**COURSE DESCRIPTION**

**Course Title:** Engineering and Technology STEM Pathway

**Course Number:** 00798

**Course Prerequisites:** None

**Course Description:** The WCSD Engineering and Industrial Technology Pathway will explore various systems of technology. Students have access to experiments with circuitry, computer graphics, digital communications, mechanics and structures, robotics and control technology, scientific data analysis, software engineering, sustainability, and more options as they develop. Students will utilize a variety of systems to design, build, and program in order to solve relevant challenges. It will also allow students to explore other engineering and industrial aspects such as 3D Design, fabrication, coding and programming, as well as drone technology. This pathway is specifically designed to build upon the skills developed in the STEM Academy classroom and to allow students to explore potential career interests.

**Suggested Grade Level**: Grades 9-12

**Length of Course:** Two Semesters

**Units of Credit:** 1

**PDE Certification and Staffing Policies and Guidelines (CSPG) Required Teacher Certifications:**

CSPG65 – Technology Education

To find the CSPG information, go to [CSPG](https://www.education.pa.gov/Educators/Certification/Staffing%20Guidelines/Pages/default.aspx)

**Certification verified by the WCSD Human Resources Department:** [x] Yes [ ] No

**WCSD STUDENT DATA SYSTEM INFORMATION**

**Course Level:** Academic

**Mark Types:** Check all that apply.

[x] F – Final Average [x] MP – Marking Period [x] EXM – Final Exam

**GPA Type**: [ ]  GPAEL-GPA Elementary [ ]  GPAML-GPA for Middle Level [x]  NHS-National Honor Society

[x]  UGPA-Non-Weighted Grade Point Average [x]  GPA-Weighted Grade Point Average

**State Course Code**: 21003

To find the State Course Code, go to [State Course Code](https://nces.ed.gov/forum/sced.asp), download the Excel file for *SCED*, click on SCED 6.0 tab, and choose the correct code that corresponds with the course.

**TEXTBOOKS AND SUPPLEMENTAL MATERIALS**

**Board Approved Textbooks, Software, and Materials:**

**Title:**  No text used within this course.

**Publisher:** N/A

**ISBN #:**  N/A

**Copyright Date:** N/A

**WCSD Board Approval Date:** N/A

**Supplemental Materials:** Creative Learning Systems Kits and equipment, drone technology, CNC Machine, 3D Printer, and STEM resources including but not limited to the items within the task grid below

**Curriculum Document**

**WCSD Board Approval:**

**Date Finalized:** 7/26/2023

**Date Approved:**  10/9/2023

**Implementation Year:** 2023-2024

**SPECIAL EDUCATION, 504, and GIFTED REQUIREMENTS**

The teacher shall make appropriate modifications to instruction and assessment based on a student’s Individual Education Plan (IEP), Chapter 15 Section 504 Plan (504), and/or Gifted Individual Education Plan (GIEP).

**SCOPE AND SEQUENCE OF CONTENT AND CONCEPTS**

Students may approach course content in different directions and at different speeds. Background knowledge and skills may determine different areas of interest and ability.

Course content is not limited to task grid items, as new and changing technology creates new opportunities to learn.

**Standards/Eligible Content and Skills**

| **Performance Indicator** | **PA Core Standard and/or Eligible Content** |  |
| --- | --- | --- |
| **Competency Task List** |  |  |
| **ORIENTATION AND SAFETY** |  |   |
| Complete record keeping, updating ePortfolio in a frequent and timely fashion. | 15.4.8.C |   |
| Proficiently operate computers with different operating systems: Windows and Mac OS. | 15.4.12.E |   |
| Perform housekeeping duties daily, cable management, physical memory, tool replacement. |  |   |
| Follow verbal instructions to complete work assignments and rules. |  |   |
| Follow written instructions to complete work assignments and rules. |  |   |
| Follow emergency action plan (all inclusive). |  |   |
|   |  |   |
| **CIRCUITRY** |  |   |
| Basic understanding of electricity | ISTE  6a |   |
| Basic understanding of a circuit | ISTE  6b |   |
| Basic understanding of the flow of electricity and possible problems | ISTE  4b |   |
| Comparing conductors and insulators. | ISTE  3c |   |
| AC vs. DC Current | ISTE  7c |   |
| Elements of a circuit: power source, path, flow control, load | ISTE  5a |   |
| Build a simple circuit with LEDs, switches, potentiometer | ISTE  4a |   |
|  |  |   |
|  |  |   |
|   |  |   |
| **COMPUTER GRAPHICS** |  |   |
| Capturing content through screenshots | ISTE 1b |   |
| Appropriate tool selection for 2D graphics or 3D graphics. | ISTE 6b |   |
| Adobe program constants: toolbar, workspace, file manipulation | ISTE 4b |   |
| 2D Graphics manipulation: Photoshop: Layers, Selection, Combining Elements | ISTE 6a |   |
| 3D Graphics manipulation: CAD: placing shapes, measuring, cutting, combining | ISTE 4c |   |
|  |  |   |
| Carbide Create: designing a project for CNC milling | ISTE 5b |   |
| TinkerCAD: designing a project for 3D printing | ISTE 2b |   |
| LaserGRBL: designing a project for laser engraving | ISTE 6b |   |
| Digital attribution and respecting rights and intellectual property | ISTE 3a |   |
|   |  |   |
| **DIGITAL COMMUNICATIONS** |  |   |
| Sound Engineering: Basic Elements - Tempo, Key | ISTE 6b |   |
| Sound Engineering: Remix Music | ISTE 6a |   |
| Sound Engineering: Create an original piece of music using premade sound clips | ISTE 6d |   |
| Website Creation: Personalizing a Premade Template | ISTE 2b |   |
| Website Creation: Adding Pages and Customizing for Target Audience | ISTE 3d |   |
| Animation: Stop Motion with Physical Objects | ISTE 6c |   |
| Animation: Digital Animation with Adobe or FireAlpaca | ISTE 6a |   |
| Digital Design: Procreate use for original illustration | ISTE 6b |   |
|  |  |   |
|   |  |   |
| **MECHANICS AND STRUCTURES** |  |   |
| FischerTechnik Mechanics and Statics Simple machines in action | ISTE 6a |   |
| FischerTechnik Mechanics and Statics Build stable bridges, cranes, high seats | ISTE 4b |   |
| FischerTechnik Mechanics and Statics Explain how multiple forces act on a static structure | ISTE 3b |   |
| FischerTechnik Optics Properties of light: reflection, refraction, propagation, bundling  | ISTE 6c |   |
| FischerTechnik Optics Spectral decomposition of light. light, color and vision. | ISTE 6d |   |
| Engino: Stable structures under force | ISTE 2d |   |
| Engino: Solve an original problem with an original design | ISTE 4d |   |
| Bridge Designer: structural integrity in bridge design | ISTE 5a |   |
| Bridge Designer: using trusses to support structural weight | ISTE 4c |   |
| Bridge Designer: reducing the cost of a successful bridge | ISTE 1c |   |
|   |  |   |
| **ROBOTICS AND CONTROL TECHNOLOGY** |  |   |
| Vex: robot construction - choosing a chassis type and purpose | ISTE  4a |   |
| Vex: robot construction - choosing wheel type based on desired movementy type | ISTE  4a |   |
| Vex: robot construction - solving original problems with an original design | ISTE  4d |   |
| Vex: robot construction - modifying prototypes for better design | ISTE  4d |   |
| Vex: robot programming - writing a simple program to control movement | ISTE  5b |   |
|  |  |   |
|  |  |   |
|  |  |   |
| FischerTechnik - Programming to run motors based on timers | ISTE  5a |   |
| FischerTechnik - Programming perform action based on temperature sensor | ISTE  5b |   |
| FischerTechnik - Programming perform action based on light sensor  | ISTE  5b |   |
| FischerTechnik - Programming change action based on a sensor reading (turn around, stop, back up) | ISTE  5b |   |
| CNC Milling - machine setup for milling | ISTE  4a |   |
| CNC Milling - jig setup for milling | ISTE  4a |   |
| CNC Milling - programming for multicut and mill swap | ISTE  5c |   |
| Laser Engraving - Programming a design for engraving | ISTE  5c |   |
| Laser Engraving - Alter settings to engrave on different materials | ISTE  5b |   |
| Laser Engraving - Alter settings for laser intensity and speed to cut materials | ISTE  5b |   |
| Drone Flight - physical components of aircraft | ISTE  6a |   |
| Drone Flight - physical components of controller | ISTE  6a |   |
| Drone Flight - Complying with basic FAA regulations | ISTE  2b |   |
| Drone Flight - Inspecting batteries and blades for damage and wear | ISTE  6b |   |
| Drone Flight - Safe flight in different conditions - altitude | ISTE  6c |   |
| Drone Flight - Safe flight in different conditions - wind | ISTE  6c |   |
| Drone Flight - Safe flight in different conditions - speed | ISTE  6c |   |
| Drone Flight - capturing still imagery | ISTE  4c |   |
| Drone Flight - capturing video while moving | ISTE  4c |   |
| Lego Mindstorms - building and wiring a robot | ISTE  4a |   |
| Lego Mindstorms - writing a simple program to include movement | ISTE  5b |   |
| Lego Mindstorms - writing a program to perform actions based on sensor readings | ISTE  5b |   |
| Lego Mindstorms - programming sounds based on inputs | ISTE  5b |   |
|   |  |   |
| **SCIENTIFIC DATA ANALYSIS** |  |   |
| ArcGIS - Using geographic information systems | ISTE 6d |   |
| ArcGIS - Finding and interpreting maps | ISTE 6d |   |
| ArcGIS - Adding modifying properties to basemaps | ISTE 6d |   |
| ArcGIS - Sharing maps through email or social media | ISTE 6c |   |
| AcrGIS - Creating original maps with interactive features | ISTE 4b |   |
| Flight Simulator - Use the forces of lift, thrust, drag, and gravity of a plane in flight. | ISTE 6a |   |
| Flight Simulator - Principles of flight takeoff and landing | ISTE 6a |   |
| Google Earth - How to create a custom map | ISTE 6d |   |
| Google Earth - Locating with latitude and longitude | IST  6d |   |
| Google Earth - Creating a custom tour | ISTE 6d |   |
| Google Earth - Measuring distances | ISTE 6d |   |
| Stellarium - Bookmark objects in the sky | ISTE 6b |   |
| Stellarium - Constellation locations in the celestial sphere | ISTE 6b |   |
| Stellarium - Astronomical distances and brightness | ISTE 6b |   |
| Stellarium - Using tools to predict and plan for outdoor observations | ISTE 6b |   |
| Vernier - Light Sensors in test models | ISTE 3b |   |
| Vernier - Force Sensors in test models | ISTE 3b |   |
| Vernier - Temperature Sensors in test models  | ISTE 3b |   |
|   |  |   |
| **SOFTWARE ENGINEERING** |  |   |
| Scratch for animation - vectors vs bitmaps | ISTE 6d |   |
| Scratch for animation - simulating movement | ISTE  4d |   |
| Scratch for animation - changing backdrops based on conditions | ISTE 5b |   |
| Scratch for game design - programming sprites with logic | ISTE 5b |   |
| Scratch for game design - creating an original game | ISTE 4a |   |
| Dreamweaver for Website Design | ISTE 1a |   |
| Google Sites for Website Design from Templates | ISTE 1a |   |
| RPG Paper Maker - Sprites and Logic programming  | ISTE 5b |   |
| App Maker Jotform for Android and iOS | ISTE 5a |   |
| Coding: Python | ISTE 5a |   |
| Stencyl Game Design | ISTE 4a |   |
|   |  |   |
| **SUSTAINABILITY** |  |   |
| Energy Efficiency Infrared Camera | HS-PS3-4 |   |
| Energy Efficiency Watt Meter | HS-PS3-4 |   |
| Energy Efficiency Energy Audit | HS-ETS1-1 |   |
| Solar Photovoltaics with Vernier | HS-ETS1-1 |   |
| Solar Water Pasteurization  | HS-PS3-3 |   |
| Solar Energy: Designing a Solar Box Oven | HS-PS3-3 |   |
|  |  |   |
| Solar Energy: Generating Power and Doing Work with Solar Panels | HS-PS3-3 |   |
| Wind Power: Blade Designs | HS-PS3-3 |   |
| Wind Power: Calculating and Testing Output | HS-PS3-3 |   |
| FischerTechnik: Hydro Energy - Water energy to electricity | HS-PS3-3 |   |
| FischerTechnik: Hydro Energy - Water energy to mechanical energy  | HS-PS3-3 |   |
| FischerTechnik: Wind Energy - Wind energy to electricity | HS-PS3-3 |   |
| FischerTechnik: Wind Energy - Wind energy to mechanical energy | HS-PS3-3 |   |
| FischerTechnik: Solar Energy - Solar energy to mechanical energy | HS-PS3-3 |   |
| FischerTechnik: Solar Energy - measuring energy output | HS-PS3-3 |   |
| FischerTechnik: Storing energy from renewable sources | HS-ESS3-4 |   |
|  |  |   |
|   |  |   |
| **GENERAL STEM PERFORMANCE MEASURES** |  |   |
| Hardware Knowledge: Cables (USB, Lightning, Ethernet, Audio) | 15.4.12.C |   |
| Software Knowledge: Operating Systems (Windows, MacOS, ChromeOS) | 15.4.12.E |   |
| Software Knowledge: Mobile Operating Systems (Android, iOS) | 15.4.12.E |   |
| Software Knowledge: file types for images (jpg, png, svg, converting) | 15.4.12.G |   |
| Software Knowledge: file types for audio (wav, mp3, converting) | 15.4.12.G |   |
| Software Knowledge: file types for video (mp4, mov, converting) | 15.4.12.G |   |
| Software Knowledge: file types for office work (docx, pdf, converting) | 15.4.12.G |   |
| Tool Knowledge: hand tools (screwdriver types, wrench types, pliers) | 3.4.12.A3 |   |
| Hardware Knowledge: Displays (FPS levels, Refresh Rates, Resolutions (1080p vs. 4k)) | 15.4.12.C |   |
| Hardware Knowledge: Removable Media (SD cards, USB drives, transfer speeds) | 15.4.12.C |   |
| Hardware Knowledge: Mobile Devices (Cell Phone Distinctions, SIM cards, removable media) | 15.4.12.C |   |
| Performance Measure: Touch Type at least 50 WPM | 3.4.12.A3 |   |
| Performance Measure: Track Data with Excel | 3.4.12.A3 |   |
| Performance Measure: Microsoft Office Organization (tabs, ribbon, ruler, saving) | 3.4.12.A3 |   |
| Performance Measure: Digital Organization (folders, files, File Explorer vs. Finder | 3.4.12.A3 |   |
| Performance Measure: Keyboard Shortcuts (app switching, tab switching, opening, closing) | 3.4.12.A3 |   |
| Performance Measure: Sending a professional email | 3.4.12.A3 |   |
|  |  |   |

**ASSESSMENTS**

**PDE Academic Standards, Assessment Anchors, and Eligible Content:** The teacher must be knowledgeable of the PDE Academic Standards, Assessment Anchors, and Eligible Content and incorporate them regularly into planned instruction.

**Formative Assessments:** The teacher will utilize a variety of assessment methods to conduct in-process evaluations of student learning.

**Effective formative assessments for this course include:**

**Teacher will use standards-based assessment throughout the course.**

* Discussions
* Teacher Observation/Questioning
* Summarizing
* Outlining
* Oral Presentations
* Journaling
* Presentation/Projects

**Summative Assessments: The** teacher will utilize a variety of assessment methods to evaluate student learning at the end of an instructional task, lesson, and/or unit.

**Effective summative assessments for this course include:**

* Task Grid Utilization and Portfolio