Robotics

Middle Township Public Schools
216 S. Main Street
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Committee

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Introduction: Recent advances in robotics have revolutionized our personal and business lives. Today, commercial and industrial robots are in widespread use, performing jobs more cheaply and in some cases with greater accuracy and reliability than humans. They are also employed for jobs which are too dirty dangerous, or dull to be suitable for humans. Robots are widely used in manufacturing, assembly and packing, transport, earth and space exploration, surgery, weaponry, laboratory research, safety, and the mass production of consumer and industrial goods. Robots play significant roles in our personal lives as well by serving humans and performing everyday tasks such as cleaning, cooking, and repairing. Intense involvement of these artificial helpers in everyday life requires human specialists with up-to-date knowledge to maintain and monitor existing robots, as well as to develop new, smarter, safer, and more advanced machines. To meet this need, educational institutions must adequately respond to the high demand for specialists in the field of robotics by developing and offering appropriate courses and/or certifying workers involved in the industry of robotics and automation.

Robotics 1 is a course intended to introduce students to this field and to engage them in the study of society's need for robots. Robotics 1 is seen as an interdisciplinary, project-based learning curriculum drawing on math, science, and technology and offering major benefits in education. Robotics implements 21st century technologies and can foster problem solving skills, communication skills, teamwork skills, independence, imagination, and creativity. Taking into consideration that students gain a better understanding when they express themselves through invention and creation, robotics activities are considered to be a valuable learning tool that can contribute to the enhancement of learning and to the development of students' thinking.

Course Goals Robotics 1 is a full year elective course offered by Middle Township High School to 11-12 grade students. The primary goal of the course is for students to realize that they have the power to create and build new ideas; that invention is not something somebody else does, but something they can do. This goal will be reached through a combination of theoretical and hands-on work, and they will have the opportunity to work as a team and have the opportunity to work on basic electrical and mechanical devices. The class will be taught with the plan being that in June student built robots will battle other student robots for the championship. "Best ROBOT" will be based on the idea from the TV show Battle bots found on the Discovery Channel. The students will be introduced to the classroom and general safety of the room. They will start off in cooperative learning groups to solve problems and work on general too skills. They will construct and engineer a Rube Goldberg device in groups. Followed be introductions to Maglev, Computer repair, and electrical wiring. The students will then construct simple robots from kits, focusing on different areas, like sound, motion and hydraulics. The students will then attempt to construct a mechanical arm that can pick up a move an object; followed by constructing a programmable robotic arm form a kit. The final project will be hand controlled robot built by a student team to fight it out for the title of top robot.

Assessment Evaluation will be based on projects and class participation. The projects are a significant part of the grade and these will be evaluated on the processes the student uses to create them (with a heavy emphasis on planning first), the thought put into the project, and the final product. When a project is a group effort, students will also be assessed on how well they work with the other members of the group. All assignments must be attempted and strong evidence of group cooperative work needs to be demonstrated throughout the whole course.

ROBOTICS 1 Curriculum Guide 3 Overarching Understandings: Through critical thinking and adept collaboration in virtual environments, that incorporate global perspectives into problem solving, a new vision of technological tools can be formed and shared. Established Goals: New Jersey Core Curriculum Content Standards.

Unit 1: Introduction to Systems (2 weeks)

Enduring Understandings: Organizational skills are applicable to increased productivity and understanding in technology.

Essential Questions: Is there a practical benefit to being organized?

UNIT VOCABULARY (if applicable) Sorting Tray, Storage Box, RCX, ROBOLAB

Topic	Objectives	NJ CCCS/ CPI	NJ TECH CPI	Suggested Activities	Assessments: D/F/S
Introduction to the System	Students will work on problem solving skills.	8.2	8.2	Show class resources and identify different types of equipment.	Observation, quiz, demonstrations
Inventory	Students will become familiar with the elements that make up the building systems.	8.2	8.2	Have students inventory the kit so that all pieces are present or a list of parts needed is created	
Build your first project and learn about naming parts	Development of hand-eye coordination and understand the building process following the Lego manuals	8.2	8.2	Build introductory projects that will familiarize the student with processes of structural stability and procedures following building instruction sheets	

Unit 2: Design and Mechanics (5 weeks)

Enduring Understandings: Basic theories of simple machines, pneumatics and power/energy are applicable to design of robots.

Essential Questions: How can acquisition of knowledge help resolve difficult problems?

UNIT VOCABULARY (if applicable)Spur gears, bevel gears, and worm gears

Topic	Objectives	NJ CCCS/ CPI	NJ TECH CPI	Suggested Activities	Assessments: D/F/S
Mechanical issues like friction, gears aligned, power transfer, motors running at different rates, wheels falling off, etc.	Demonstrate how kits are assembled, how axles are joined, the front and back of tires, friction points, how to make adjustments in friction, etc.	8.2	8.2	Develop more intricate projects that require utilizing various components while following detailed instruction in both a graphic format as well as written instructional guidelines.	F/S Evaluation will be based on projects and class participation.
The concept of robust design	Show designs that hold together well with the additional structural support compared to designs that fall apart	8.2	8.2	Modify and adjust any design components to make a more durable design of your own.	Teacher observation, completion of assigned work

Unit 3 -Basic RCX Introduction (5 weeks)

Enduring Understandings: Basic theories of electronics and programming are applicable to creating a robot design that meets desired results.

Essential Questions: What would be the possibility of making a robot respond as planned without sensors.

UNIT VOCABULARY (if applicable) IR tower, a RCX, motors, light sensor, touch sensor, rotational sensor

Topic	Objectives	NJ CCCS/ CPI	NJ TECH CPI	Suggested Activities	Assessments: D/F/S
Basic RCX introduction – install batteries and use built in programs					Participate in teacher led discussion on RoboLab icons, modifiers, ports, loops, jumps, lands, and wait states. Complete teacher assigned problems that use wait states, modifiers, power levels and input & output ports. Students will develop a RoboLab program incorporating various aspects and save it for later evaluation.
Introduction to the RCX	Hooking up wires, forward and reverse, turning on Motors	8.2	8.2	Training video and demonstration using Vision Software and instructional DVD	
Battle Bots, Sphero Bolt, and Vex Windows	How to open Vex Robot	8.2	8.2	Identify appropriate icons to activate needed software	
Basic Programming	How to open Programmer	8.1 - 8.2	8.1 - 8.2	Watch the Tutorial –Essentials – RCX Introduction	
Program 1 – Control Motors	Functions Palette: How to download a program using the IR Tower	8.1 - 8.2	8.1 - 8.2	View Tutorials and complete the assigned activities at the end of the lesson	
Program 2 – Motor on/off with touch sensor controls	Utilize touch sensors to control motor activity	8.1-8.2	8.1-8.2		
Program 3 – Using a light sensor to control a motor	Utilize light sensors to control motor activity	8.1-8.2	8.1-8.2		
Program storage and recovery	How to save a program	8.1 - 8.2	8.1 - 8.2	Save and relocate developed program	

Unit 4 - Introduction and Basic Programming (10 weeks)

Enduring Understandings:

Essential Questions:

UNIT VOCABULARY (if applicable)
Sphero Bolt, Hydraulic, Vex Robot

Topic	Objectives	NJ CCCS/ CPI	NJ TECH CPI	Suggested Activities	Assessments: D/F/S
Technological Concepts Basic operation of the RCX Basic Circuits Electromagnetism Generators DC Motor Polarity Introduction to Sphero Bolt Vex Robot Introduction to Basic Programming & Logic	Students will explore the basic operation of the RCX and be able to demonstrate basic functions for proper operation of the various functions Students will practice working in the ROBOLABTM programming environment. Students build a couple simple programs without having to worry about difficult programming logic. To teach basic programming logic and how to program robots. Students will learn to combine basic behaviors to build simple behaviors.	8.1 -8.2	8.1 -8.2	List examples of electronic control in their lives Actively participate in a teacher lead discussion on basic electronics. Complete teacher assigned labs on basic “Introduction to Robotics” Install and test IR communications with the RCX. Build several robots and download programs that demonstrate how sensors work. This demonstration is to be used as an anticipatory set to excite the class about robotics. Suggested robot demonstrations: 1.Robot demonstrating simple behaviors using timing 2.Robot demonstrating simple behaviors using a touch sensor 3.Robot demonstrating simple behaviors using a light sensorasic circuits, DC motors, or generators. Tutorial beginner's slideshow. Assign your students programming exercises, and reinforce the idea that these programs combine basic behaviors to build simple behaviors	Teacher observation, completion of assigned work, evaluation form, Teacher designed quiz Discuss how feedback from the sensor is used in forks and loops to control behaviors (conditional statements). Teacher observation, completion of assigned work, evaluation Form, Teacher designed quiz

Unit 5: Introduction to Sensors (10 weeks)

Enduring Understandings: Students will be able to use input sensors to control the activity of a robot

Essential Questions: What limitations do we see in the ability of robots to develop into near human functions.

UNIT VOCABULARY (if applicable)
Rotation Sensor
Input device that reads rotation in either angle degrees or sixteenths of a rotation.

Topic	Objectives	NJ CCCS/ CPI	NJ TECH CPI	Suggested Activities	Assessments: D/F/S
Introduction to Touch Sensors	Demonstrate how a Touch Sensor works (Sensors Module/Touch Sensor/Engineering). To be able to demonstrate the difference between Wait-for-Push and Wait-for-Let Go	8.1 -8.2	8.1 -8.2	Assign students the following programming exercises: Wait for Push (Programming Module/Touch Sensors/Wait for Push) Wait for Let Go(Programming Module/Touch Sensors/Wait for Let Go) Tank Bot (Programming Module/Touch Sensors/Tank Bot) Remote Control (Programming Module/Touch Sensor/Remote Control)	Complete the touch sensor worksheet (Investigations Module, Motion Planning, Building Behaviors, touch sensor worksheet).
Introduction to Rotation Sensor/Angle Sensors Overview : The Rotation Sensor, also called the angle sensor.	The Rotation Sensor is a very powerful tool to teach measurement and applied geometry.			Demonstrate how a Touch Sensor works (Sensors Module/Touch Sensor/Engineering). Demonstrate the difference between Wait-for-Push and Wait-for-Let Go. Assign students programming exercises: Wait for Push (Programming Module/Touch Sensors/Wait for Push) Wait for Let Go(Programming Module/Touch Sensors/Wait for Let Go) Tank Bot (Programming Module/Touch Sensors/Tank Bot) Remote Control (Programming Module/Touch Sensor/Remote Control)	

Unit 6: OPEN ENDED DESIGN PROBLEM (8 weeks)

Enduring Understandings: Working together as teams resolves complex problems faster and with greater success

Essential Questions: What is practical use of robots in resolving complex problems?

Topic	Objectives	NJ CCCS/ CPI	NJ TECH CPI	Suggested Activities	Assessments D/F/S
Investigations Module/Project Management/Engineering Process	Students will work on designing, building, and testing their solution to the project. To prepare students for their open ended design problem.	8.1 – 8.2	8.1 – 8.2	Student selected team project to be built and Programmable to meet the pre-assigned requirement. Battle Bots- Construction, testing, and completion.	Teacher observation, completion of assigned work, evaluation form

Differentiation: (What type of differentiated instruction will be used for ELL, SP.ED. and G&T students?)	***Additional considerations for English Language Learners (ELLs), Special Needs, Below Level (BSI)*** ***Individualized Education Plans (IEPs):*** ⇒ Exemplars of varied performance levels ⇒ Multi-media presentations Consultation with ESL teachers ⇒ Manipulatives ⇒ Tiered/Scaffolded Lessons ⇒ Mnemonic devices ⇒ Visual aids ⇒ Modeling ⇒ Guided note-taking ⇒ Study Guides ⇒ Modified homework ⇒ Differentiated pre-typed class notes and example problems	***Additional considerations for English Language Learners (ELLs), Special Needs, Below Level (BSI)*** ***Individualized Education Plans (IEPs):*** ⇒ Exemplars of varied performance levels ⇒ Multi-media presentations Consultation with ESL teachers ⇒ Manipulatives ⇒ Tiered/Scaffolded Lessons ⇒ Mnemonic devices ⇒ Visual aids ⇒ Modeling ⇒ Guided note-taking ⇒ Study Guides ⇒ Modified homework ⇒ Differentiated pre-typed class notes and example problems

	Advanced/Gifted Students: ⇒ Open-ended responses ⇒ Curriculum Compacting ⇒ Advanced problems to extend the critical thinking skills of advanced learner ⇒ Supplemental reading material for independent study ⇒ Flexible grouping ⇒ Tiered assignments ⇒ Topic selection by interest	***Advanced/Gifted Students:*** ⇒ Open-ended responses ⇒ Curriculum Compacting ⇒ Advanced problems to extend the critical thinking skills of advanced learner ⇒ Supplemental reading material for independent study ⇒ Flexible grouping ⇒ Tiered assignments ⇒ Topic selection by interest

https://youtu.be/ZluyTRFn3OY
https://www.youtube.com/watch?v=uOU-q3YHBSk

Links of the Sphero Bolt

https://youtu.be/-YjBcXFoiNQ

Battle Bolt Competiton