Southern Cayuga Central School District – Curriculum Map

Subject: **Robotics** School Year: **2023-2024**

Title or Topics w/ NYS Standards	Essential Questions & Vocabulary	Content Skills (Activities to cover Essential Questions)	Major Assessments (Tests, Project, etc.)	Time Frame
Unit 1: Introduction to Engineering and STEM *NGSS Standards: HS-ETS1-3*	What do engineers need to know to design and operate a robotic system to do work? • What is technology? • What is engineering? • What is the engineering design process? • What careers involve robotics? • How are Vex components used on a robot? Vocabulary: engineering, chassis, bumper angle, motor coupler, spacer, cortex, gear, shaft, range finder, bumper switch, shaft encoder, potentiometer, limit switch, light sensor, line followers, slalom, manipulator, input, output	• Paper tower engineering • Orthographic view • Discovery Channel – Robotics Rising • Career connections	STEM Challenge #1 STEM Challenge #2 STEM Challenge #3 STEM Challenge #4	1-2 weeks

Unit 2: Intro to Robotics Building *NGSS Standards: HS-ETS1-2, HS-ETS1-3*	How do parts work together to form a functioning robot? • How are motors incorporated into a drivetrain? • How can elevator stages be added for height? • Can linkages have benefits over elevators? • How does passive assistance change the work load of a robot? How can gears be changed for desired speed or power? • How is mechanical advantage achieved? How can you configure the joystick to control all motors and mechanisms of a robot? <u>Vocabulary:</u> drivetrain, chassis, rotating joints, elevators, linkages, passive assistance, torque, mechanical advantage, gear reduction, passive assistance	• Degrees of freedom of a human arm • Elevator lift • Linkage support	Build: Basic Armbot Challenge: Obstacle Course Challenge: Sack Attack	5 weeks

Unit 3: Movement and Basic Coding *NGSS Standards: HS-ETS1-2, HS-ETS1-3, HS-ETS1-4*	How do programmers design, write, and execute instructions to control a robot? • What are robot behaviors? • What are the behaviors of the robot in the simple labyrinth challenge? How do we program a robot to reproducibly travel the same distance? • What are encoder sensors and how are they used? How do you program a robot to autonomously straighten its path while traveling forward? • What parts of a drive forward program need to be developed further to have the robot travel a straight path? • How can we enable the robot to adjust the power levels of the motors automatically? • How can we use variables to improve out programs? How do you program a robot to perform the same behavior differently? • How can we reuse lines of code (for behaviors) multiple times without rewriting the code? • How do parameters expand the utility of functions in the program? <u>Vocabulary:</u> labyrinth, encoder, autonomous, automated, variable, loops, value, pseudocode, program, parameters, if/else statement	• PBJ activity • Movement and Turn coding • Power levels • Encoder code • If/else statement code • Loop code	Challenge: Labyrinth code Challenge: Drive straight Challenge: Maze	6 weeks

Unit 4: Sensors *NGSS Standards: HS-ETS1-2, HS-ETS1-3*	How can feedback from a digital touch sensor like a bumper be used to control robotics behaviors? • What is the relationship between the status of the touch sensor and the values returned to the Cortex? How can the sonar sensor be used to control robotics behavior? • What is the proper wire placement and configuration? How can the light sensor be used to control robotic behavior? • What is the threshold value and how is it used with a light sensor? How do we program a robot to use line following to control robot behaviors? <u>Vocabulary:</u> bumper, light sensor, sonar, threshold, loops, analog input, digital input, behaviors	• Bumperbot Challenge • Sentry II Challenge • Light tag Challenge • Tablebot Challenge • Slalom Challenge	Build: Soccer Bot Challenge: Maze 2.0	6 weeks

Unit 5: Control Functions *NGSS Standards: HS-ETS1-2, HS-ETS1-3*	What are the commands that can be programmed for wireless control of a robot? • How are autonomous and operator control different and alike? • How can we program the robot to perform autonomous tasks while using the wireless remote with operator control? How do while loops and if/else statements work together to cause a robot to perform a desired behavior? • <u>Vocabulary:</u> RC control, while loop, infinite loop, word circles, button steering	• Operator Control Challenge	Challenge: Pathfollow	3 weeks

Unit 6: Final Project *NGSS Standards: HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4*	How can we incorporate all coding and building skills into designing and building a robot for a one on one challenge in a modified competition field? • How can designs be used for offensive/defensive strategies? • How can the autonomous code give a competitive advantage? <u>Vocabulary:</u> analysis, pre-autonomous, enable, disable	• Engineering notebook	Final: Swept Away Challenge	3 weeks

Unit 7: Competition *NGSS Standards: HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4*	How can we incorporate all coding and building skills to solve the problem presented by the current Vex VRC Challenge? • How does strategic design influence building both on a team and against potential opponents? • How can cost benefit analysis be factored into design and building? <u>Vocabulary:</u> analysis, pre-autonomous, enable, disable, platform, elevation, game objects, perimeter, gravity, accuracy, agility	• Vex in the Zone • Vex Nothing But Net • Engineering notebook	Challenge: Current VRC competition	12 weeks