAS exam.

LIFE SCIENCE (Course Number 915b)	**5 Credits * Full Year * Core Focus * Grade 9**

Prerequisite: Recommendation of the GHS Special Education Department

This course is for students requiring specifically designed instruction in the study of life and living things. It focuses on patterns of thinking that apply to biological communities and individual organisms. Special topics include ecology, biomes, populations, communities and behavioral patterns.

BIOLOGY (Course Number 915a)	**5 Credits * Full Year * Core Focus * Grade 10**

Prerequisite: Life Science 915b; Recommendation of the GHS Special Education Department

Biology 915a is for students requiring specifically designed instruction. This laboratory-oriented class will explore the science of life through a molecular and cellular approach. Laboratory reports will be generated on a weekly basis as laboratory activities are performed. The same topics as CP Biology will be covered at a less rigorous pace. Students enrolled in this course will complete the Biology MCAS.

SOCIAL STUDIES DEPARTMENT

All students are required to take and pass three years of Social Studies including U.S. History 9, U.S. History 10 and World Regions and Cultures.

UNITED STATES HISTORY (Course Number 111U)	**5 Credits * Full Year * Honors * Grade 9**
UNITED STATES HISTORY (Course Number 112U)	**5 Credits * Full Year * CP1 * Grade 9**
UNITED STATES HISTORY (Course Number 113U)	**5 Credits * Full Year * CP2 * Grade 9**

United States History 9 is a concept-based approach to the study of the historical and intellectual origins of the United States from the year 1400 to 1877. Students will learn about important developments that helped shape American society during its early history. Study will include exploration of a new world, causes for colonial conflict, revolution for independence, the key ideas and writing of the United States Constitution, the sectional differences, causes, and consequences of the Civil War and Reconstruction.

UNITED STATES HISTORY (Course Number 913) **5 Credits * Full Year * Core * Grade 9**

**Prerequisite: Recommendation of the GHS Special Education Department*

UNITED STATES HISTORY Grade 10 (Course Number 121U)	**5 Credits*Full Year*Honors**
UNITED STATES HISTORY Grade 10 (Course Number 122U)	**5 Credits*Full Year*CP1**
UNITED STATES HISTORY Grade 10 (Course Number 123U)	**5 Credits*Full Year*CP2**

In United States History 10 students will study the time period beginning with the year 1877 up through the year 2000. They will analyze the causes and consequences of the Industrial Revolution and America's growing role in diplomatic relations. Other topics of study include the Progressive movement, the New Deal, World Conflict, the Cold War, and the Civil Rights movement. Students will also engage in a study of economic, social, and political issues of the second half of the 20th century.

UNITED STATES HISTORY (Course Number 914) **5 Credits * Full Year * Core * Grade 10**

**Prerequisite: Recommendation of the GHS Special Education Department*