Unit	Content	Skills	Assessment	Standards
What is Automation and Robotics?	Automation is the use of technology to ease human labor or to extend the mental or physical capabilities of humans. Robotics is the specialized field of engineering and computer science that deals with the design, construction, and application of robots. The use of automation and robotics affects humans in various ways, both positively and negatively, including their safety, comfort, choices, and attitudes about a technology's development and use. Automation and robotics have had an influence on society in the past and present and will influence society in the future. Engineers, designers, and engineering technologists are needed in high demand for the development of future technology to meet societal needs and wants	Describe the purpose of automation and robotics and its effect on society. Summarize ways that robots are used in today's world and the impact of their use on society. Describe positive and negative effects of automation and robotics on humans in terms of safety and economics. Investigate a career related to automation and robotics and determine the requirements for entering the field.	A Brief History of Robotics Assessment Robot Research Project	**Common Core State Standards for English Language Arts** *Reading* *Key Ideas and Details* 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. (AS.R.1) 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. (AS.R.4) 7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words. (AS.R.7) *Text Types and Purposes* 2. Write informative/explanatory texts to examine and convey complex ideas and

				information clearly and accurately through the effective selection, organization, and analysis of content. (AS.W.2) 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (AS.W.4) 7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation. (AS.W.7) *Comprehension and Collaboration* 1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. (AS.SL.1) 2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. (AS.SL.2) 4. Present information, findings, and supporting evidence such that listeners

				can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. (AS.SL.4) **Standards for Technological Literacy** *Students will develop an understanding of the characteristics and scope of technology.* 6-8 F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (1.6-8.F) H. Technology is closely linked to creativity, which has resulted in innovation. (1.6-8.H) 9-12 M. Most development of technologies these days is driven by the profit motive and the market. (1.9-12.M) *Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.*

				6-8 D. Technological systems often interact with one another. (3.6-8.D) *Students will develop an understanding of the cultural, social, economic, and political effects of technology.* 6-8 D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. (4.6-8.D) E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (4.6-8.E) F. The development and use of technology poses ethical issues. (4.6-8.F) G. Economic, political, and cultural issues are influenced by the development and use of technology. (4.6-8.G) *Students will develop an understanding of the role of society in the development and use of technology.*

				6-8 E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. (6.6-8.E) *Students will develop an understanding of the attributes of design.* 6-8 E. Design is a creative planning process that leads to useful products and systems. (8.6-8.E) G. Requirements for design are made up of criteria and constraints. (8.6-8.G) *Students will develop the abilities to use and maintain technological products and systems.* 6-8 H. Use information provided in manuals, protocols, or by experienced people to see and understand how things work. (12.6-8.H) J. Use computers and calculators in various applications. (12.6-8.J)
Mechanical Systems	Engineers and technologists design mechanisms to change energy by transferring direction, speed, type of movement, and force or torque.	It is expected that students will: Investigate and understand various mechanisms to determine their purpose and applications.	Gears & Gear Ratios Assessment using the Gear Ratio machine Mechanisms Build Presentation Project	**Next Generation Science Standards** *Energy* MS-PS3-1. Construct and

	Mechanisms can be used individually, in pairs, or in systems. The 12 most common mechanisms: Simple Gear Train, Idler Gear Train, Bevel Gears, Differential Gear, Worm & Wheel, Leadscrew, Rack & Pinion, Universal Joint, Chain Drive, Belt Drive, Crank & Slider, Cam & Follower	Be able to apply their knowledge of mechanisms to solve a unique problem Recognize the various common mechanisms in real life scenarios and their uses. Calculate gear ratios and explain the result in its physical application within various mechanisms	Mechanisms Quiz Windmill / Wind Turbine Project	interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. (MS.PS3.1) MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (MS.PS3.2) MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (MS.PS3.4) MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. (MS.PS3.5) *Engineering Design* MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles

				and potential impacts on people and the natural environment that may limit possible solutions. (MS.ETS1.1) MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS.ETS1.2) MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS.ETS1.3) MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS.ETS1.4) **Common Core State Standards for Mathematics** **Grade 6** *Ratios and Proportional Relationships* -Understand ratio concepts and use ratio reasoning to

				solve problems. 2. Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." (6.RP.A.2) 3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. (6.RP.A.3) 3.d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. (6.RP.A.3d) *Expressions and Equations* -Apply and extend previous understandings of arithmetic to algebraic expressions. 2. Write, read, and evaluate expressions in which letters stand for numbers. (6.EE.A.2)

				2.a. Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as 5 - y. (6.EE.A.2a) -Reason about and solve one-variable equations and inequalities. 6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (6.EE.B.6) **Grade 7** *Ratios and Proportional Relationships* -Analyze proportional relationships and use them to solve real-world and mathematical problems. 1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the

				complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour. (7.RP.A.1) 2. Recognize and represent proportional relationships between quantities. (7.RP.A.2) <u>Expressions and Equations</u> -Solve real-life and mathematical problems using numerical and algebraic expressions and equations. 3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate

				can be used as a check on the exact computation. (7.EE.B.3) **Common Core State Standards for English / Language Arts** *Reading Key Ideas and Details* 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. (AS.R.1) 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. (AS.R.4) 10. Read and comprehend complex literary and informational texts independently and proficiently. (AS.R.10) *Text Types and Purposes* 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (AS.W.4)

				Comprehension and Collaboration 1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. (AS.SL.1) 2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. (AS.SL.2) 4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. (AS.SL.4) *Conventions of Standard English* 1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. (AS.L.1) 2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. (AS.L.2)

				6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. (AS.L.6) **Standards for Technological Literacy** *Students will develop an understanding of the characteristics and scope of technology*. 6-8 F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (1.6-8.F) G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative. (1.6-8.G) H. Technology is closely linked to creativity, which has resulted in innovation.

				(1.6-8.H) *Students will develop an understanding of the core concepts of technology.* 6-8 M. Technologies systems include input, processes, output, and at times, feedback. (2.6-8.M) N. Systems thinking involves considering how every part relates to others. (2.6-8.N) *Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.* 6-8 E. A product, system, or environment developed for one setting may be applied to another setting. (3.6-8.E) *Students will develop an understanding of the attributes of design.* 6-8 E. Design is a creative planning process that leads to useful products and systems. (8.6-8.E)

				G. Requirements for design are made up of criteria and constraints. (8.6-8.G) 9-12 I. Design problems are seldom presented in a clearly defined form. (8.9-12.I) *Students will develop an understanding of engineering design.* 6-8 F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. (9.6-8.F) G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. (9.6-8.G) H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. (9.6-8.H) *Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.*

				6-8 F. Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system. (10.6-8.F) *Students will develop the abilities to apply the design process.* 6-8 H. Apply a design process to solve problems in and beyond the laboratory-classroom. (11.6-8.H) I. Specify criteria and constraints for the design. (11.6-8.I) J. Make two-dimensional and three-dimensional representations of the designed solution. (11.6-8.J) *Students will develop an understanding of and be able to select and use energy and power technologies.* 6-8 E. Energy is the capacity to do work. (16.6-8.E) F. Energy can be used to do work, using many processes. (16.6-8.F)

				G. Power is the rate at which energy is converted from one form to another or transferred from one place to another, or the rate at which work is done. (16.6-8.G)
Automated Systems	Automated systems require minimal human intervention as they work by themselves due to programming (computer coding) Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system. Invention is a process of turning ideas and imagination into devices and systems. Some technological problems are best solved through experimentation.	Solve various robotic challenges through RobotC coding language solutions. Design, build, wire, and program both open and closed loop systems. Troubleshoot a malfunctioning system using a methodical approach.	VEX Test Car programming challenges (Using RobotC computer programming language) Automation Through Programming Final Project	**Next Generation Science Standard** *Energy* MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (MS.PS3.2) MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (MS.PS3.4) MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. (MS.PS3.5)

				Engineering Design MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (MS.ETS1.1) MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS.ETS1.2) MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS.ETS1.3) MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS.ETS1.4)

				Common Core State Standards for English / Language Arts *Key Ideas and Details* 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. (AS.R.1) 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. (AS.R.4) 7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words. (AS.R.7) *Text Types and Purposes* 2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. (AS.W.2)

				4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (AS.W.4) *Comprehension and Collaboration* 1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. (AS.SL.1) 2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. (AS.SL.2) *Conventions of Standard English* 1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. (AS.L.1) 2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. (AS.L.2) 6. Acquire and use accurately a range of general academic and

				domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. (AS.L.6) **Standards for Technological Literacy** *Students will develop an understanding of the characteristics and scope of technology.* 6-8 F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (1.6-8.F) G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative. (1.6-8.G) H. Technology is closely linked to creativity, which has resulted in innovation. (1.6-8.H)

				Students will develop an understanding of the core concepts of technology. 6-8 M. Technologies systems include input, processes, output, and at times, feedback. (2.6-8.M) N. Systems thinking involves considering how every part relates to others. (2.6-8.N) O. An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback. (2.6-8.O) P. Technological systems can be connected to one another. (2.6-8.P) Q. Malfunctions of any part of a system may affect the function and quality of the system. (2.6-8.Q) R. Requirements are the parameters placed on the development of a product or system. (2.6-8.R) S. Trade-off is a decision process recognizing the need for careful compromises among competing factors. (2.6- 8.S)

				V. Controls are mechanisms or particular steps that people perform using information about the system that causes systems to change. (2.6-8.V) *Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.* 6-8 D. Technological systems often interact with one another. (3.6-8.D) E. A product, system, or environment developed for one setting may be applied to another setting. (3.6-8.E) *Students will develop an understanding of the attributes of design.* 6-8 E. Design is a creative planning process that leads to useful products and systems. (8.6-8.E) F. There is no perfect design. (8.6-8.F) G. Requirements for design are made up of criteria and constraints. (8.6-8.G)

				Students will develop an understanding of engineering design. 6-8 F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. (9.6-8.F) G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. (9.6-8.G) H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. (9.6-8.H) 9-12 K. A prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (9.9-12.K) *Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.* 6-8

				F. Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system. (10.6-8.F) G. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it. (10.6-8.G) H. Some technological problems are best solved through experimentation. (10.6-8.H) *Students will develop the abilities to apply the design process.* 6-8 H. Apply a design process to solve problems in and beyond the laboratory-classroom. (11.6-8.H) I. Specify criteria and constraints for the design. (11.6-8.I) J. Make two-dimensional and three-dimensional representations of the designed solution. (11.6-8.J) K. Test and evaluate the design in relation to pre-established

				requirements, such as criteria and constraints, and refine as needed. (11.6-8.K) L. Make a product or system and document the solution. (11.6-8.L) *Students will develop the abilities to use and maintain technological products and systems.* 6-8 H. Use information provided in manuals, protocols, or by experienced people to see and understand how things work. (12.6-8.H) I. Use tools, materials, and machines safely to diagnose, adjust, and repair systems. (12.6-8.I) J. Use computers and calculators in various applications. (12.6-8.J) K. Operate and maintain systems in order to achieve a given purpose. (12.6-8.K) *Students will develop an understanding of and be able to select and use information and communication technologies.* 6-8

				H. Information and communication systems allow information to be transferred from human to human, human to machine, and machine to human. (17.6-8.H) K. The use of symbols, measurements, and drawings promotes a clear communication by providing a common language to express ideas. (17.6-8.K)