# Robotics Focus

The Robotics program provides students with the principles of robotics and programming. Areas of study include methodology, algorithms, data structures and object-oriented programming. Java, Python, javascript and C++ are the primary languages taught.

## Introduction

The competencies in this document are designed to clearly state what the student should know and be able to do upon completion of an advanced high school Robotics program. These standards are designed for a two course sequence that prepares the student for technical assessments directly aligned to the standards.

These exit-level competencies are designed for the student to complete all competencies through their completion of a program of study. These competencies are intended to guide curriculum objectives for a program of study.

The standards are organized as follows:

* Competencies are general statements that identify major areas of knowledge, understanding, and the skills students are expected to learn in key subject and career areas by the end of the program.
* Standards follow each content standard. Standards identify the more specific components of each Competency and define the expected abilities of students within each Competency.
* Learning Targets are very specific criteria statements for determining whether a student meets the Standard. Learning Targets may also be used as learning outcomes, which teachers can identify as they plan their program learning objectives.

The crosswalk and alignment section of the document shows where the Learning Targets support the New Hampshire Content Standards. Where correlation with an academic content standard exists, students in the Robotics program perform learning activities that support, either directly or indirectly, achievement of the academic Competencies that are listed.

All students are encouraged to participate in the career and technical student organization (CTSO) that relates to the Robotics program. CTSOs are co-curricular national organizations that directly reinforce learning in the CTE classroom through curriculum resources, competitive events, and leadership development. CTSOs provide students the ability to apply academic and technical knowledge, develop communication and teamwork skills, and cultivate leadership skills to ensure college and career readiness.

The Employability Skills for Career Readiness identifies the “soft skills” needed to be successful in all careers and must be taught as an integrated component of all CTE course sequences. These Competencies are available in a separate document.

The Standards Reference Code is only used to identify or align Learning Targets listed in the Competency to daily lesson plans, curriculum documents, or national standards. The Standards Reference Code is an abbreviated name for the program, and the Competency, Standard, and Learning Targets are referenced in the program Competency. This abbreviated code for identifying competencies uses each of these items. For example, RCS is the Standards Reference Code for Robotics Programming. For Competency 2, Standard 3 and Learning Target 4 the Standards Reference Code would be RCS.2.3.4.

# Algorithms and Programming

Create meaningful and efficient programs including choosing which information to use and how to process and store it, breaking apart large problems into smaller ones, recombining existing solutions, and analyzing different solutions.

## 1.0 Programming

### 1.1 Program Design

1.1.1

### 1.2 Data Structures

1.2.1

### 1.3 Modularity

1.3.1

### 1.4 Algorithms

1.4.1

# Data and Analysis

Synthesize concepts, practices and processes of data collection, resource management, and techniques to different types of data in order to discover useful information that can communicate storytelling and to inform decision-making.

## 2.0 Data and Analysis

### 2.1 Storage

4.1.1 Save, retrieve, copy, and delete files from a computing device.

4.1.2 Explain how computers store information in bits and bytes and define what information is stored.

4.1.3 Describe how numbers, text, and media are represented in bits/bytes and stored as files.

4.1.4 Assess the benefits and drawbacks of various storage models, including cloud storage, by considering factors such as cost, speed, reliability, accessibility, privacy, and integrity.

### 2.2 Collection, Visualization, And Transformation

4.2.1 Collect data using an appropriate tool and organize it.

4.2.2 Collect, organize, and present data in at least three different formats and use it to support a claim or tell a story.

4.2.3 Analyze how data collection and visualization/storytelling can be shaped by human motive, perspective, and bias.

4.2.4 Develop a simple algorithm or program that allows them to organize and represent a dataset to analyze findings, predict future outcomes, or infer trends

4.2.5 Describe the attributes that define big data, including volume, velocity, variety, veracity, and value and consider how big data has transformed our everyday lives.

### 2.3 Inference And Models

4.3.1 Identify patterns in data, charts, and/or graphs.

4.3.2 Create a simple model that organizes patterns observed in data, charts, and/or graphs.

4.3.3 Make predictions based on patterns found in data, charts, and/or graphs.

4.3.4 Create a computational model based on patterns observed in data and use it to predict future outcomes.

4.3.5 Create a computational model based on patterns observed in data and use it to predict future outcomes.

# Computing Systems

Apply concepts of physical components and software that make up a computing system which communicate and process information in digital form, along with practices and methodology for troubleshooting issues in those systems.

## 3.0 Circuits

### 3.1 Electricity

3.1.1

### 3.2 Circuits

3.2.1

## 4.0 Robot Systems

### 4.1 History of Robots

4.1.1

### 4.2 Components

4.2.1

### 4.3 Software

4.3.1

## 5.0 Safety procedures

### 5.1 Safety hazards

5.1.1

### 5.2 Safe work practices

5.2.1

# Networks and the Internet

Apply networking concepts, using various models to implement protocols and standards when moving data. Design systems with working switching and routing "packets" to ensure data flows to the correct destination. Ensure data traffic flows through the internet effectively.

# Cybersecurity

Prove how to detect, prevent and mitigate threats in order to secure a computing system or network in an ethical manner, and in accordance with international, federal,state, local and cyber laws and regulations.

## 6.0 System and Security

### 6.1 Security Issues

6.1.1

### 6.2 Network System hardware

6.2.1

### 6.3 Network Protocols

5.3.1

# Robotics Curriculum Framework

## Program of Study

The program of study illustrates the sequence of academic and career and technical education coursework that is necessary for the student to successfully transition into postsecondary educational opportunities and employment in their chosen career path.

## Program Structure

The core course sequencing provided in the following table serves as a guide to schools for their programs of study. Each course is listed in the order in which it should be taught and has a designated level. Complete program sequences are essential for the successful delivery of all state standards in each program area.

**Robotics I**

**Robotics II**

**Robotics III (optional)**

The core course sequencing with the complementary courses provided in the following table serves as a guide to schools for their programs of study. Each course is listed in the order in which it should be taught and has a designated level. A program does not have to utilize all of the complementary courses in order for their students to complete their program of study. Complete program sequences are essential for the successful delivery of all state standards in each program area.

## Robotics I

This course will introduce students to the essential ideas of Robotics and show how computing and technology can influence the world. This course focuses on technology and programming as a means to solve computational problems and find creative solutions. The appropriate use of technology and industry-standard equipment is an integral part of this course.

### Technical Competencies

**1.0 Programming**

**2.0 Data and Analysis**

**3.0 Circuits**

**4.0 Robot Systems**

**5.0 Safety Procedures**

**6.0 Systems and Security**

### CTE Professionalism and IT Essentials Competencies

Terminology and Communications

Tools and Equipment

Project Management

Applied Mathematics

Safety

## Robotics II

This course will introduce students to the essential ideas of Robotics and show how computing and technology can influence the world. This course focuses on technology and programming as a means to solve computational problems and find creative solutions. Students will creatively address real-world issues and concerns while using the same processes and tools as artists, writers, computer scientists, and engineers to bring ideas to life. The appropriate use of technology and industry standard equipment is an integral part of this course.

### Technical Competencies

**1.0 Programming**

**2.0 Data and Analysis**

**3.0 Circuits**

**4.0 Robot Systems**

**5.0 Safety Procedures**

**6.0 Systems and Security**

### CTE Professionalism and IT Essentials Competencies

Terminology and Communications

Tools and Equipment

Project Management

Applied Mathematics

Safety

## Robotics III

This course provides intermediate Programming students with instruction in advanced techniques and using sensors to more accurately accomplish tasks or problem solve. The appropriate use of technology and industry-standard equipment is an integral part of this course.

### Technical Competencies

Students have achieved all program content standards and will pursue advanced study through investigation and indepth research

### CTE Professionalism and IT Essentials Competencies

Students have achieved all program content standards and will pursue advanced study through investigation and indepth research.

### Sample Topics

* Internship
* Capstone Project
* Portfolio
* Class Project Manager
* Teaching Assistant
* CTSO Leadership