Randolph Township Schools
Randolph Middle School
Introduction to Technology Curriculum

"We are changing the world with technology"
-Bill Gates

STEM Department
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July 2021

Date of Board Approval:
September 21, 2021

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Mission Statement

We commit to inspiring and empowering all students in Randolph schools to reach their full potential as unique, responsible and educated members of a global society.

Affirmative Action Statement
Equality and Equity in Curriculum

The Randolph Township School district ensures that the district's curriculum and instruction are aligned to the state's standards. The curriculum provides equity in instruction, educational programs and provides all students the opportunity to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

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EDUCATIONAL GOALS
VALUES IN EDUCATION

The statements represent the beliefs and values regarding our educational system. Education is the key to self-actualization, which is realized through achievement and self-respect. We believe our entire system must not only represent these values, but also demonstrate them in all that we do as a school system.

We believe:

- The needs of the child come first
- Mutual respect and trust are the cornerstones of a learning community
- The learning community consists of students, educators, parents, administrators, educational support personnel, the community and Board of Education members
- A successful learning community communicates honestly and openly in a non-threatening environment
- Members of our learning community have different needs at different times. There is openness to the challenge of meeting those needs in professional and supportive ways
- Assessment of professionals (i.e., educators, administrators and educational support personnel) is a dynamic process that requires review and revision based on evolving research, practices and experiences
- Development of desired capabilities comes in stages and is achieved through hard work, reflection and ongoing growth

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Introduction

Introduction to Technology is a marking period cycle course offered to students interested in technology and engineering. This course introduces students to the fields of engineering through interactive STEM based activities. Introduction to Technology topics include basic engineering skills, virtual reality, laser engraving technology, stop motion animation, and 3D printing design and creation. Through these activities, students will develop and apply problem solving, creative and technological skills to create real-world solutions. By the end of this course, students will gain a fundamental understanding of basic technologies and ideas within 21st century engineering topics, as well as gain interest in continuing to study other technology and engineering areas. This course will be guided by the current New Jersey Learning Standards in Computer Science and Design Thinking, Career Readiness, Life Literacies, and Key Skills, Science, Mathematics, and English.

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Curriculum Pacing Chart

SUGGESTED TIME ALLOTMENT	UNIT NUMBER	CONTENT - UNIT OF STUDY
2 weeks	**I**	**Basic Engineering Skills**
2 weeks	**II**	**Virtual Reality**
3 weeks	**III**	**Computer Aided Design & Fabrication**
2 weeks	**IV**	**Stop Motion Animation**

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Unit I: Basic Engineering Skills

<table>
<tr><td rowspan="4">STANDARDS / GOALS:

NJ 2020 SLS: Computer Science and Design Thinking
8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.

8.2.8.ED.3 Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

8.2.8.ED.4 Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Resources are necessary for technological developments and to services that meet human needs and wants.

Accurate measurements are essential in designing and developing engineering ideas.

Engineering drafting is a way to communicate architectural designs.</td><td>• How do resources effect the technological advancements of our world today?

• How do measurements effect the world around you?

• How does drafting assist us in communicating ideas?</td></tr>
<tr><td><u>KNOWLEDGE</u>
Students will know:</td><td><u>SKILLS</u>
Students will be able to:</td></tr>
<tr><td>Technological resources help engineers plan designs by influencing the criteria and constraints of their problem.</td><td>Identify the key resources of technology as people, information, materials, tools & machines, energy, capital, and time.

Communicate a real-world scenario that involves technological resources.</td></tr>
</table>

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Unit I: Basic Engineering Skills

<table>
<tr>
<td rowspan="2">NJ 2020 SLS: Career Readiness, Life Literacies, and Key Skills
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

NJ 2020 SLS: Science
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.

NJ 2020 SLS: Science: Crosscutting Statements 6-8
• Structure and function
• Systems and system models

NJ 2020 SLS: Science: Science and Engineering Practices 6-8
• Asking questions and defining problems
• Developing and using models
• Using mathematics and computational thinking
• Constructing explanations and designing solutions</td>
<td>The Metric System and US Customary System are measuring standards used to provide a reliable comparison of size.

Orthographic and isometric drawings have differences and similarities and each help engineers design solutions to technical problems.</td>
<td>Identify key differences between the metric system and the US Customary System.

Utilize measuring tools to read and record accurate measurements.

Identify useful drafting tools.

Explain the various uses of different drafting tools.

Construct useful drawings that communicate engineering ideas.</td>
</tr>
<tr>
<td>VOCABULARY: Procedures, analysis, resources, researching, brainstorming, developing, communicating, building, testing, reflection, criteria, constraints, teamwork

KEY TERMS: Resources of technology, technical drafting, isometric, orthographic, metric system, US Customary System, meter stick, yard stick, architecture, architect scale, tape measure, framing square, protractor, computer aided design</td>
<td></td>
</tr>
</table>

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Unit I: Basic Engineering Skills

NJ 2020 SLS: Science: Disciplinary Core Ideas 6-8 • Developing Possible Solutions • Developing and Using Models **NJ 2016 SLS: Math** 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. 7.G.A.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. 7.G.A.3 Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prism and right rectangular pyramids. **Mathematical Practices** **MP4** Model with mathematics **MP5** Use appropriate tools strategically		

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Unit I: Basic Engineering Skills

ASSESSMENT EVIDENCE: Students will show their learning by:

- Presenting a creative multimedia poster on the many resources of technology
- Utilizing measuring tools to accurately measure everyday objects around the classroom
- Creating orthographic drawings of everyday objects
- Reflecting on basic engineering skills

KEY LEARNING EVENTS AND INSTRUCTION:

- Students will engage in small group collaboration (planning and creating)
- Students will produce technical drafts
- Students will reflect daily in engineering journals

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Unit I: Basic Engineering Skills

SUGGESTED TIME ALLOTMENT	**2 weeks**
SUPPLEMENTAL UNIT RESOURCES	<u>Required Supplies/Activities/Software:</u> Computers Microsoft PowerPoint (Office 365) Graph Paper Measuring and drafting tools Various items for measurement practice Various 3D objects for drafting <u>Suggested Supplies/Activities/Software:</u> TinkerCAD “Resources of Technology” “Reading the Ruler” “Orthographic Practice”

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Unit II: Virtual Reality

STANDARDS / GOALS:	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
NJ 2020 SLS: Computer Science and Design Thinking 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem. 8.2.8.ED.3 Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). 8.2.8.ED.5: Explain the need of optimization in a design process. 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decision made as a	Virtual reality is a computer-generated environment that lets you experience a different reality.	• How can virtual reality benefit human functionality in the 21st century?
	KNOWLEDGE **Students will know:**	**SKILLS** **Students will be able to:**
	Virtual reality makes use of computer technology to create interactive virtual experiences. Virtual reality can be experienced in multiple ways; such as in education, entertainment, simulation, etc.	Research various virtual reality headset models and their functionality. Utilize prior knowledge to produce a technical drawing of a functioning virtual reality headset. Construct virtual reality headsets using cardboard and/or construction paper. Demonstrate multiple realities while using various virtual reality headsets.

result of specific constraints and trade-offs (e.g., annotated sketches). **NJ 2020 SLS: Career Readiness, Life Literacies, and Key Skills** 9.4.8.TL.3: Select appropriate tools to organize and present information digitally. **NJ 2020 SLS: Science** MS-EST1-4 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. **NJ 2020 SLS: Science: Crosscutting Statements 6-8** • Structure and function • Systems and system models **NJ 2020 SLS: Science: Science and Engineering Practices 6-8** • Asking questions and defining problems • Developing and using models • Using mathematics and computational thinking	Software can be used to experience virtual reality in our everyday technology.	Compare and contrast various technology devices for applying virtual reality to their own headsets. Research widespread applications that allow for virtual reality experiences.
	VOCABULARY: Procedures, resources, researching, brainstorming, developing, communicating, building, testing, reflection, constraints **KEY TERMS:** Virtual reality, computer generated, simulation	

• Constructing explanations and designing solutions **NJ 2020 SLS: Science: Disciplinary Core Ideas 6-8** • Developing Possible Solutions • Developing and Using Models **NJ 2016 SLS: Math** 7.G.A.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. **Mathematical Practices** **MP4** Model with mathematics **MP5** Use appropriate tools strategically		

ASSESSMENT EVIDENCE: Students will show their learning by:

- Designing a technical sketch of their virtual reality headset plans
- Constructing and evaluating a functioning virtual reality headset out of cardboard/construction paper
- Downloading and utilizing a virtual reality application
- Reflecting on virtual reality experiences

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Unit II: Virtual Reality

KEY LEARNING EVENTS AND INSTRUCTION:

- Students will engage in small group collaboration (planning and creating)
- Students will produce technical drafts
- Students will research virtual reality applications
- Students will reflect daily in engineering journals

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Unit II: Virtual Reality

SUGGESTED TIME ALLOTMENT	**2 weeks**
SUPPLEMENTAL UNIT RESOURCES	Required Supplies/Activities/Software: Computers Thin cardboard box such as a cereal or snack box Construction Paper Measuring and drafting tools Suggested Supplies/Activities/Software: "Virtual Reality Design Specifications"

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Unit III: Computer Aided Design & Fabrication

<table>
<tr><td rowspan="5">STANDARDS / GOALS:

NJ 2020 SLS: Computer Science and Design Thinking
8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.

8.2.8.ED.3 Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

NJ 2020 SLS: Career Readiness, Life Literacies, and Key Skills
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Computer-aided design is the use of computers to aid in the creation, modification, analysis, or optimization of a design.</td><td>• How does the process of computer aided design effect the way products are developed in the 21st century?</td></tr>
<tr><td><u>KNOWLEDGE</u>
Students will know:</td><td><u>SKILLS</u>
Students will be able to:</td></tr>
<tr><td>Various software is used to design objects that can be downloaded and printed on 3D printers and laser engravers.

3D printing is an additive manufacturing process while laser engraving is a subtractive manufacturing process.</td><td>Utilize the various functions of TinkerCAD.

Design 3-Dimensional objects on TinkerCAD.

Analyze both subtractive and additive manufacturing processes.

Compare and contrast the key functions of additive and subtractive processes.</td></tr>
</table>

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Unit III: Computer Aided Design & Fabrication

<table>
<tr>
<td rowspan="2">NJ 2020 SLS: Science
MS-EST1-4 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.

NJ 2020 SLS: Science: Crosscutting Statements 6-8
• Structure and function
• Systems and system models

NJ 2020 SLS: Science: Science and Engineering Practices 6-8
• Asking questions and defining problems
• Developing and using models
• Using mathematics and computational thinking
• Constructing explanations and designing solutions

NJ 2020 SLS: Science: Disciplinary Core Ideas 6-8
• Developing Possible Solutions
• Developing and Using Models</td>
<td>Essential elements (controller board, filament, extruder, power supply, printer bed, connectivity) that allow 3D Printer’s to function.

Essential elements (lenses, laser generator, laser engraver head, power supply, stepper motor, water chiller, air compressor, filter) allow laser engravers to function.</td>
<td>Identify the structures and functions of 3D printers.

Develop a basic design for 3D printing.

Identify the structures and functions of laser engravers.

Develop a complex design for laser engraving.</td>
</tr>
<tr>
<td>VOCABULARY: Procedures, analysis, resources, researching, brainstorming, developing, communicating, building, testing, reflection, criteria, constraints, teamwork

KEY TERMS: computer aided design, Autodesk, TinkerCAD, 3D model, .STL file, extruder, ABA plastic, PLA plastic, MakerBot, vector line, raster, engraving</td>
<td></td>
</tr>
</table>

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Unit III: Computer Aided Design & Fabrication

NJ 2016 SLS: Math 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. 7.G.A.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. **Mathematical Practices** **MP4** Model with mathematics **MP5** Use appropriate tools strategically		

ASSESSMENT EVIDENCE: Students will show their learning by:

- Designing multiple objects on TinkerCAD that fit within given criteria and constraints
- Expressing knowledge of saving and downloading files for 3D Printing
- Fabricating an object using a 3D Printer
- Inventing and fabricating a design using a laser engraver
- Reflecting on computer-aided design elements

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Unit III: Computer Aided Design & Fabrication

KEY LEARNING EVENTS AND INSTRUCTION:

- Students will engage in small group collaboration (communicating, planning, and creating)
- Students will participate in TinkerCAD tutorial lessons/activities
- Students will present 3D printing/Laser engraving
- Students will reflect daily in engineering journals

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Unit III: Computer Aided Design & Fabrication

SUGGESTED TIME ALLOTMENT	**3 weeks**
SUPPLEMENTAL UNIT RESOURCES	Required Supplies/Activities/Software: Computers PowerPoint Computer Aided Design Software such as TinkerCAD RetinaEngrave 3D Printer Laser Engraver Various 3D Printer Filament Spools Materials for Laser cutting (wood, plastic, etc.) Suggested Supplies/Activities/Software: "TinkerCAD Tutorials" "TinkerCAD Project 1" "TinkerCAD Project 2" "TinkerCAD Project 3" "Laser Cutting Logo Creation"

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Unit IV: Stop Motion Animation

<table>
<tr>
<td rowspan="4">STANDARDS / GOALS:

NJ 2020 SLS: Computer Science and Design Thinking
8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.

8.2.8.ITH.2: Compare how technologies have influenced society over time.

NJ 2020 SLS: Career Readiness, Life Literacies, and Key Skills
9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT,3).

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

NJ 2020 SLS: Science: Crosscutting Statements 6-8
• Structure and function
• Systems and system models</td>
<td>ENDURING UNDERSTANDINGS</td>
<td>ESSENTIAL QUESTIONS</td>
</tr>
<tr>
<td>Creating a stop motion animation involves the collaboration of a team and the assignment of key roles.</td>
<td>• What makes a strong team?</td>
</tr>
<tr>
<td><u>KNOWLEDGE</u>
Students will know:</td>
<td><u>SKILLS</u>
Students will be able to:</td>
</tr>
<tr>
<td>Stop motion is an animation technique to make a physically manipulated object or person appear to move on its own, while video files display a realistic view.

The multiple steps in stop motion film development: brainstorming, creating a storyboard, utilizing props, and filming.</td>
<td>Illustrate the purpose and functionality of a stop motion film.

Collaborate on the development of key frames of a short stop motion film.

Develop the key frames of a short stop motion film.</td>
</tr>
</table>

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Unit IV: Stop Motion Animation

<table>
<tr>
<td rowspan="2">NJ 2020 SLS: Science: Science and Engineering Practices 6-8
• Asking questions and defining problems
• Developing and using models
• Constructing explanations and designing solutions

NJ 2020 SLS: Science: Disciplinary Core Ideas 6-8
• Developing Possible Solutions
• Developing and Using Models

Mathematical Practices
MP5 Use appropriate tools strategically</td>
<td>Software can be used to develop stop motion animation films.</td>
<td>Utilize various props to bring their ideas to life.

Create and film a short stop motion film.

Upload and edit pictures on stop motion software.

Evaluate the strength and weaknesses of the film and modify as needed.</td>
</tr>
<tr>
<td>VOCABULARY: Procedures, resources, researching, brainstorming, developing, communicating, building, testing, reflection, criteria, constraints, teamwork

KEY TERMS: Stop motion animation, storyboard, Stop Motion Studio, director, animator, theme</td>
<td></td>
</tr>
</table>

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Unit IV: Stop Motion Animation

ASSESSMENT EVIDENCE: Students will show their learning by:

- Planning a storyboard
- Creating a short stop motion animation film
- Evaluating the strength and weaknesses of the film and modify as needed
- Reflecting on daily stop motion designs

KEY LEARNING EVENTS AND INSTRUCTION:

- Students will engage in small group collaboration (communicating, planning and creating)
- Students will reflect daily in engineering journals

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Unit IV: Stop Motion Animation

SUGGESTED TIME ALLOTMENT	**2 weeks**
SUPPLEMENTAL UNIT RESOURCES	Required Supplies/Activities/Software: Computers iPad or cellphone Applications such as Stop Motion Studio Backdrop Multiple props and characters (Legos, clay, action figures etc.) Suggested Supplies/Activities/Software: "Storyboard creation" "Stop Motion Animation"