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| <b>Course Title:</b> | Robotics, Coding for Engineering |
| <b>Grade(s):</b>     | 9-12                             |

| Course Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| <p>This course will provide students with opportunities to explore and learn a variety of current technologies and hypothesize future ones. Students will learn promising new applications of technology along with related principles of Science, Technology, Engineering, and Mathematics (STEM) through critical thinking and problem-solving experiences. Students will discover the fundamentals of robotic systems and apply that knowledge to create solutions to real-world challenges.</p> <p><i>Prerequisite: Successful Completion of ONE previous Technology Education class.</i></p> |
| Approved Curricular Materials/Textbook(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| Unit Title     | Unit Description (Include Unit Objectives)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Unit Pacing |
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| Unit 1: Safety | <p>Students will learn and apply essential safety practices used in robotics laboratories, engineering environments, and manufacturing settings. Emphasis is placed on proper tool use, equipment operation, electrical safety, personal protective equipment (PPE), and maintaining a safe and organized workspace.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Identify potential hazards in a robotics laboratory.</li> <li>• Demonstrate proper use of personal protective equipment (PPE).</li> <li>• Follow established safety procedures when using hand and power tools.</li> <li>• Apply safe practices when working with electrical components and batteries.</li> <li>• Maintain a clean and organized work area.</li> <li>• Demonstrate responsible behavior during robotics activities and competitions.</li> </ul> | Ongoing     |

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|                                | <ul style="list-style-type: none"> <li>• Pass a robotics laboratory safety assessment.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |
| Unit 2: Mathematical Reasoning | <p>Students will develop the mathematical skills necessary for robotics design, programming, and problem-solving. Topics include measurement, ratios, proportions, geometry, algebraic reasoning, coordinate systems, and data analysis.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Perform accurate measurements using standard engineering tools.</li> <li>• Apply ratios, proportions, and scaling to robotics designs.</li> <li>• Use geometric principles to calculate distances, angles, and dimensions.</li> <li>• Interpret graphs and data collected from robotic systems.</li> <li>• Apply algebraic formulas to solve engineering problems.</li> <li>• Use coordinate systems to describe robot movement and positioning.</li> <li>• Analyze numerical data to improve robot performance.</li> </ul>                             | 1 week  |
| Unit 3: Programming Languages  | <p>Students will explore programming concepts used in robotics systems. Through hands-on coding activities, students will learn programming logic, variables, functions, loops, conditionals, and debugging techniques while developing code to control robotic devices.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the role of programming in robotics systems.</li> <li>• Write and modify basic robotic programs.</li> <li>• Use variables, operators, and data types appropriately.</li> <li>• Create programs using loops and conditional statements.</li> <li>• Develop and use functions to improve code efficiency.</li> <li>• Debug and troubleshoot programming errors.</li> <li>• Document code using comments and proper formatting.</li> <li>• Test and refine programs to achieve desired robot behaviors.</li> </ul> | 2 weeks |
| Unit 4: Engineering Design     | <p>Students will apply the engineering design process to identify problems, develop solutions, create prototypes, and evaluate performance. Students will utilize design software and</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 weeks |

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|                                         | <p>physical modeling techniques to create effective robotic systems.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Describe the steps of the engineering design process.</li> <li>• Identify design requirements and constraints.</li> <li>• Generate multiple design concepts through sketching and brainstorming.</li> <li>• Create digital models using CAD software.</li> <li>• Construct and test physical prototypes.</li> <li>• Evaluate design performance using objective criteria.</li> <li>• Revise designs based on testing results and feedback.</li> <li>• Communicate design solutions through presentations and documentation.</li> </ul>                                                                                                                                      |         |
| Unit 5: Engineering Sensors Algorithms  | <p>Students will investigate how robots gather information from their environment through sensors and use algorithms to make decisions. Students will integrate sensor data into robotic programming to improve autonomous performance.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the purpose of sensors in robotic systems.</li> <li>• Identify common robotic sensors and their applications.</li> <li>• Collect and interpret sensor data.</li> <li>• Develop algorithms that respond to sensor input.</li> <li>• Implement decision-making structures within robotic programs.</li> <li>• Calibrate sensors for reliable performance.</li> <li>• Test and troubleshoot sensor-based systems.</li> <li>• Evaluate the effectiveness of autonomous robotic behaviors.</li> </ul> | 2 weeks |
| Unit 6: Engineering Design Manipulators | <p>Students will design, build, and evaluate robotic manipulators used to interact with objects. Students will explore mechanical advantages, structural design, and task-specific solutions to improve robot functionality.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2 weeks |

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|                                                   | <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the purpose and function of robotic manipulators.</li> <li>• Analyze task requirements to determine manipulator design needs.</li> <li>• Design manipulators capable of grasping, lifting, or moving objects.</li> <li>• Apply principles of force and mechanical advantage.</li> <li>• Build and test manipulator prototypes.</li> <li>• Evaluate manipulator performance using established criteria.</li> <li>• Modify designs to improve efficiency and reliability.</li> <li>• Document the design process and testing results.</li> </ul>                                                                                                                                                                      |         |
| Unit 7: Driver Control Coding/Autonomous Movement | <p>Students will develop programming solutions for both driver-controlled and autonomous robot operation. Emphasis is placed on control systems, navigation, movement accuracy, and performance optimization.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Program robots for manual driver-controlled operation.</li> <li>• Configure controllers and user inputs.</li> <li>• Develop autonomous movement routines.</li> <li>• Apply sensor feedback to improve navigation accuracy.</li> <li>• Use variables and algorithms to control robot movement.</li> <li>• Test and refine autonomous paths.</li> <li>• Troubleshoot movement and control issues.</li> <li>• Compare the advantages and limitations of driver-controlled and autonomous systems.</li> </ul> | 2 weeks |
| Unit 8: Gears, Chains, and Sprockets              | <p>Students will examine mechanical power transmission systems commonly used in robotics. Through design challenges and experimentation, students will learn how gears, chains, and sprockets affect speed, torque, and overall robot performance.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Identify common power transmission components.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                            | 2 weeks |

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|                                                                             | <ul style="list-style-type: none"> <li>● Explain the relationship between gear ratios, speed, and torque.</li> <li>● Calculate gear ratios for robotic applications.</li> <li>● Design gear trains to meet specific performance requirements.</li> <li>● Assemble chain and sprocket systems correctly.</li> <li>● Evaluate the efficiency of mechanical transmission systems.</li> <li>● Troubleshoot mechanical drive systems.</li> <li>● Select appropriate transmission components based on design goals.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |
| Unit 9: Engineering Design Manipulators/ Lifts/Driver Control Game Strategy | <p>Students will integrate mechanical design, programming, and strategic planning to create competitive robotic systems. Students will design manipulators and lifting mechanisms while developing driver-control strategies based on game objectives and performance analysis.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>● Analyze game rules and scoring opportunities.</li> <li>● Design manipulators tailored to specific game challenges.</li> <li>● Design and build lifting systems capable of meeting performance requirements.</li> <li>● Evaluate trade-offs between speed, strength, stability, and reliability.</li> <li>● Develop effective driver-control strategies.</li> <li>● Collaborate as a team to improve robot performance.</li> <li>● Use testing data to optimize robot design and gameplay decisions.</li> <li>● Present and justify engineering and strategic decisions using evidence.</li> <li>● Demonstrate effective problem-solving throughout the design cycle.</li> <li>● Compete successfully while exhibiting professionalism and teamwork.</li> </ul> | 3 weeks |