Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Classroom Safety**

Content Standard: **Understand and demonstrate various safety practices.**

#	**State Curriculum Standard**
3.4.10. D1.	Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it.
3.4.10. E6.	Illustrate how manufacturing systems may be classified into types; such as customized production, batch production, and continuous production.
3.1.10. E7.	Evaluate structure design as related to function, considering such factors as style, convenience, safety and efficiency.

Course Content	Student Performance	Resources/Activities	Assessments

A. Select and Apply Appropriate Tools, Materials and Processes Necessary to Solve Complex Problems
 	
B. Demonstrate Safe Use of Complex Tools and Machines within Their Specifications
 	
C. Common Cause of Accidents
 	
D. Accident Prevention Measures
 	
E. Safety Tools, Equipment and Machine Practices
 	
F. Safe Operating Practices and Procedures in the Electronics Laboratory
	• Participate in a discussion
	
	• Take notes on the safety issues in the classroom lab
	
	• Identify common causes of accidents
	
	• Identify and apply accident prevention measures
	
	• Follow and generalize safe operating practices and procedures in a lab setting
	
	• Demonstrate cooperative working attitude
		• Teacher-generated safety handouts
		• Watch a safety video
		  ◦ Take notes
		  ◦ Participate in a follow-up discussion
		
		• Solid State Fundamentals for Electricians 2nd Ed., ATP,1993
		
		• "Electrical Safety Video" Meridian Education Corporation, 1995
		
		• Teacher Tool Bag
		
		• SeaPerch Kit
			• Teacher generated safety test (true & false, multiple choice, and short answer)
			
			• Notes in notebook

Technology Planned Course: STEM Robotics Engineering Curriculum - SeaPerch

Unit: **Assembly of Subsystem: The Vehicle Frame**

Content Standard: **Understand and apply knowledge about Buoyancy, Measurement, and Design.**

#	State Curriculum Standard
3.4.10. C1.	Apply the components of the technological design process.
3.4.10. C2.	Analyze a prototype and / or create a working model to test a design concept by making actual observations and necessary adjustments.
3.1.12. D2.	Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.

Course Content	Student Performance	Resources	Assessments

A. Proper Tools and Equipment to Assemble Vehicle Frame
• Ruler
• 1/2" PVC Pipe
• 1/2" PVC Elbows
• PVC Pipe Cuter
• Drill
• 1/4" Drill Bit
• 3/32" Drill Bit
• Vise
• Safety Glasses
 	
B. Making Our Own Submarine
• Buoyancy
• Measurement (Standard and Metric)
• Design
 	
C. Vehicle Frame Assembly
• Components
• Part Cutting
• Drain Holes
• Float Supports
• Motor Mounting
• Payload Netting
	• Identify and understand how a submarine works
	  • Buoyance
	  • Design
	
	• Define word used in a basic engineering procedure
	
	• Use PVC pipe, connectors, and design to construct vehicle frame
	
	• Use Drill and proper drill bits to construct vehicle drain holes
	
	• Use foam to achieve accurate buoyance
	
	• Maintain a SeaPerch journal
	
	• Demonstrate the assembly of:
	  • Vehicle frame
	  • Drain Holes
	  • Flotation
	  • Motor Mounting
	  • Buoyance
		• Electricity and Electronics Technology, 7th ed. Text Book, Glencoe / McGraw-Hill, 1999
		
		• Electricity Concepts Lab Manual, Energy Concepts, Inc, 1996
		
		• www.seaperch.org
		
		• Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal.
		
		• www.kiddoscience.co.za/teacherprimarbuoyancy.html
		
		• Underwater Archeology shipwreck technology www.abc.se/~m10354/publ/uwarctec.htm
		
		• Teacher Tool Bag
		
		• SeaPerch Kit
			• Notes in notebook journal
			
			• Rubrics
			
			• Teacher observations
			
			• Professionalism
			
			• Student participation
			
			• Peer/teacher feedback
			
			• Presentations
			
			• Regional, State and National Event Competitions

Technology Planned Course: STEM Robotics Engineering Curriculum - SeaPerch

Unit: **Assembly of Subsystem: The Vehicle Frame**

Content Standard: **Understand and apply knowledge about Buoyancy, Measurement, and Design.**

#	State Curriculum Standard
3.4.10. C1.	Apply the components of the technological design process.
3.4.10. C2.	Analyze a prototype and / or create a working model to test a design concept by making actual observations and necessary adjustments.
3.1.12. D2.	Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.

Course Content	Student Performance	Resources	Assessments
D. Competitive Competitions • National SeaPerch Challenge • Local School Competition • Spring SeaPerch Derby	• Demonstrate the ability to: • Focus during a high demand situation • Conduct oneself professionally in all settings • Meet expectations and follow guidelines • Analyze and solve basic operating systems problems	• Electricity and Electronics Technology, 7th ed. Text Book, Glencoe / McGraw-Hill, 1999. • Electricity Concepts Lab Manual, Energy Concepts, Inc, 1996 • www.seaperch.org • Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal. • www.kiddoscience.co.za/teacherprimarbuoyancy.html • Underwater Archeology shipwreck technology www.abc.se/~m10354/publ/uwarctec.htm • Teacher Tool Bag • SeaPerch Kit	• Notes in notebook journal • Rubrics • Teacher observations • Professionalism • Student participation • Peer/teacher feedback • Presentations • Regional, State and National Event Competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: The Thruster Assembly**

Content Standard: **Understand and apply knowledge about Polarity, Soldering, Waterproofing, Measurement, and Design.**

#	State Curriculum Standard
3.4.10. C1.	**Apply the components of the technological design process.**
3.4.10. C2.	**Analyze a prototype and /or create a working model to test a design concept by making actual observations and necessary adjustments.**
3.1.12. D2.	**Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.**

Course Content	Student Performance	Resources	Assessments

A. Proper Tools and Equipment to Assemble Vehicle Thrusters.
• Drill
• Drill Bit 3/32
• Lead Sinkers
• Pliers
• Saw
• Marker
• Soldering Iron and Solder
• Safety Glasses
B. Proper Polarity of Terminals.
• Positive
• Negative
• Electric Motors
• Electrical Wires
C. Proper Assembly of Tether Wires to Motors.
• Soldering Iron
• Cat 5 Color Coding
• Function Motors
• Wire Placement
D. Thruster Assembly.
• Potting
• Thruster Containers
• Waterproofing
• Propellers
• Mounting to Vehicle Frame
	• Identify and illustrate the difference between polarity of terminals and motors
	• Define and apply terms used in a basic engineering procedure
	• Use tether wire, DC motors, red and black hook up wire, soldering, and waterproofing to assemble vehicle thrusters
	• Maintain a SeaPerch journal
	• Understand the role of polarity both positive and negative.
	• Demonstrate the assembly of Thrusters
	• Demonstrate the operation of: Thrusters
	• Demonstrate the ability to:
	  • Focus during a high demand situation
	  • Conduct oneself professionally in all settings
		• Electricity and Electronics Technology, 7th ed. Text Book, (Glencoe/McGraw-Hill, 1999)
		• Electricity Concepts Lab Manual, (Energy Concepts, Inc, 1996)
		• www.seaperch.org
		• www.seaperch.mit.edu
		• www.oceanexplorer.noaa.gov
		• Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsena
		• Build Your Own Under Water Robot and Other Wet Projects Text Book, (Westcoast Words, 2009)
		• Teacher tool bag
		• SeaPerch kit
			• Notes in notebook journal
			• Rubric
			• Teacher observations
			• Professionalism
			• Presentations
			• Student participation
			• Peer/teacher feedback
			• Regional, state and national event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: The Thruster Assembly**

Content Standard: **Understand and apply knowledge about Polarity, Soldering, Waterproofing, Measurement, and Design.**

#	State Curriculum Standard
3.4.10. C1.	**Apply the components of the technological design process.**
3.4.10. C2.	**Analyze a prototype and /or create a working model to test a design concept by making actual observations and necessary adjustments.**
3.1.12. D2.	**Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.**

Course Content	Student Performance	Resources	Assessments
E. Competitive Competitions. • National SeaPerch Challenge • Local School Competition • Spring SeaPerch Derby	• Meet expectations • Follow guidelines • Prepare for competitions	• Electricity and Electronics Technology, 7th ed. Text Book, Glencoe/McGraw-Hill,1999) • Electricity Concepts Lab Manual, (Energy Concepts, Inc. 1996) • www.seaperch.org • www.seaperch.mit.edu • www.oceanexplorer.noaa.gov. • Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsena • Build Your Own Under Water Robot and Other Wet Projects Text Book, (Westcoast Words, 2009) • Teacher tool bag • SeaPerch kit	• Notes in notebook journal • Rubric • Teacher observations • Professionalism • Presentations • Student participation • Peer/teacher feedback • Regional, state and national event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: The Control Box Assembly**

Content Standard: **Understand and apply knowledge about Circuit Diagram, Soldering, Waterproofing, Measurement, and Design.**

#	State Curriculum Standard
3.4.10. C1.	**Apply the components of the technological design process.**
3.4.10. C2.	**Analyze a prototype and /or create a working model to test a design concept by making actual observations and necessary adjustments.**
3.1.12. D2.	**Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.**

Course Content	Student Performance	Resources	Assessments

A. Proper Tools and Equipment to Assemble Vehicle Control Box
• Screwdriver Phillips
• Needle Nose Pliers
• Wire Strippers
• Soldering Iron.
• Sharpie (Marker)
• Ruler
• Safety Glasses
 	
B. Circuit Diagram.
• Pictorial
• Circuit
• Schematic
• Block
• Architectural
 	
C. Control Box Assembly.
• Components
• Enclosure
• Power Cable
• Push-button Vertical
• Push-button Horizontal
• Testing
	• Identify and understand the difference between:
	  • Circuit diagram
	  • Circuit components
	
	• Define and apply terms used in a basic engineering procedure
	
	• Use electrical components, soldering terminals, power cable, and waterproofing to assemble a vehicle control box
	
	• Maintain a SeaPerch journal
	
	• Understand the role polarity both positive and negative
	
	• Demonstrate the assembly of: Control Box
	
	• Demonstrate operation of: Control Box
	
	• Demonstrate the ability to:
	  • Focus during a high demand situation
		• Electricity and Electronics Technology, 7th ed., (Glencoe/ McGraw-Hill,1999)
		
		• Electricity Concepts, (Energy Concepts, Inc., 1996)
		
		• www.seaperch.org
		
		• Professional contact: Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal.
		
		• Sea Profiles CD-ROM Set www.hboi.edu/docs/ed_products.html
		
		• http://www.tsaweb.org/Vex-Robotics-Competition
		
		• Teacher tool bag
		
		• SeaPerch kit
			• Notes in notebook journal
			
			• Rubrics
			
			• Teacher observations
			
			• Professionalism
			
			• Student participation
			
			• Peer/teacher feedback
			
			• National SeaPerch Challenge
			
			• Regional, state, and national event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: The Control Box Assembly**

Content Standard: **Understand and apply knowledge about Circuit Diagram, Soldering, Waterproofing, Measurement, and Design.**

#	State Curriculum Standard
3.4.10. C1.	**Apply the components of the technological design process.**
3.4.10. C2.	**Analyze a prototype and /or create a working model to test a design concept by making actual observations and necessary adjustments.**
3.1.12. D2.	**Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.**

Course Content	Student Performance	Resources	Assessments
D. Competitive Competitions • TSA VEX Robotics Competition • Robot Boot	• Conduct oneself professionally in all settings • Meet expectations • Follow guidelines • Analyze and solve basic problems	• Electricity and Electronics Technology, 7th ed., (Glencoe/ McGraw-Hill,1999) • Electricity Concepts, (Energy Concepts, Inc., 1996) • www.seaperch.org • Professional contact: Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal. • Sea Profiles CD-ROM Set www.hboi.edu/docs/ed_products.html • http://www.tsaweb.org/Vex-Robotics-Competition • Teacher tool bag • SeaPerch kit	• Notes in notebook journal • Rubrics • Teacher observations • Professionalism • Student participation • Peer/teacher feedback • National SeaPerch Challenge • Regional, state, and national event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: Building the BaseBot**

Content Standard: **Understand and apply knowledge about Assembly Techniques, Measurement, and Design.**

#	State Curriculum Standard
3.4.10. C1.	**Apply the components of the technological design process.**
3.4.10. C2.	**Analyze a prototype and / or create a working model to test a design concept by making actual observations and necessary adjustments.**
3.1.12. D2.	**Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.**

Course Content	Student Performance	Resources	Assessments
A. Proper Tools and Equipment to Assemble BaseBot • Hack Saw • Vise • Hand File • Band Saw • Bench Grinder B. Metal Cutting. • Long Bar • Angle Bar • Square Bar • Measurement (Standard and Metric) • Design C. Assembly Techniques. • Material Lists • Picture of Assembly • Description of Each Step • Animated Diagrams D. Assembling the BaseBot Chassis. • Required Materials • Wrench • Mounting	• Identify and understand how a basic robot works: drive train, wiring, radio control, and design • Define word used in a basic engineering procedure • Use tools, materials, connectors, and design to construct Vex robot • Use classroom inventory to identify robotic components • Maintain an engineering journal • Demonstrate the assembly of: • BaseBot Chassis • Gear Alignment • Drive Train • Motor Mounting • Design	• LearnMate v4 Standalone content viewer. (Intelitek, 2005) • www.chiefdelphi.com • www.howstuffworks.com • Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal. • www.usfirst.org • www.intelitek.com • www.jpl.nasa.gov • http://www.tsaweb.org/Vex-Robotics-Competition • LearnMate curriculum with optional classroom LearnMate Management System (LMS) EasyC v4 for Cortex robotic programming software • Robust Vex Robotics Design System hardware • Robot Boot Camp	• Notes in notebook journal • Rubrics • Teacher observations • Professionalism • Student participation • Peer/Teacher feedback • Presentations • Drawing a square challenge. • Regional, state, and national event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: Building the BaseBot**

Content Standard: **Understand and apply knowledge about Assembly Techniques, Measurement, and Design.**

#	State Curriculum Standard
3.4.10. C1.	**Apply the components of the technological design process.**
3.4.10. C2.	**Analyze a prototype and / or create a working model to test a design concept by making actual observations and necessary adjustments.**
3.1.12. D2.	**Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.**

Course Content	Student Performance	Resources	Assessments
• Components • Gears • Motors • Drive Train E. Competitive Competitions. • TSA VEX Robotics Competition • Robot Boot	• Demonstrate the ability of: ◦ Focus during a high demand situation ◦ Publicly conduct themselves in a professional manner ◦ Meet expectations ◦ Follow guidelines	• LearnMate v4 Standalone content viewer. (Intelitek, 2005) • www.chiefdelphi.com • www.howstuffworks.com • Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal. • www.usfirst.org • www.intelitek.com • www.jpl.nasa.gov • http://www.tsaweb.org/Vex-Robotics-Competition • LearnMate curriculum with optional classroom LearnMate Management System (LMS) easyC v4 for Cortex robotic programming software • Robust Vex Robotics Design System hardware • Robot Boot Camp	• Notes in notebook journal • Rubrics • Teacher observations • Professionalism • Student participation • Peer/teacher feedback • Presentations • Drawing a square challenge. • Regional, state, and national event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: Radio Control**

Content Standard: **Understand and apply knowledge about Assembly Techniques, Measurement, and Radio Control.**

#	State Curriculum Standard
3.4.10. C1.	**Apply the components of the technological design process.**
3.4.10. C2.	**Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments.**
3.1.12. D2.	**Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.**

Course Content	Student Performance	Resources	Assessments

A. Radio Waves
• Telemedicine
• Space Exploration
• Industrial Applications
• Radio Receiver Module
• Joystick Channels
• Broadcast Frequencies
 	
B. Mounting the Controller.
• Vex Controller
• Angle Bar
• 8-32 BHCS x ½
• Keps Nuts
• Threaded Beams
• Base Plate
• Battery Strap
• 7.2 Volt Power Pack
 	
C. Connecting the Motors to the Controller.
• Routing Motor Wires
• Motor Ports
• Cable Ties
 	
D. Setting up RC.
• RF Receiver Module
• Antenna Sleeve and Holder
	• Identify and understand how radio waves are used:
	  ◦ Industrial,
	  ◦ Space
	  ◦ Telemedicine
	
	• Define and apply terms used in a basic engineering procedure
	
	• Participate actively in classroom discussions
	
	• Utilize LearnMate software and radio control plans to complete controller correctly
	
	• Differentiate between materials for various parts of the Vex Robot
	
	• Maintain a robot journal
	
	• Demonstrate the assembly of:
	  ◦ Mounting the controller
	  ◦ Connecting the Motors
	  ◦ Setting up RC
		• Learnmate v4 Standalone content viewer. (Intelitek, 2005)
		
		• www.chiefdelphi.com
		
		• www.howstuffworks.com
		
		• Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal.
		
		• www.usfirst.org
		
		• www.intelitek.com
		
		• www.jpl.nasa.gov
		
		• http://www.tsaweb.org/Vex-Robotics-Competition
		
		• LearnMate curriculum with optional classroom LearnMate Management System (LMS)
		
		• EasyC v4 for Cortex robotic programming software R
		
		• Robust Vex Robotics Design System Hardware
		
		• Robot Book Camp
			• Notes in notebook journal
			
			• Rubrics
			
			• Teacher observations
			
			• Professionalism
			
			• Student participation
			
			• Peer/teacher feedback
			
			• Presentations
			
			• Drawing a square challenge.
			
			• Regional, state, and national event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: Radio Control**

Content Standard: **Understand and apply knowledge about Assembly Techniques, Measurement, and Radio Control.**

#	State Curriculum Standard
3.4.10. C1.	**Apply the components of the technological design process.**
3.4.10. C2.	**Analyze a prototype and / or create a working model to test a design concept by making actual observations and necessary adjustments.**
3.1.12. D2.	**Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.**

Course Content	Student Performance	Resources	Assessments
• Receiver Cable • Choosing Frequency • Installing Frequency Crystals • Installing Battery E. Competitive Competitions • TSA VEX Robotics Competition • Robot Boot	• Demonstrate the ability to: • Focus during a high demand situation • Conduct oneself professionally in all settings • Meeting expectations • Follow guidelines	• Learnmate v4 Standalone content viewer. Intelitek, 2005 • www.chiefdelphi.com • www.howstuffworks.com • Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal. • www.usfirst.org • www.intelitek.com • www.jpl.nasa.gov • http://www.tsaweb.org/Vex-Robotics-Competition • LearnMate curriculum with optional classroom LearnMate Management System (LMS) • EasyC v4 for Cortex robotic programming software R • Robust Vex Robotics Design System Hardward • Robot Book Camp	• Notes in notebook journal • Rubrics • Teacher observations • Professionalism • Student participation • Peer/teacher feedback • Presentations • Drawing a square challenge • Regional, state, and national event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: Programming in Easy C**

Content Standard: **Understand and apply knowledge about Programming in Easy C.**

#	**State Curriculum Standard**
3.4.10. C1.	Apply the components of the technological design process.
3.2.P.B. PHYSICS	Develop qualitative and quantitative understanding of current, voltage, resistance, and the connections among them.
3.1.12. D2.	Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.

Course Content	Student Performance	Resources	Assessments
A. Proper equipment to program in easy C. • Computer • Vex Starter kit • Vex Power Pack • Base Bot • Programming Module • Easy C B. Safety and the programming components • Static Electricity • Momentary Connections • Polarity • Overheating • Safety Precaution • Connect to PC • Connect to Controller • Connections Layout C. Configuring easy C D. Assembling the BaseBot Chassis E. Gear Alignment Techniques	• Create schematics and layouts using Easy C • Define word used in a basic engineering procedure • Apply troubleshooting techniques towards programming in Easy C • Demonstrate setting up an Easy C programming command • Utilize LearnMate software and Easy c plans to correctly complete programming • Maintain a robot journal • Demonstrate the operation of: • BaseBot • Configuring Easy C • Polarity • Connections • Safety Precautions	• LearnMate v4 Standalone content viewer. Intelitek, 2005. • www.chiefdelphi.com • www.howstuffworks.com • Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal. • www.usfirst.org • www.intelitek.com • www.jpl.nasa.gov • http://www.tsaweb.org/Vex-Robotics-Competition • LearnMate curriculum with optional classroom LearnMate Management System (LMS) • Easy Cv4 for Cortex robotic programming software • Robust Vex Robotics Design system hardware • Robot Boot Camp	• Notes in notebook journal • Rubrics • Teacher observations • Professionalism • Student participation • Peer/teacher feedback • Presentations • Drawing a square Challenge • Regional, State, and National Event competitions

Technology Planned Course: STEM Robotics Engineering Curriculum – Sea Perch

Unit: **Assembly of Subsystem: Programming in Easy C**

Content Standard: **Understand and apply knowledge about Programming in Easy C.**

#	**State Curriculum Standard**
3.4.10. C1.	Apply the components of the technological design process.
3.2.P.B. PHYSICS	Develop qualitative and quantitative understanding of current, voltage, resistance, and the connections among them.
3.1.12. D2.	Verify that engineering design is influenced by personal characteristics; such as creativity, resourcefulness, and the ability to visualize and think abstractly.

Course Content	**Student Performance**	**Resources**	**Assessments**
F. BaseBot Drive Train G. Competitive Competitions • TSA VEX Robotics competition • Robot Boot	Demonstrate the ability to: • Focus during a high demand situation • Conduct oneself professionally in all settings • Meet expectation • Follow guidelines • Assemble a BaseBot drive train • Prepare for regional, state, and national competitions	• LearnMate v4 Standalone content viewer. Intelitek, 2005. • www.chiefdelphi.com • www.howstuffworks.com • Professional contact Sharam Dabiri (STEM Technology Manager) Picatinny Arsenal. • www.usfirst.org • www.intelitek.com • www.jpl.nasa.gov • http://www.tsaweb.org/Vex-Robotics-Competition • LearnMate curriculum with optional classroom LearnMate Management System (LMS • Easy Cv4 for Cortex robotic programming software • Robust Vex Robotics Design system hardware • Robot Boot Camp	Notes in notebook journal • Rubrics • Teacher observations • Professionalism • Student participation • Peer/teacher feedback • Presentations • Drawing a square Challenge • Regional, State, and National Event competitions

TECHNOLOGY PLANNED COURSE: STEM ROBOTICS ENGINEERING CURRICULUM – SEA PERCH APPENDIX
Standards and Assessment Anchors:
Standards for Technological Literacy (ITEA)
Source: Standards for Technological Literacy: Content for the Study of Technology Copyright: 2000, International Technology Education Association
ITEA Technology Content Standards
• Abilities for a Technological World
• Students will develop the abilities to apply the design process
• Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
• Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
• Apply a design process to solve problems in and beyond the laboratory classroom.
• Identify the design problem to solve and decide whether or not to address it.
• Specify criteria and constraints for the design.
• Develop and produce a product or system using a design process.
• Identify criteria and constraints and determine how these will affect the design process.
• Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual and written means in addition to three-dimensional models.
• Test and evaluate the design in relation to pre-established requirements, such as criteria and constrains, and refine as needed.
• Students will develop the abilities to use and maintain technological products and systems.
• Use computers and calculators to access, retrieve, organize, maintain, interpret, and evaluate data and information in order to communicate.
• Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
• Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
• Operate systems so that they function in the way they were designed.
The Nature of Technology
• Students will develop an understanding of the core concepts of technology.
• Different technologies involve different sets of processes.
• Requirements are the parameters placed on the development of a product or system.
• Complex systems have many layers of controls and feedback loops to provide information.
• Quality control is a planned process to ensure that a product, service, or system meets established criteria.
• Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
• Technological systems include input, processes, output, and, at times, feedback.
• Optimization is an ongoing process or methodology of designing or making a product and ids dependent on criteria and constraints.
• Selecting resources involves tradeoffs between competing values, such as availability, cost, desirability, and waste.

• Controls are mechanisms or particular steps that people perform using information about the system that causes systems to change.
• New technologies create new processes.
• An open-loop system has no feedback path and requires human intervention while a closed-loop system has no feedback path and requires human intervention.
• Technological systems can be connected to one another.
• Systems thinking involves considering how every part relates to others.
• Systems' thinking applies logic and creativity with appropriate compromises in complex real-life problems.
• Malfunctions of any part of a system may affect the function and quality of the system.
• Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.
• Maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability.
• Trade-off is a decision process recognizing the need for careful compromises among competing factors.
• The stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.
• Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.
• Technological progress promotes the advancement of Science and Mathematics.
• Students will develop an understanding of the characteristics and scope of technology.
• The development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.
• Technology is closely linked to creativity, which has resulted in innovation.
• The rate of technological development and diffusion is increasing rapidly.
• Inventions and innovations are the results of specific, goal-directed research.
The Designed World
• Students will develop an understanding of and be able to select and use information and communication technologies.
• There are many ways to communicate information, such as graphic and electronic means.
• The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.
• Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.
• Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.
• Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information
Design
• Students will develop an understanding of the role of troubleshooting, research and developments, invention and innovation, and experimentation in problem-solving.
• Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
• Many technological problems require a multi-disciplinary approach.

• Invention is the process of modifying an existing product or system to improve it.
• Some technological problems are best solved through experimentation.
• Technological problems must be researched before they can be solved.
• Not all problems are technological, and not every problem can e solved using technology.
Technology
• Students will develop an understanding of the attributes of design.
• Requirements for a design are made up of criteria and constraints.
• The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.
• The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints exploring possibilities selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making, it and communicating processes and results.
• Requirements of a design; such as criteria, constraints, and efficiency sometimes compete with each other.
• There is no perfect design.
• Design problems are seldom presented in a clearly defined form.
• Design is a creative planning process that leads to useful products and systems.
• Students will develop an understanding of engineering design.
• Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.
• Established design principles are used to evaluate existing designs to collect data, and to guide the design process.
• Brainstorming is a group problem-solving design process in which each person in the group represents his or her ideas in an open forum.
• Design involves a set of steps, which can be performed in different sequences and repeated as needed.
• A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
• The process of engineering design takes into account a number of factors.
• Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
Technology and Society
• Students will develop an understanding of the influence of technology on history.
• Many inventions and innovations have evolved by using slow and methodical processes of tests and refinements.
• The specialization of function has been at the art of many technological improvements.

PA Standards for Robotics
3.1 Unifying Themes
A. Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.
• Identify the function of subsystems within a larger system (e.g. role of thermostat in an engine, pressure switch).
• Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.
• Explain the concept of system redesign and apply it to improve technological systems.
• Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.
• Analyze and describe the effectiveness of systems to solve specific problems.
3.1 Inquiry and Design
A. Apply knowledge and understanding about the nature of scientific and technological knowledge.
• Compare and contrast scientific theories and beliefs.
B. Apply process knowledge and organize scientific and technological phenomena in varied ways.
• Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled-experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.
• Use process skills to make inferences and predictions using collected information and to communicate, using space/time relationships, defining operationally.
C. Apply the elements of scientific inquiry to solve problems.
• Design an investigation with adequate control and limited variables to investigate a question.
• Conduct a multiple step experiment.
• Organize experimental information using a variety of analytic methods.
• Judge the significance of experimental information in answering the question.
• Suggest additional steps that might be done experimentally.
D. Identify and apply the technological design process to solve problems.
• Evaluate the solution, test, redesign and improve as necessary.
• Communicate the process and evaluate and present the impacts of the solution.
3.6 Technology Education
A. Apply knowledge of information technologies of encoding, transmitting, receiving, storing, retrieving and decoding.
• Describe the proper use of graphic and electronic communication systems.
• Apply a variety of advanced mechanical and electronic drafting methods to communicate a solution to a specific problem.
• Apply and analyze advanced communication techniques to produce an image that effectively conveys a message (e.g. desktop publishing, audio and/or video production). • Illustrate an understanding of a computer network system by modeling, constructing or assembling its components.
B. Apply physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems.
3.7 Technological Devices
A. Apply appropriate instruments and apparatus to examine a variety of objects and processes.

• Describe and use appropriate instruments to gather and analyze data.
• Compare and contrast different scientific measurements systems; select the best measurement system for a specific situation.
• Explain the need to estimate measurements within error of various instruments.
• Apply accurate measurement knowledge to solve everyday problems.
• Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties (e.g. scanning electron microscope, nuclear magnetic resonance machines).
B. Apply basic computer operations and concepts.
• Identify solutions to basic hardware and software problems.
• Apply knowledge of advanced input devices.
• Apply knowledge of hardware setup.
• Describe the process of basic software installation and demonstrate it.
• Analyze and solve basic operating systems problems.
• Apply touch keyboarding skills and techniques at expectable speed and accuracy.
• Demonstrate the ability to perform basic software installation.
C. Utilize computer software to solve specific problems.
• Identify legal restrictions in the use of software and the output of data.
• Apply advanced graphic manipulation and desktop publishing techniques.
• Apply basic multimedia applications.
• Apply advanced word processing, database and spreadsheet skills.
• Describe and demonstrate how two or more software applications can be used to produce an output.
• Select and apply software designed to meet specific needs.
D. Apply basic computer communications systems.
• Identify and explain various types of on-line services.
• Identify and explain the function of the parts of a basic network.
• Describe and apply the components of a web page and their function.
• Explain and demonstrate file transfer within and outside of a computer network.
• Identify, describe, and complete advanced on-line research.
3.8 Science, Technology and Human Endeavors
A. Analyze the relationship between social demands and scientific and technological enterprises.
• Compare technologies that are applied and accepted differently in various cultures (e.g. factory farming, nuclear power).
• Describe and evaluate social change as a result of technological developments.
• Assess the social impacts of a specific international environmental problem by designing a solution that applies the appropriate technologies and resources.
B. Analyze how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.
• Identify several problems and opportunities that exist in your community, apply various problem-solving methods to design and evaluate possible solutions.

C. Evaluate possibilities consequences and impacts of scientific and technological solutions.		
• Relate scientific and technological advancements in terms of cause and effect.		
• Describe and evaluate the impacts that financial considerations have had on specific scientific and technological applications.		
• Compare and contrast potential solutions to technological, social, economic and environmental problems.		
• Analyze the impacts on society of accepting or rejecting scientific and technological advances.		
Big Idea(s)		
During the semester students build a solid foundation in robotics by: • Building and programming their own robot. • Gaining hands-on knowledge about physics, technology, engineering and math while using their robot. • Completing a capstone project that challenges the student to solve a real-life problem.		
It reviews fundamental robotic terms and concepts required throughout the course. The students learn about the engineering design cycle and how to record information into an engineering notebook. As the student progresses through the unit, they will be constructing their first Vex robot, the BaseBot. They will learn how to use basic assembly tools as well as how to identify classroom inventory system. After the robot is constructed, the students test and trouble shoot their creating. They learn how to operate Vexbot using radio control in both Arcade and Tank style. They will also use mathematic formulas to solve engineering design problems and challenges.	• Acceleration • Actuator • Algorithm • Alternating Current • Anode • Boolean Algebra • Brainstorming • Callee • Cathode • Char • Diametral Pitch • Easy C • Electrical Current • Echolocation • Electrode • Frequency • Function • Loading • Mechanical Energy • Multifunctional • Newton’s 1, 2, 2 Laws • Self-Documenting Code • Spectrometer • Timing Diagram • Voltage	• LearnMate Software • Vex Started Kit • Power Pack • Programming Kit • Ultrasonic Range Finder • Line Follower Kit • 12” Ruler • Stop Watch • Electrical Tape • Tape Measure • Spring Scale • Easy C 2.0 • Crystal Upgrade Kit

ASSESSMENT EVIDENCE	
Formative Assessment:	**Summative Assessment:**
• Technical Robotic Rubric	• Students will apply information learned in a design activity and project.
• Building the Robot	• Students will be tested in the classroom on the information learned in the design activity.

LEARNING PLAN
Instructional Activities:
• Programming in Easy C
• Robot Race
• Drawing a Square
• User Functions
• Maze
• Gear Switch
• Bumper Bots
• Robotic Arm
• Pick-Up Cups
Enrichments:
• Students can use LearnMate software for remediation.
• Students can use LearnMate for clarification.