Typical Computer Science and Engineering Progressions

Note:

Students are strongly encouraged to meet with both the high school counselor AND the programmatic teacher(s) for advisement EARLY in the progression process. This is highly recommended BEFORE entering grade 9.

Program	Grade 9	Grade 10	Grade 11	Grade 12
Robotic Engineering	Computer Science Essentials or Intro to Eng Design	Principles of Engineering	Robotic Engineering I Applied Math Robotics I	Robotic Engineering II Applied Math Robotics II
Engineering	Introduction to Engineering Design	Principles of Engineering	Civil Engineering and Architecture	Robotic Engineering I Applied Math Robotics I
Computer Science	Computer Science Essentials	AP Computer Principles	Cybersecurity or AP Computer Science A	AP Computer Science A or Cybersecurity

AP Computer Science A

Credit: 1
Weighting: 5

Course Description

A student taking this course should be comfortable with functions and function notation. It is important that students understand that this course builds upon a foundation of mathematical reasoning that should be acquired before attempting this course.
This course emphasizes object-oriented programming methodology with an emphasis on problem solving and algorithm development and is meant to be the equivalent of a first-semester course in computer science. It also includes the study of data structures and abstraction. This course covers the following topics: Object-Oriented Program Design, Program Implementation, Program Analysis, Standard Data Structures, Standard Algorithms, and Computing in Context.

Course Requirements

Prerequisite: Knowledge of basic English and Algebra

AP Computer Science Principles

Credit: 1
Weighting: 5

Course Description

Computer Science Principles (CSP) is a PLTW course to implement the College Board's new AP CS Principles framework. Students work in teams to develop computational thinking and solve problems. The course does not aim to teach mastery of a single programming language but aims instead to develop computational thinking, to generate excitement about the field of computing, and to introduce computational tools that foster creativity. The course also aims to build students' awareness of the tremendous demand for computer specialists and for professionals in all fields who have computational skills. Each unit focuses on one or more computationally intensive career paths. The course also aims to engage students to consider issues raised by the present and future societal impact of computing.

Course Requirements

None

Applied Math Robotics I

Credit: .5
Weighting: 0

Course Description

It is crucial for students to develop algebraic thinking and engineering design skills as we prepare to compete in the global economy. Algebraic thinking involves identifying patterns, relationships, and functions between one or more objects and being able to find the interrelationships between the variables that make up the objects; it is the beginning of symbolic reasoning. Engineering design skills provide students with a systematized methodology for solving complex problems; it is rigorous creativity. The Robot Algebra Project uses classroom friendly technologies to develop students' algebraic thinking and reasoning skills by placing them in technology-rich problem solving situations where they must find the mathematical rule of principle to unlock the solution to the problem and then apply that rule across multiple contexts.

Course Requirements

Prerequisite: Student must be enrolled in Robotics Engineering I (.5 credit) at the same time as this course; instructor approval needed. One-half semester credit will be given for ***each*** course: Applied Mathematics Robotics I and Robotic Engineering I.) (Limit 10 students)

Applied Math Robotics II

Credit: .5
Weighting: 0

Course Description

It is crucial for students to develop algebraic thinking and engineering design skills as we prepare to compete in the global economy. Algebraic thinking involves identifying patterns, relationships, and functions between one or more objects and being able to find the interrelationships between the variables that make up the

objects; it is the beginning of symbolic reasoning. Engineering design skills provide students with a systematized methodology for solving complex problems; it is rigorous creativity. The Robot Algebra Project uses classroom friendly technologies to develop students' algebraic thinking and reasoning skills by placing them in technology-rich problem solving situations where they must find the mathematical rule of principle to unlock the solution to the problem and then apply that rule across multiple contexts.

Course Requirements

Successful completion of Applied Math Robotics I **and** Robotic Engineering I is a prerequisite for this second-level course. Instructor approval is also required.

Applied Math Robotics III

Credit: .5
Weighting: 0

Course Description

It is crucial for students to develop algebraic thinking and engineering design skills as we prepare to compete in the global economy. Algebraic thinking involves identifying patterns, relationships, and functions between one or more objects and being able to find the interrelationships between the variables that make up the objects; it is the beginning of symbolic reasoning. Engineering design skills provide students with a systematized methodology for solving complex problems; it is rigorous creativity. The Robot Algebra Project uses classroom friendly technologies to develop students' algebraic thinking and reasoning skills by placing them in technology-rich problem solving situations where they must find the mathematical rule of principle to unlock the solution to the problem and then apply that rule across multiple contexts.

Course Requirements

Successful completion of Applied Math Robotics II and/or Robotic Engineering II is a prerequisite for this third-level course. Instructor approval is also required.

Civil Engineering and Architecture

Credit: 1 (3 college credits)
Weighting: 4

Course Description

Students in this course will engage in a variety of experiences that will provide an overview of the fields of Civil Engineering and Architecture. In addition, students learn Revit, which is a state of the art 3D design software package from AutoDesk. Students will utilize the Revit software to aid them in the development and design of their course projects. Students learn about documenting their project, solving problems, and communicating their solutions to their peers and members of the professional community of civil engineering and architecture.

A major focus of the Civil Engineering and Architecture (CEA) course is a long-term project that involves the development of a local property site. As students learn about various aspects of civil engineering and architecture, they apply what they learn to the design and development of this property. College credit is awarded by Rochester Institute of Technology (RIT).

Course Requirements

Limited seating due to safety constraints for tools and Machines

Computer Science Essentials

Credit: 1

Weighting: 0

Course Description

Computer Science Essentials (CSE) is designed as an excellent entry point for new high school computer science (CS) learners; it is the first in a 4-year sequence of classes. Students who have prior CS experiences will find many opportunities to expand upon those experiences in this course. There will be many opportunities for creative expression and exploration in topics of personal interest, whether it be through app development, web design, or connecting computing with the physical world. CS Essentials introduces students to coding fundamentals through an approachable, block-based programming language where they will have early success in creating usable apps. As students sharpen their computational thinking skills, they will transition to programming environments that reinforce coding fundamentals by displaying block programming and text based programming side-by-side creating programs that will send self-driving vehicles through obstacle courses. Finally, students will learn the power of text-based programming as they are introduced to the Python® programming language. This course will help students gain confidence and reinforce essential concepts and skills that build toward life-long success in the computer science pathways beyond just PLTW courses.

Course Requirements

None

Cyber Security

Credit: 1

Weighting: 0

Course Description

As our world becomes increasingly dependent on technology, cybersecurity is a topic of growing importance. It is crucial that companies and individuals take precautions to protect themselves from the growing threat of cyber-attacks. This course prepares students with crucial skills to be responsible citizens in a digital future.

The Introduction to Cybersecurity is the first online blended K12 cybersecurity course. The Vigenère year-long version is designed for students with some exposure to computer science, but there are no specific course prerequisites. Students will learn foundational cybersecurity topics including digital citizenship and cyber hygiene, the basics of cryptography, software security, networking fundamentals, and basic system administration and all through the CodeHS web-based platform. Students will complete projects at the end of each module, and a culminating course project where they will complete a simulated hack walkthrough. This is not a coding intensive course, but students will learn basic SQL, and will utilize basic HTML and JavaScript within specific contexts and will be provided supports within those contexts.

Course Requirements

None

Introduction to Engineering Design

(Also satisfies requirements for ***Design and Drawing for Production***)

Credit: 1

Weighting: 0

Course Description

Introduction to Engineering Design (IED) is a high school level course that is appropriate for 9th or 10th grade students who are interested in designing, engineering or a technical career. The major focus of the IED course is to expose students to a design process, professional communication and collaboration methods, design ethics, and technical documentation. IED gives students the opportunity to develop skills in research and analysis, teamwork, technical writing, engineering graphics, and problem solving through activity-, project-, and problem-based (APPB) learning. Used in combination with a teaming approach, IED challenges students to continually hone their interpersonal skills and creative abilities while applying math, science, and technology knowledge learned in other courses to solve engineering design problems and communicate their solutions. IED also allows students to develop strategies to enable and direct their own learning, an ultimate goal of education.

In addition, students will use industry standard 3D solid modeling software to facilitate the design and documentation of their solutions to design problems and challenges. As the course progresses and the complexity of the design problems increase students will learn more advanced computer modeling skills as they become more independent in their learning, more professional in their collaboration and communication, and more experienced in problem solving. Some of the activities they may engage in will utilize mechanisms, motors and the use of the wood shop to build working models.

Course Requirements

None

Principles of Engineering

Credit: 1

Weighting: 4

Course Description

Principles Of Engineering (POE) is a high school-level survey course of engineering. The course exposes students to some of the major concepts that they will encounter in a post-secondary engineering course of study. Students have an opportunity to investigate engineering and high tech careers. POE gives students the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APPB) learning. Used in combination with a teaming approach, APPB learning challenges students to continually hone their interpersonal skills, creative abilities, and problem solving skills based upon engineering concepts. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.

Unit 1 <u>Energy and Power</u> *(25 days)*
Lesson 1.1 Mechanisms (8 days)
Lesson 1.2 Energy Sources (5 days)
Lesson 1.3 Energy Applications (5days)
Lesson 1.4 Design Problem –Energy and Power (6 days)

Unit 2 Materials and Structures *(20 days)*
Lesson 2.1 Statics (7 Days)
Lesson 2.2 Material Properties (5Days)
Lesson 2.3 Material Testing (5Days)
Lesson 2.4 Design Problem – Materials and Structures (2 Days)

Unit 3 Control Systems *(23 days)*
Lesson 3.1 Machine Control (coding) (8 days)
Lesson 3.2 Fluid Power (7 days)
Lesson 3.3 Design Problem – Control Systems (7 days)

Unit 4 Statistics and Kinematics *(7 days)*
Lesson 4.1 Statistics (2 Days)
Lesson 4.2 Kinematics (5 Days)

Course Requirements

Introduction to Engineering Design (for Engineering Sequence)
Computer Science Essentials or Introduction to Engineering (for Robotic Engineering Sequence)

Robotic Engineering I

Credit: .5
Weighting: 0

Course Description

A first course in robotics starts from the ground floor when exploring the applications and methods of robotic engineering technology. The course discusses motors, microprocessors, mechanics, artificial intelligence and sensors. It teaches the theory of electrical, pneumatic and hydraulic control systems as well as real-time programming and the concepts of work envelope. The class also discusses the various use of robotics in different fields, such as aerospace, medical, automotive and manufacturing industries. This course is taught in conjunction with Applied Math Robotics where Coding is the emphasis.

Course Requirements

Prerequisite: To be taken in conjunction with Applied Math Robotics I

Robotic Engineering II

Credit: .5
Weighting: 0

Course Description

Multidisciplinary teams of students design, build, and demonstrate a robotic system, including all sensing, computation, and actuation. The specific VEX state robotic competition tasks, such as stacking, shooting, climbing etc, changes each year, and is designed to be challenging for ambitious students. Robots will compete in NY State Vex competitions periodically 2 to 3 times during the term. This course is taught in conjunction with Applied Math Robotics 2 where Coding for competitions is the emphasis.

Course Requirements

Prerequisite: To be taken in conjunction with Applied Math Robotics II

Robotic Engineering III

Credit: .5

Weighting: 0

Course Description

This 3rd year course will involve students in the development, building and fabrication of robotics chassis'. Students will work hands on in teams to design, build, program and document their progress. Topics may include motor control, gear ratios, torque, friction, sensors, decision making, propulsion systems and locomotive systems. The objective of this course is to use a hands on approach to introduce the basic concepts in robotics, focusing on The VEX state robotics competition and tournaments.. Students who successfully complete this course will have learned:

- Fundamentals of programming concepts
- Scientific method and inquiry
- Basic physics and physical science concepts
- Programming concepts related to robotics
- Fundamentals of engineering concepts related to robotics
- Focus on teamwork and collaboration
- Robotics competitions and the robotics industry
- Introduction to 3D modeling of robotics

Course Requirements

Prerequisite: To be taken in conjunction with Applied Math Robotics III