Fair Lawn
Public Schools
Fair Lawn, NJ

Robotics

Adopted August

2017

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Developed August 2012

The Robotics Honors course has been designed for the student who has completed Visual Computer Programming and met the prerequisite of B- or higher.

Robotics

Fair Lawn School District

Committee Credits
Robotics Team

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Robotics

I. Course Synopsis

Robotics Honors is a course that asks the student to develop, design and build machines to perform a specific task. Students are encouraged to work independently and as a team with a variety of devices. Students learn to plan and organize their thoughts before approaching a project, and after completion, will present their project to the class in a professional fashion. Students learn the importance of, as well as the difficulties associated with working a group

Throughout the course, mathematical concepts will be reinforced with an emphasis on enduring understandings, essential questions, real-world application, technology, and cross-curricular interaction.

II. Philosophy & Rationale

The purpose of the Robotics Honors course is to help students develop thinking and planning skills, enhance programming abilities, encourage participation between students, and improve presentation skills.

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

MATH.PRACTICE.MP1 - Make sense of problems and persevere in solving them.
Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and

relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

MATH.PRACTICE.MP2 - Reason abstractly and quantitatively.
Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

MATH.PRACTICE.MP3 - Construct viable arguments and critique the reasoning of others.
Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

MATH.PRACTICE.MP4 - Model with mathematics.
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can

apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

MATH.PRACTICE.MP5 - Use appropriate tools strategically.
Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

MATH.PRACTICE.MP6 - Attend to precision.
Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

MATH.PRACTICE.MP7 - Look for and make use of structure.
Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see

complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

MATH.PRACTICE.MP8 - Look for and express regularity in repeated reasoning.
Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

III. Scope & Sequence

Unit 1: Introduction to Basic Robotics and Starter Projects (4 Weeks):

Review of basic programming concepts
Review of basic mathematic concepts
Introduction to machines including power, efficiency, gears, gravity, energy
Basic properties of electricity
Introduction to the design process
Working as a group to design and build projects from everyday items
Lab assignments – Worksheets from STEM textbooks, multiple projects made from everyday materials

Unit 2: The Lego Mindstorms (10 weeks – not consecutive)

Introduction to the Lego Mindstorm components
Writing a project description
Writing a rubric
Lab assignments – Grabbing Objects, Battle Bot, Racer, Tug of War, Wheel-less Vehicle, Pentathlon, Capture Objects

Unit 3: Robix Kits (6 Weeks):

Building the basic Robix arm
Writing a project description
Writing a rubric
Writing a project description
Writing a rubric
Independent Robox project from the Robix project book
Labs – basic arm, independent student choice projects, Spaghetti Cutter project, larger Independent project

Unit 4: Vex Kits (3 Weeks):

Introduction to Vex manuals
Building the basic square bot
Using the sensors
Student designed project
Labs – square bot, independent projects

Unit 5: Robodyssey and Parallax Robots (3 Weeks):

ESRA expressive robot
Mouse robot
Hexcrawler robot
Lab assignments – student choice

Unit 6: Articles and Readings (4 Weeks – not consecutive):

Research on the history of robotics
Review of current articles on robotics and technology
Discussion of the legal, moral and social responsibilities associated with the use of robots
Short stories and other fictional writings about robots

IV. Unit Descriptions

Unit 1: Introduction to Basic Robotics and Starter Projects

Enduring Understanding

1. Coding is a natural extension of the way that we think and plan a solution to a problem.
2. The concepts learned in mathematics courses are as important in this course as in the math course.
3. The process of developing a project statement, creating a rubric, choosing and implementing a design requires careful planning.
4. The dynamics of group work are very different than individual work.

Essential Question(s)

1. How do we most efficiently learn a new programming language?
2. What mathematics might be involved in robot design?
3. What basic concepts of machines are important?
4. How do you design a project as a group, making sure everyone has input and shares the work load equally?

Learning Objectives

Students will be able to:

1. Work cooperatively to build a device from everyday items to perform a specific task
2. Understand basic concepts of machines
3. Complete worksheets on the topics provided in the reading material

New Jersey Student Learning Standards

- **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **HSG.GMD.B.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **HSG.MG.A.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Suggested Activities/Modifications

All lab assignments can be enhanced and/or modified. For example, readings can be appropriately assigned based on student ability. The same lab can be modified for at risk

students, students with disabilities, and ELL students, to be done in stages. The assignment to build a device from everyday materials can be adjusted. The project to get a ball in a cup in the center of a large circle using limited materials can be modified by making the circle smaller or larger.

1. STEM workbook readings
2. STEM workbook assignments
3. Reading various articles on current events in robotics and technology
4. Creating a device from everyday materials

New Jersey Student Learning Standards - Technology

- 8.2.12.C.6 Research an existing product, reverse engineer and redesign it to improve form and function.
- 8.2.12.C.1 Explain how open source technologies follow the design process.
- 8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants. The application of engineering design.
- 8.2.12.C.3 Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics)

Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers Strand C: Career Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.
- 9.3.12.AC.2 Use architecture and construction skills to create and manage a project.
- 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project.
- 9.3.12.AC-CST.4 Apply scheduling practices to ensure the successful completion of a construction project..
- 9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.

- 9.3.12.AR.1 Analyze the interdependence of the technical and artistic elements of various careers within the Arts, A/V Technology & Communications Career Cluster.
- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.

Unit 2: The Lego Mindstorms

Enduring Understanding

1. Legos are a powerful tool for building.
2. Legos use programming to command the intelligent brick.
3. Following the specifications and guidelines of a project statement are important.
4. Cooperation among group members is essential for success.

Essential Question(s)

1. How does the intelligent brick work?
2. What is the function of each of the categories of Lego pieces?
3. How can I foster communication and cooperation within my group?

Learning Objectives

Students will be able to:

1. Design and build various Lego devices and control them through the programmable brick.
2. Follow a rubric to help achieve the maximum grade possible
3. Work as a group as well as alone.

New Jersey Student Learning Standards

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- **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **HSG.GMD.B.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **HSG.MG.A.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, Pentathlon lab can be modified for at risk students, students with disabilities, and ELL students, to be done either in stage or with fewer or simpler events. Gifted and talented students can be given an extra event.

1. Tug of War
2. Pentathlon
3. Battle Bot,
4. Racer
5. Capture Objects

New Jersey Student Learning Standards - Technology

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- 8.2.12.C.1 Explain how open source technologies follow the design process.
- 8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants. The application of engineering design.
- 8.2.12.C.3 Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics)

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Career & Technical Education Content Area: 21st Century Life and Careers Standards

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- 9.3.12.AR.1 Analyze the interdependence of the technical and artistic elements of various careers within the Arts, A/V Technology & Communications Career Cluster.

- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.

Unit 3: Robix Kits

Enduring Understanding

1. Robix is a powerful tool for creating "pick and place" machines.
2. Robix uses its own programming language
3. Following the specifications and guidelines of a project statement are important.
4. Cooperation among group members is essential for success.

Essential Question(s)

1. For what type of project is Robix most appropriate?
2. What differences are there in algorithm analysis when using an array as opposed to an ArrayList?
3. What is the purpose of an interface?
4. How do sort routines differ from one another and why would we choose one over the other?

Learning Objectives

Students will be able to:

1. Build the basic Robix arm after watching the video.
2. Build a project from the Robix project manual.
3. Build a project of their own choosing
4. Build the spaghetti cutter to cut spaghetti into one inch pieces, place them in a cup, and place the waste in a second cup.

New Jersey Student Learning Standards

- **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **HSG.GMD.B.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **HSG.MG.A.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, spaghetti cutter lab can be modified for at risk students, students with disabilities, and ELL students, to be done to simply

cut the spaghetti to a length with a certain tolerance. Gifted and talented students can be given an extra step to have a second robot feed the spaghetti into the cutter.

1. Building the basic Robix arm
2. Building one of the basic Robix projects from the manual
3. The spaghetti cutter project

New Jersey Student Learning Standards - Technology

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- 8.2.12.C.1 Explain how open source technologies follow the design process.
- 8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants. The application of engineering design.
- 8.2.12.C.3 Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics)

Career Readiness Practices

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9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers Strand C: Career Preparation

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- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.

Unit 4: Vex Kits

Enduring Understanding

1. Vex can be a powerful tool for building.
2. Vex has limitations that are different from other kits.

Essential Question(s)

1. When is Vex appropriate?
2. How do the sensors that come with the kit work?
3. How can I learn from the Vex manual, and are there any other sources of information that may be useful?

Learning Objectives

Students will be able to:

1. Build the basic Vex square bot.
2. Build a project of their choice.

New Jersey Student Learning Standards

- **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
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- **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **HSG.GMD.B.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **HSG.MG.A.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, the independent project can be modified for at risk students, students with disabilities, and ELL students, to be done as a simple modification to the square bot, or to build a project with the help of an online video. Gifted and talented students can be given an extra step to have a second robot feed the spaghetti into the cutter.

1. Building the basic Vex square bot
2. Independent project

New Jersey Student Learning Standards - Technology

- 8.2.12.C.6 Research an existing product, reverse engineer and redesign it to improve form and function.
- 8.2.12.C.1 Explain how open source technologies follow the design process.
- 8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants. The application of engineering design.
- 8.2.12.C.3 Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics)

Career Readiness Practices

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Unit 5: Robodyssey and Parallax Robots

Enduring Understanding

1. The concepts of programming are universal from one device to another.
2. Older equipment can present some unique challenges

Essential Question(s)

1. How is the ESRA programmed?
2. Is there any practical use for such a robot as ESRA?
3. How is the Mouse programmed?
4. How is the Hexcrawler programmed?

Learning Objectives

Students will be able to:

1. Program the ESRA to move its four essential parts.
2. Program the Mouse to move in a random pattern
3. Program the Hexcrawler to walk.

New Jersey Student Learning Standards

- **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **HSG.GMD.B.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **HSG.MG.A.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, the ESRA lab can be modified for at risk students, students with disabilities, and ELL students, to have just one of the parts move, or to build a project with the help of an online video. Gifted and talented students can be given a project to combine the ESRA with the motors from the Robix kits.

1. ESRA expressive robot – using all movable parts
2. Mouse robot – move in random pattern to “create” artwork
3. Hexcrawler

New Jersey Student Learning Standards - Technology

- 8.2.12.C.6 Research an existing product, reverse engineer and redesign it to improve form and function.
- 8.2.12.C.1 Explain how open source technologies follow the design process.
- 8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants. The application of engineering design.

- 8.2.12.C.3 Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics)

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Unit 6: Articles and Readings

Enduring Understanding

1. It is important to keep abreast of developments in technology
2. Robots must not be misused.
3. That which we though was not possible, has come to be, and that which we think is impossible, will likely come to be.

Essential Question(s)

1. What is the history of robots and robotics?

2. Who is Isaac Asimov and why is he important?
3. What ethical or practical concerns do I have with emerging technology?

Learning Objectives

Students will be able to:

1. Discuss who Isaac Asimov is, and state his three laws of robotics.
2. Read and discuss current articles on robots
3. Give a general description of the history of robotics.

New Jersey Student Learning Standards

- **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **HSG.GMD.B.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **HSG.MG.A.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, the readings can be modified to be appropriately leveled for at risk students, students with disabilities, and ELL students. Gifted and talented students can employ some of the ideas they read about with our existing equipment.

1. Readings from articles suggested by ACM Tech News
2. Isaac Asimov short stories and novels
3. Readings from current articles from various sources

New Jersey Student Learning Standards - Technology

- 8.2.12.C.6 Research an existing product, reverse engineer and redesign it to improve form and function.
- 8.2.12.C.1 Explain how open source technologies follow the design process.
- 8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants. The application of engineering design.
- 8.2.12.C.3 Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics)

Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers
Strand C: Career Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.
- 9.3.12.AC.2 Use architecture and construction skills to create and manage a project.
- 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project.
- 9.3.12.AC-CST.4 Apply scheduling practices to ensure the successful completion of a construction project..
- 9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
- 9.3.12.AR.1 Analyze the interdependence of the technical and artistic elements of various careers within the Arts, A/V Technology & Communications Career Cluster.
- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.

V. Course Materials

Robix Kits
Vex Programmable Robot Kits
ESRA and Mouse from Robodyssey
Parallax Hexcrawler
Lego Mindstorms
Extreme NXT by Michael Gasperi
Various books by Isaac Asimov
Printed and online manuals for all equipment listed above
Web site for the Robotics Exam at apcentral.collegeboard.org

VI. Assessments

Tests
Oral presentations
Written homework
Class work
Laboratory programming assignments
Midterm exam
Final exam

VII. Cross Curricular Aspects

The Robotics Honors course allows students to be creative and expand their projects to include topics they have learned in mathematics, science and other courses. Language arts skills can be used when presenting a project either verbally or on paper. Topics in business and finance can be incorporated when discussing the various readings provided to the students throughout the year.