**COURSE DESCRIPTION**

**Course** **Title:** STEM 9

**Course** **Number:** 00767

**Course** **Prerequisites:** None

**Course** **Description:** STEM (Science, Technology, Engineering, and Math) education is an integrated, interdisciplinary, and student-centered approach to learning that encourages curiosity, creativity, artistic expression, collaboration, computational thinking, communication, problem solving, critical thinking, and design thinking.

**Suggested Grade** **Level**: Grade 9

**Length of Course:** One Semester

**Units of** **Credit:** .5

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

CSPG 65 Technology Education; CSPG 71 Computer Science 7-12; CSPG 50 Mathematics 7-12; CSPG 53 Middle Level Mathematics; CSPG 54 Middle Level Science; CSPG 69 Grades PK-4; CSPG 70 Grades 4-8; CSPG 46 General Science; CSPG 104 Expansion of Secondary Certification to Sixth Grade; CSPG 56 Physics

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:** Yes No

**WCSD STUDENT DATA SYSTEM INFORMATION**

**Course** **Level:** Academic

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

F – Final Average MP – Marking Period EXM – Final Exam

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

UGPA-Non-Weighted Grade Point Average  GPA-Weighted Grade Point Average

**State Course** **Code**: Instructional Technology 19155; Computer Science Principals 10011

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:** SmartLab Learning Hub

**Publisher:** Creative Learning Systems

**ISBN #:**  N/A

**Copyright** **Date:** 2023

**WCSD Board Approval** **Date:** July 31, 2023

**Supplemental Materials:** ArcGIS Online Educational Program, Esri Global Online Educational Program, Fischertechniks Mechanics 2.0 Set, Vernier Go Direct Structures and Materials Tester, FlexClip Online, Scratch, MIT App Inventor, Creo Parametric, Flashprint, Afinia Studio, MakeCode Arcade, RealFlight 9.5, RC Controller, Free Flight Mini, Parrot Drones, Audacity, Audio Director, CorelDraw, ULS Engraver, Epilog Dashboard, MeshCAM, UGS for CNC Controller

**Curriculum Document**

**WCSD Board Approval:**

**Date** **Finalized:** 1/12/2024

**Date Approved:**  5/6/2024

**Implementation Year:** 2024-2025

**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**

**Marking Period 1**

* ArcGIS (1 week required)
  + Getting Started with ArcGIS Online
  + Geographic Inquiry Process
  + Creating an Original GIS Map
* Bridge Design (5 weeks required)
  + Bridge Designer (Software)
    - Exploring Virtual Bridge Design
    - Design Decisions with Estimation
    - Design Decisions with Graphs and Charts
    - Designing from Scratch with Bridge Designer
    - The Time and Money Challenge
* Engino
* Building Bridges
* Fischertechnik Mechanics 2.0
  + Building Bridges
* Vernier Structures and Materials Testing
  + Design, Build, Crush
  + Build a Better Bridge
* Video Production (5-week project option)
  + Padcaster, Premiere Elements (Adobe PhotoShop), Flex Clip Online, Stop Motion Studio, Frames
* App Development (5-week project option)
  + Kodu, MakeCode Arcade, Scratch, or MIT App Inventor
* Engineering Design and 3D Printing (5-week project option)
  + Tinkercad, Dremel 3D, Creo Parametric, FlashPrint, Fusion 360, and/or Afinia Studio
* Hummingbird Bit Robotics (5-week project option)
  + MakeCode Arcade, VexIQ, micro:bit
* Flight Simulator (1 week project option)
  + RealFlight 9.5 with RC Controller
* Drones (1 week project option)
  + Free Flight Mini and FTW Code, Tello Drone, or Parrot
* Photography (1 week project option)
  + Flex Clip Online, Premier Elements (Adobe Photoshop)
* Video Production (1 week project option)
  + Padcaster, Premiere Elements (Adobe PhotoShop), Flex Clip Online, Stop Motion Studio, Frames
* Audio Production (1 week project option)
  + Audacity, Garage Band, Audio Director
* Laser Engraving (1 week project option)
  + CorelDraw, ULS Engraver, or Epilog Dashboard
* Engineering Design and 3D Printing (1 week project option)
  + Tinkercad, Dremel 3D, Creo Parametric, FlashPrint, Fusion 360, Afinia Studio
* CNC Carving (1 week project option)
  + MeshCAM and UGS for CNC Controller
* VEX VR (1 week project option)
  + VEX VR Coding app online

**Marking Period 2**

* ArcGIS (1 week required)
  + Getting Started with ArcGIS Online
  + Geographic Inquiry Process
  + Creating an Original GIS Map
* Bridge Design (5 weeks required)
  + Bridge Designer (Software)
    - Exploring Virtual Bridge Design
    - Design Decisions with Estimation
    - Design Decisions with Graphs and Charts
    - Designing from Scratch with Bridge Designer
    - The Time and Money Challenge
* Engino
* Building Bridges
* Fischertechnik Mechanics 2.0
  + Building Bridges
* Vernier Structures and Materials Testing
  + Design, Build, Crush
  + Build a Better Bridge
* Video Production (5-week project option)
  + Padcaster, Premiere Elements (Adobe Photo Shop), Flex Clip Online, Stop Motion Studio, Frames
* App Development (5-week project option)
  + Kodu, Make Code Arcade, Scratch, or MIT App Inventor
* Engineering Design and 3D Printing (5-week project option)
  + Tinkercad, Dremel 3D, Creo Parametric, FlashPrint, Fusion 360, Afinia Studio
* Hummingbird Bit Robotics (5-week project option)
  + MakeCode, VexIQ, micro:bit
* Flight Simulator (1 week project option)
  + RealFlight 9.5 with RC Controller
* Drones (1 week project option)
  + Free Flight Mini and FTW Code, Tello Drone, or Parrot
* Photography (1 week project option)
  + Flex Clip Online, Premiere Elements (Adobe Photoshop)
* Video Production (1 week project option)
  + Padcaster, Premiere Elements, Flex Clip Online, Stop Motion Studio, Frames, or Premiere Elements (Adobe Photoshop)
* Audio Production (1 week project option)
  + Audacity, Garage Band, Audio Director
* Laser Engraving (1 week project option)
  + CorelDraw, ULS Engraver, or Epilog Dashboard
* Engineering Design and 3D Printing (1 week project option)
  + Tinkercad, Dremel 3D, Creo Parametrics, FlashPrint, Fusion 360, Afinia Studio
* CNC Carving (1 week project option)
  + MeshCAM and UGS for CNC Controller
* VEX VR (1 week project option)
  + VEX VR Coding app online

**Marking Period 3**

* ArcGIS (1 week required)
  + Getting Started with ArcGIS Online
  + Geographic Inquiry Process
  + Creating an Original GIS Map
* Bridge Design (5 weeks required)
  + Bridge Designer (Software)
    - Exploring Virtual Bridge Design
    - Design Decisions with Estimation
    - Design Decisions with Graphs and Charts
    - Designing from Scratch with Bridge Designer
    - The Time and Money Challenge
* Engino
* Building Bridges
* Fischertechnik Mechanics 2.0
  + Building Bridges
* Vernier Structures and Materials Testing
  + Design, Build, Crush
  + Build a Better Bridge
* Video Production (5-week project option)
  + Padcaster, Premiere Elements (Adobe PhotoShop), Flex Clip Online, Stop Motion Studio, Frames
* App Development (5-week project option)
  + Kodu, MakeCode Arcade, Scratch, or MIT App Inventor
* Engineering Design and 3D Printing (5-week project option)
  + Tinkercad, Dremel 3D, Creo Parametric, FlashPrint, Fusion 360, and/or Afinia Studio
* Hummingbird Bit Robotics (5-week project option)
  + MakeCode Arcade, VexIQ, micro:bit
* Flight Simulator (1 week project option)
  + RealFlight 9.5 with RC Controller
* Drones (1 week project option)
  + Free Flight Mini and FTW Code, Tello Drone, or Parrot
* Photography (1 week project option)
  + Flex Clip Online, Premier Elements (Adobe Photoshop)
* Video Production (1 week project option)
  + Padcaster, Premiere Elements (Adobe PhotoShop), Flex Clip Online, Stop Motion Studio, Frames
* Audio Production (1 week project option)
  + Audacity, Garage Band, Audio Director
* Laser Engraving (1 week project option)
  + CorelDraw, ULS Engraver, or Epilog Dashboard
* Engineering Design and 3D Printing (1 week project option)
  + Tinkercad, Dremel 3D, Creo Parametric, FlashPrint, Fusion 360, Afinia Studio
* CNC Carving (1 week project option)
  + MeshCAM and UGS for CNC Controller
* VEX VR (1 week project option)
  + VEX VR Coding app online

**Marking Period 4**

* ArcGIS (1 week required)
  + Getting Started with ArcGIS Online
  + Geographic Inquiry Process
  + Creating an Original GIS Map
* Bridge Design (5 weeks required)
  + Bridge Designer (Software)
    - Exploring Virtual Bridge Design
    - Design Decisions with Estimation
    - Design Decisions with Graphs and Charts
    - Designing from Scratch with Bridge Designer
    - The Time and Money Challenge
* Engino
* Building Bridges
* Fischertechnik Mechanics 2.0
  + Building Bridges
* Vernier Structures and Materials Testing
  + Design, Build, Crush
  + Build a Better Bridge
* Video Production (5-week project option)
  + Padcaster, Premiere Elements (Adobe PhotoShop), Flex Clip Online, Stop Motion Studio, Frames
* App Development (5-week project option)
  + Kodu, MakeCode Arcade, Scratch, or MIT App Inventor
* Engineering Design and 3D Printing (5-week project option)
  + Tinkercad, Dremel 3D, Creo Parametric, FlashPrint, Fusion 360, and/or Afinia Studio
* Hummingbird Bit Robotics (5-week project option)
  + MakeCode Arcade, VexIQ, micro:bit
* Flight Simulator (1 week project option)
  + RealFlight 9.5 with RC Controller
* Drones (1 week project option)
  + Free Flight Mini and FTW Code, Tello Drone, or Parrot
* Photography (1 week project option)
  + Flex Clip Online, Premier Elements (Adobe Photoshop)
* Video Production (1 week project option)
  + Padcaster, Premiere Elements (Adobe PhotoShop), Flex Clip Online, Stop Motion Studio, Frames
* Audio Production (1 week project option)
  + Audacity, Garage Band, Audio Director
* Laser Engraving (1 week project option)
  + CorelDraw, ULS Engraver, or Epilog Dashboard
* Engineering Design and 3D Printing (1 week project option)
  + Tinkercad, Dremel 3D, Creo Parametric, FlashPrint, Fusion 360, Afinia Studio
* CNC Carving (1 week project option)
  + MeshCAM and UGS for CNC Controller
* VEX VR (1 week project option)
  + VEX VR Coding app online

**Standards/Eligible Content and Skills**

| **Performance Indicator** | **PA Core Standard and/or Eligible Content** | **Marking Period Taught** |
| --- | --- | --- |
| Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems. | 3.5.9-12.A | MP1, MP2, MP3, MP4 |
| Critically assess and evaluate a technology that minimizes resource use and resulting waste to achieve a goal. | 3.5.9-12.B | MP1, MP2, MP3, MP4 |
| Develop a solution to a technological problem that has the least negative environmental and social impact. | 3.5.9-12.C | MP1, MP2, MP3, MP4 |
| Critique whether existing or proposed technologies use resources sustainably. | 3.5.9-12.D | MP1, MP2, MP3, MP4 |
| Evaluate how technology and engineering advancements alter human health and capabilities. | 3.5.9-12.E | MP1, MP2, MP3, MP4 |
| Evaluate a technological innovation that arose from a specific society’s unique need or want. | 3.5.9-12.F | MP1, MP2, MP3, MP4 |
| Evaluate a technological innovation that was met with societal resistance impacting its development. | 3.5.9-12.G | MP1, MP2, MP3, MP4 |
| Evaluate ways that technology and engineering can impact individuals, society, and the environment. | 3.5.9-12.H | MP1, MP2, MP3, MP4 |
| Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts | 3.5.9-12.I | MP1, MP2, MP3, MP4 |
| Synthesize data and analyze trends to make decisions about technological products, systems, or processes. | 3.5.9-12.J | MP1, MP2, MP3, MP4 |
| Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. | 3.5.9-12.K | MP1, MP2, MP3, MP4 |
| Interpret laws, regulations, policies, and other factors that impact the development and use of technology. | 3.5.9-12.L | MP1, MP2, MP3, MP4 |
| Develop a device or system for the marketplace. | 3.5.9-12.M | MP1, MP2, MP3, MP4 |
| Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems. | 3.5.9-12.N | MP1, MP2, MP3, MP4 |
| Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality. | 3.5.9-12.O | MP1, MP2, MP3, MP4 |
| Apply a broad range of design skills to a design thinking process. | 3.5.9-12.P | MP1, MP2, MP3, MP4 |
| Implement and critique principles, elements, and factors of design. | 3.5.9-12.Q | MP1, MP2, MP3, MP4 |
| Use a design thinking process to design an appropriate technology for use in a different culture. | 3.5.9-12.R | MP1, MP2, MP3, MP4 |
| Conduct research to inform intentional inventions and innovations that address specific needs and wants. | 3.5.9-12.S | MP1, MP2, MP3, MP4 |
| Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. | 3.5.9-12.T | MP1, MP2, MP3, MP4 |
| Evaluate and define the purpose of a design. | 3.5.9-12.U | MP1, MP2, MP3, MP4 |
| Apply principles of human-centered design. | 3.5.9-12.V | MP1, MP2, MP3, MP4 |
| Optimize a design by addressing desired qualities within criteria and constraints while considering trade-offs. | 3.5.9-12.W | MP1, MP2, MP3, MP4 |
| Implement the best possible solution to a design using an explicit process. | 3.5.9-12.X | MP1, MP2, MP3, MP4 |
| Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. | 3.5.9-12.Y | MP1, MP2, MP3, MP4 |
| Recognize and explain how their community and the world around them informs technological development and engineering design. | 3.5.9-12.Z | MP1, MP2, MP3, MP4 |
| Safely apply an appropriate range of making skills to a design thinking process. | 3.5.9-12.AA | MP1, MP2, MP3, MP4 |
| Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system. | 3.5.9-12.BB | MP1, MP2, MP3, MP4 |
| Analyze how technology transfer occurs when a user applies an existing innovation developed for one function for a different purpose. | 3.5.9-12.CC | MP1, MP2, MP3, MP4 |
| Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system. | 3.5.9-12.DD | MP1, MP2, MP3, MP4 |
| Connect technological and engineering progress to the advancement of other areas of knowledge and vice versa. | 3.5.9-12.EE | MP1, MP2, MP3, MP4 |
| Evaluate how technology enhances opportunities for new products and services through globalization. | 3.5.9-12.FF | MP1, MP2, MP3, MP4 |
| Evaluate how technology and engineering have been powerful forces in reshaping the social, cultural, political, and economic landscapes throughout history. | 3.5.9-12.GG | MP1, MP2, MP3, MP4 |
| Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time. | 3.5.9-12.HH | MP1, MP2, MP3, MP4 |
| Investigate the widespread changes that have resulted from the Information Age, which has placed emphasis on the processing and exchange of information. | 3.5.9-12.II | MP1, MP2, MP3, MP4 |
| Identify and explain how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools, materials, and processes. | 3.5.9-12.JJ | MP1, MP2, MP3, MP4 |
| Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge. | 3.5.9-12.KK | MP1, MP2, MP3, MP4 |
| Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop. | 3.5.9-12.LL | MP1, MP2, MP3, MP4 |
| Troubleshoot and improve a flawed system embedded within a larger technological, social, or environmental system. | 3.5.9-12.MM | MP1, MP2, MP3, MP4 |
| Analyze the rate of technological and engineering development and predict future diffusion and adoption of new innovations and technologies. | 3.5.9-12.NN | MP1, MP2, MP3, MP4 |
| Use project management tools, strategies, and processes in planning, organizing, and controlling work. | 3.5.9-12.OO | MP1, MP2, MP3, MP4 |
| Demonstrate the use of conceptual, graphical, virtual, mathematical, and physical modeling to identify conflicting considerations before the entire system is developed and to aid in design decision making. | 3.5.9-12.PP | MP1, MP2, MP3, MP4 |
| Implement quality control as a planned process to ensure that a product, service, or system meets established criteria. | 3.5.9-12.QQ | MP1, MP2, MP3, MP4 |

**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 use various assessment methods to conduct in-process evaluations of student learning.**

**Effective formative assessments for this course include:** (not limited to) Bell ringers, exit tickets, worksheets, quizzes, lab assignments, practice tests, writing prompts, teacher questioning, class discussions, individual and team-based 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 including, but not limited to a CER paragraph.

**Effective summative assessments for this course** **include:** Projects, performance tasks, project-based assessments