



Delaware Department of Education
 CTE & STEM Office
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 Dover, DE 19901
 PHONE: 302.735.4015 FAX: 302.739.1780

DELAWARE CTE PROGRAM OF STUDY APPLICATION

LOCAL EDUCATION AGENCY INFORMATION		
Local Education Agency (LEA):		
School(s) where the Program of Study will be Located:		Program of Study Start Date:
LEA CTE Coordinator Name:	Phone:	E-Mail Address:
Career Cluster Title: STEM	Career Pathway Title: Engineering and Technology	Program of Study Title: Engineering – 6 credit
CTE Program of Study Course Titles & Sequence:		
1. Introduction to Engineering Design (IED) 4. Aerospace Engineering (AE)* 2. Principles of Engineering (POE) 5. Civil Engineering and Architecture (CEA)* 3. Digital Electronics (DE) 6. Engineering Design and Development (EDD)**		
*In 2016-17 PLTW will offer a new course entitled Environmental Engineering which may be substituted for either Aerospace Engineering or Civil Engineering & Architecture – to be determined by the LEA. **EDD is the capstone course and must be offered as the last course in the Engineering POS sequence.		
CTE Program of Study Request:		
<input checked="" type="checkbox"/> State-model CTE Program of Study <input type="checkbox"/> Local CTE Program of Study		
ASSURANCES & SIGNATURES		
CTE Program of Study approval and funding is contingent upon the following assurances:		
1. The LEA will comply with Delaware Administrative Code, 14 Del.C. §525, Requirements for Career and Technical Education Programs and the Delaware State Plan for the Carl D. Perkins Career and Technical Education Act of 2006; 2. The LEA will submit CTE program data as required by the Delaware Department of Education; 3. All teachers are certified in the appropriate CTE area and participate in program specific professional learning; 4. The LEA will convene and engage a program advisory committee for the purposes of program development, implementation, and continuous improvement; 5. All students have equal access to the program of study as well as early career/early college options; 6. Career and Technical Student Organizations are integral components of the program of study; 7. The LEA will maintain safe facilities and equipment aligned with the program of study goals; and 8. A process for continuous improvement has been established, which includes a model of evaluation and program improvement.		
LEA CTE Coordinator Signature:		Date:
LEA Chief School Officer Signature:		Date:

PROGRAM ADVISORY COMMITTEE MEMBER INFORMATION

Complete the list of program advisory committee members. Program of study representatives should include, but are not limited to: CTE and academic teachers, CTE/curriculum district coordinators, school counselors, business and industry representatives, labor representatives, and post-secondary partners. Community stakeholders including parents and students can also be considered. *Attach additional information if applicable.*

Name: _____ Title: _____

Affiliation: _____

Address: _____

Phone: _____ E-Mail: _____

Area of Expertise: _____

Representing:
 Business/Industry
 Secondary Education
 Post-Secondary Education
 Community/Other

Name: _____ Title: _____

Affiliation: _____

Address: _____

Phone: _____ E-Mail: _____

Area of Expertise: _____

Representing:
 Business/Industry
 Secondary Education
 Post-Secondary Education
 Community/Other

Name: _____ Title: _____

Affiliation: _____

Address:	
Phone:	E-Mail:
Area of Expertise:	
Representing: <input type="checkbox"/> Business/Industry <input type="checkbox"/> Secondary Education <input type="checkbox"/> Post-Secondary Education <input type="checkbox"/> Community/Other	
Name:	Title:
Affiliation:	
Address:	
Phone:	E-Mail:
Area of Expertise:	
Representing: <input type="checkbox"/> Business/Industry <input type="checkbox"/> Secondary Education <input type="checkbox"/> Post-Secondary Education <input type="checkbox"/> Community/Other	
Name:	Title:
Affiliation:	
Address:	
Phone:	E-Mail:
Area of Expertise:	
Representing: <input type="checkbox"/> Business/Industry <input type="checkbox"/> Secondary Education <input type="checkbox"/> Post-Secondary Education <input type="checkbox"/> Community/Other	

LABOR MARKET DEMAND

Certify that a labor market needs analysis has been completed for the proposed CTE program of study. Attach the [Labor Market Information \(LMI\) Review](#) document.

Access the [Labor Market Information \(LMI\) Review](#) document.

- The LEA certifies that regional, state, and local labor market data have been reviewed to assure a demand exists for the POS occupations and that the number of POS completers will not significantly exceed this demand. Department of Labor data are available and/or documented. Supporting evidence of supply and demand is submitted with this proposal.
- No data exist for POS due to a unique labor market demand. Supporting evidence of demand is submitted with this proposal. Evidence may include, but is not limited to: real-time labor market information, documentation of national, regional, state, or local labor trends, or letters from employers or workforce agencies documenting projected employment specific to the career pathway.

ACADEMIC AND TECHNICAL SKILL STANDARDS

List the academic, technical, and workplace skills and knowledge used to develop the program of study.

Title and source of academic standards:

[Common Core State Standards \(CCSS\)](#)

The Common Core State Standards (CCSS) are national standards that set clear college- and career-ready expectations for kindergarten through 12th grade in English language arts/literacy and Mathematics. The standards help to ensure that students graduating from high school are prepared to take credit bearing introductory courses in two- or four-year college programs and enter the workforce. The standards were developed by the nation's governors and education commissioners, through their representative organizations, the National Governors Association Center for Best Practices (NGA) and the Council of Chief State School Officers (CCSSO). Teachers, parents, school administrators, and experts from across the country provided input into the development of the standards. The implementation of the Common Core, including how the standards are taught, the curriculum developed, and the materials used to support teachers as they help students reach the standards, is led entirely at the state and local levels. For more information on CCSS, please visit the link above.

[Next Generation Science Standards \(NGSS\)](#)

The Next Generation Science Standards (NGSS) are national standards for science that lay out the disciplinary core ideas, science and engineering practices, as well as crosscutting concepts that students should master in preparation for college and careers. The standards were developed through a state-led effort that was managed by Achieve. The development of the NGSS involved the National Research Council (NRC), the National Science Teachers Association (NSTA), the American Association for the Advancement of Science (AAAS), and other critical partners such as K–12 teachers, state science and policy staff, higher education faculty, scientists, engineers, cognitive scientists, and business leaders. For more information on the NGSS, please visit the link above.

Project Lead the Way (PLTW) is a national Career & Technical Education instructional program that incorporates aspects of the Common Core State Standards for English language arts/literacy and Mathematics, the Next Generation Science Standards, and other national standards where appropriate. A standards and objectives alignment tool is available for all courses at: <http://alignment.pltw.org/>

Title and source of technical skill standards:

[International Technology & Engineering Educators Associate \(ITEEA\) – Standards for Technological Literacy:](#)

The Standards for Technological Literacy (STL) present a vision for what students should know and be able to do in order to be technologically literate. The standards describe what the content of technology education program should be in grades K-12 by setting forth a consistent expectation helping to ensure that all students receive effective instruction about technology. The STL was created under the ITEEA Technology for All Americans Project and was developed with hundreds of educators and professionals. For more information on STL, please visit the link above.

Project Lead the Way (PLTW) is a national Career & Technical Education instructional program that incorporates aspects of the International Technology & Engineering Educators Associate (ITEEA) Standards for Technological Literacy. A standards and objectives alignment tool is available for all courses at: <http://alignment.pltw.org/>.

Title and source of workplace or other skill standards, as applicable:

[Common Career Technical Core \(CCTC\)](#)

The Common Career Technical Core (CCTC) are national standards for Career & Technical Education (CTE) that help to inform the establishment of state standards and/or programs of study. The CCTC were developed by educators, school administrators, representatives from business and industry, faculty from higher education, as well as workforce and labor markets economists. The CCTC include a set of standards for each of the sixteen (16) Career Clusters and the corresponding Career Pathways that help to define what students should know and be able to do after completing instruction in a program of study. The CCTC standards for the STEM Career Cluster have been embedded into each course within the Project Lead the Way (PLTW) Engineering program of study. The program has students apply the CCTC STEM standards, specifically the Engineering and Technology Career Pathway standards. For more information on the CCTC, please visit the link above.

[Career Ready Practices \(CRP\)](#)

The Career Ready Practices (CRP) are a component of the CCTC framework and includes twelve (12) statements that address the knowledge, skills, and dispositions that are important to becoming career ready. The CRP describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education and should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a career pathway. The CRP statements are embedded throughout the Project Lead The Way (PLTW) Engineering program of study to ensure students display the appropriate soft skills and workplace requirements necessary to be successful in a career. For more information on the CRP, please visit the link above.

EARLY CAREER AND EARLY COLLEGE OPPORTUNITIES

Identify CTE program of study early career opportunities, industry-recognized certifications and licenses, options for early college credit, two- and four-year degree and certification program alignment, and the technical skill attainment measures for the program of study. *Attach articulation/dual enrollment agreement(s).*

Describe early career opportunities (i.e. work-based learning experiences and industry-mentored projects):

In the Project Lead The Way (PLTW) Engineering program of study, students engage in open-ended problem solving, learn and apply the engineering design process, and use industry-leading technology and software. Students apply math, science, and engineering standards to hands-on projects. They work both individually and in teams to explore a broad range of engineering topics, including mechanisms, the strength of structures and materials, and automation. Students develop skills in problem solving, research and design while learning strategies for design process documentation, collaboration, and presentation. Schools will offer a minimum of six (6) courses: Introduction to Engineering Design (IED), Principles of Engineering (POE), and Digital Electronics (DE); two (2) specialization courses, Aerospace Engineering (AE) and Civil Engineering and Architecture (CEA); and the capstone course, Engineering Design and Development (EDD). Work-based learning experiences and industry-mentored projects are included in each course and will be reviewed with the Local Education Agency (LEA) Program Advisory Council to further identify opportunities to engage the community.

List industry-recognized certifications and/or licenses, as appropriate (include the partner organization and credential):

Project Lead The Way (PLTW) provides industry-based assessments which are known as End of Course assessments for participating schools. PLTW will report valid and reliable scores on overall student performance for each course. The End of Course assessment(s) give students an objective evaluation of their achievement and stakeholders the opportunity to obtain and use data to make informed decisions.

End of Course assessments are available for all PLTW Engineering courses except the capstone course, Engineering Design and Development (EDD). The EDD capstone course uses a portfolio assessment hosted through the Innovation Portal. Students can document and demonstrate their learning in an online portfolio and have their work evaluated using the research-based Engineering Design Project Portfolio Scoring Rubric.

Describe early college credit options (i.e. advanced placement, dual enrollment, transcribed and/or articulated credit, credit by exam, pre-apprenticeship, other) and options for two- and four-year degree and/or certification program alignment (attach articulation/dual enrollment agreement). The partner organization and hours of credit earned should be included, as applicable:

Project Lead The Way partners with more than 150 [colleges and universities](#) across the country to recognize and reward the great work being accomplished by PLTW schools, students, and teachers. Opportunities for students typically include scholarships, admission preference, and college-level

recognition based on program completion and End of Course assessment scores. For more information on national recognition opportunities, please visit the link above.

Delaware students who successfully complete ALL COURSES in the pathway, who have successfully completed pre-calculus and who have demonstrated college readiness in math and ELA will receive advanced credit at **Delaware Technical and Community College** for:

- EDD171—Introduction to Computer Aided Drafting using Autocad (3 credits). This course is offered as part of the following certificate or degree programs:
 - Architectural Engineering Technology
 - Civil Engineering Technology
 - Surveying and Geomatics Engineering Technology
 - Environmental Engineering Technology
 - Design Engineering (Mechanical) Technology
 - Computer Aided Drafting and Design
 - Fire Protection Engineering Technology

Delaware students who complete Digital Electronics as one of the courses in the pathway, who have successfully completed pre-calculus and who have demonstrated college readiness in math and ELA will receive advanced credit at **Delaware Technical and Community College** for:

- ELC127—Digital Electronics (4 credits). This course is offered as part of the following certificate or degree programs:
 - Electronics Engineering Technology
 - Electromechanical Engineering Technology
 - Electronics Engineering Transfer option (2+2 with DSU)
 - Electronics Engineering Technology with the following options:
 - Biomedical
 - Instrumentation
 - Computer Engineering Technology

Delaware students who complete Digital Electronics as one of the courses in the pathway, who have maintained a high school GPA of 3.0 or higher, have successfully completed pre-calculus and who have demonstrated college readiness in math and ELA will receive advanced credit at **Delaware State University** for:

- ENGR210—Digital Logic Design (3 credits). This course is offered as part of the following Bachelor of Science degree programs:
 - Engineering Physics
 - Electrical and Electronics Engineering Technology, and;
 - Computer Information Systems

Students getting credit for ENGR210 will need to complete the lab section of the course, ENGR210 lab (1 credit) upon entry to the program.

List technical skill attainment measures for the program of study (i.e. industry recognized certification or license, advanced placement, dual enrollment, transcribed and/or articulated credit, dual enrollment, credit by exam):

Certification/credentialing exam (specify):

- Licensing exam (specify):
- Nationally recognized exam (specify): PLTW End of Course assessments
- Advanced standing (specify):
Delaware Technical Community College:
 EDD171—Introduction to Computer Aided Drafting
 ELC127—Digital Electronics
Delaware State University:
 ENGR210—Digital Logic Design
- Other (specify):

POS OVERVIEW, COURSE DESCRIPTIONS, END-OF-COURSE, AND PROGRAM ASSESSMENTS

Provide a CTE program of study overview that broadly describes the program and student expectations. Identify end-of-program assessment(s) and opportunities for students to participate in early college and early career experiences. List each course title in the CTE program of study. Provide an overview of each course and define what students should know and be able to demonstrate upon completion of each level. Identify appropriate end-of-course assessment(s).

CTE Program of Study Overview:

The Project Lead the Way (PLTW) Engineering program of study for technical high schools is a (6) course Career & Technical Education (CTE) instructional program that engages students in open-ended problem solving where students learn and apply the engineering design process and use modern, industry-leading technology and software. The program prepares students for further education and careers in engineering and engineering technology. The CTE program consists of six (6) courses including three (3) foundation courses, Introduction to Engineering Design (IED), Principles of Engineering (POE), and Digital Electronics (DE); two (2) specialization courses, Aerospace Engineering (AE) and Civil Engineering and Architecture (CEA); and the capstone course, Engineering Design and Development (EDD) that the Local Education Agency will manage along with their program advisory council.

- **Introduction to Engineering Design (IED)** provides students with the opportunity to apply the engineering design process as well as math, science, and engineering standards to hands-on projects. Students work both individually and in teams to design solutions to a variety of problems using 3D modeling software, and use an engineering notebook to document their work.
- **Principles of Engineering (POE)** allows students explore a broad range of engineering topics, including mechanisms, the strength of structures and materials, and automation. Students develop skills in problem solving, research, and design while learning strategies for design process documentation, collaboration, and presentation.
- **Digital Electronics (DE)** provides students with a foundation in electrical engineering, electronics, and circuit design. Students study topics such as combinational and sequential logic and are exposed to circuit design tools used in industry, including logic gates, integrated circuits, and programmable logic devices.

- ***Aerospace Engineering (AE)** propels students' learning in the fundamentals of atmospheric and space flight. Students explore the physics of flight, the concepts to life by designing an airfoil, propulsion system, and rockets. Students learn basic orbital mechanics using industry-standard software and explore robotic systems through projects such as remotely operated vehicles.
- ***Civil Engineering and Architecture (CEA)** provides students with fundamental aspects of building and site design and development. Students apply math, science, and standard engineering practices to design both residential and commercial projects and document their work using 3D architecture design software.
- **Engineering Design and Development (EDD)** is the capstone course for PLTW Engineering and requires students to identify an issue and then research, design, and test a solution – ultimately presenting their solution to a panel of engineers and professionals throughout the lifecycle of product development. Students apply the professional skills they have developed to document a design process to standards. Completing EDD helps students prepare for and accelerate in a post-secondary program or career.

*In 2016-17 PLTW will offer a new course entitled **Biological Engineering (BioE)** which can substitute in place of either Aerospace Engineering or Civil Engineering & Architecture if desired by the LEA. The growing market for jobs in biological engineering is playing a central role in energy and agricultural sustainability solutions. The BioE course will develop students' thinking skills and prepare them for emerging careers through topics such as genetic engineering, biofuels, and biomanufacturing. No further content or assessment information is available for this course at this time.

End-of-Program Assessment(s):

- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify): Project Lead The Way End of Course Assessments – IED, POE, DE and selected courses (AE, CEA, BioE), and EDD Capstone Portfolio
- Other (specify):

Course title:

Introduction to Engineering Design (IED)

Course description (include prerequisites):

The Introduction to Engineering Design (IED) course emphasizes design and product development. Students use computer software to produce, analyze, and evaluate mathematical models and project solutions. Students study design concepts, such as form and function, then use state-of-the-art technology to translate conceptual design into reproducible products.

Prerequisite or Concurrent Enrollment Requirement: Algebra I

Course knowledge and skills (what students will know and be able to do):

By the end of this course, students will:

1. Define and justify a design problem, present and justify design specifications, communicate the problem, problem constraints, and solution criteria; generate and document multiple ideas or solution paths to a problem, justify and validate a solution path, and construct a prototype of a problem solution to complete a design project and find a solution that meets specific design requirements.
2. Use assorted software and hand-drawing techniques with an established set of technical practices to create drawings or diagrams as representations of objects, ideas, events, or systems.
3. Understand and interpret numerical data through the use of spreadsheet software, calculation of statistics, and representation of graphic data to inform, justify and validate a design process.
4. Use skills associated with design process, technical sketching and drawing, as well as measurement and statistics to create models that represent and evaluate possible solutions using prototyping technique(s) chosen based on the presentation and/or testing requirements of a potential solution.
5. Consider cost, performance, marketability, environmental impact and expected service life in order to choose a material for use in a product design.
6. Perform a functional analysis of a product determining the purpose, inputs, outputs and operation of the product or system and perform a structural analysis of a product to determine the materials used and the form of component parts as well as the configuration and interaction of parts to reverse engineer a product and identify shortcomings of the design and/or opportunities for improvement or innovation.
7. Demonstrate positive team behaviors, establish common goals, equitable workloads, accountability, set team norms, and practice appropriate conflict resolution strategies while incorporating engineering skills to perform as an effective design team to complete an engineering problem.

End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify): Project Lead The Way End of Course Assessment – IED
- Other (specify):

Course title:

Principles of Engineering (POE)

Course description (include prerequisites):

The Principles of Engineering (POE) course provides an overview of engineering and engineering technology. Students develop problem-solving skills by tackling real-world engineering problems

through theory and practical hands-on experiences. Students address the emerging social and political consequences of technological change.

Prerequisite: Introduction to Engineering Design

Course knowledge and skills (what students will know and be able to do):

By the end of this course, students will:

1. Calculate mechanical advantage and drive ratios of mechanisms; design, create and test gear, pulley and sprocket systems; and calculate work and power in mechanical system to design, create, test and evaluate a compound mechanical design.
2. Use equations of equilibrium to calculate unknown forces; investigate specific material properties including hardness, weight, volume, mass, density, surface area, metallic properties, etc.; and conduct investigative non-destructive material property tests to determine safety and usability of materials for engineering purposes.
3. Identify and explain basic components and functions of fluid power devices; differentiate between the characteristics of pneumatic and hydraulic systems; calculate values in a fluid power system; and calculate values in a pneumatic system; calculate flow rate, flow velocity and mechanical advantage in a hydraulic system to design, create and test a hydraulic and pneumatic device.
4. Calculate distance, displacement, speed, velocity, and acceleration, and determine the angle needed to launch a projectile a specific range given an initial velocity to design, build and test a vehicle that stores and releases potential energy for propulsion.

End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify): Project Lead The Way End of Course Assessment – POE
- Other (specify):

Course title:

Digital Electronics (DE)

Course description (include prerequisites):

The Digital Electronics (DE) course introduces students to applied digital logic, a key element of careers in engineering and engineering technology. This course explores the smart circuits found in watches, calculators, video games and computers. Students use industry-standard computer software in testing and analyzing digital circuitry. Students design circuits to solve problems, export their designs to a printed circuit auto-routing program that generates printed circuit boards, and use appropriate components to build their designs. Students use mathematics and science in solving real-world engineering problems.

Prerequisite: Introduction to Engineering Design and Principles of Engineering

Course knowledge and skills (what students will know and be able to do):

By the end of this course, students will:

1. Contrast analog circuits, combinational logic circuits, and sequential logic circuits to explain how the fundamental building blocks of each give a circuit its desired function.
2. Use Binary Number Systems, Truth Tables, and Boolean Expressions appropriately to reduce circuit size, cost, and complexity.
3. Use systematic approaches of AOI Simplification, AOI Logic Analysis, and AOI Implementation to take design specifications and translate them into the most efficient circuit possible.
4. Describe how Programmable Logic Devices (PLDs) represent the next progression in technological develop for circuit design and use PLDs to design circuits and describe the advantage they provide.
5. Draw detailed timing diagrams for the D or J/K flip-flop's Q output in response to a variety of synchronous and asynchronous input conditions; analyze and design introductory flip-flop applications such as event detection circuits, data synchronizers, shift registers, and frequency dividers; and use Circuit Design Software (CDS) and a Digital Logic Board (DLB) to simulate and prototype introductory flip-flop applications.
6. Use Circuit Design Software (CDS) and Digital Logic Board (DLB) to simulate and prototype Small Scale and Medium Scale Integrated (SSI and MSI) asynchronous and synchronous counters.
7. Derive a state machine's Boolean equations from its state transition table; implement Boolean equations into a functional state machine; and use Circuit Design Software (CDS) and a PLD to simulate and prototype state machine designs implemented with discrete and programmable logic.

End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify): Project Lead The Way End of Course Assessment – DE
- Other (specify):

Course title:

*Aerospace Engineering (AE)

Prerequisites: Introduction to Engineering Design and Principles of Engineering

Course description (include prerequisites):

The Aerospace Engineering (AE) course introduces students to the world of aeronautics, flight, and engineering. Students will apply scientific and engineering concepts to design materials and processes that directly measure, repair, improve, and extend systems in different environments.

Course knowledge and skills (what students will know and be able to do):

By the end of this course, students will:

1. Explain fundamental theories of lift creation and stability, know the names and purposes of aircraft components, and describe how the motions about the three axis of an aircraft are stabilized and controlled by aircraft components to create small gliders to understand the design, construction, and testing cycle of engineering.
2. Apply Newton's Three Laws of Motion, the ideas associated with the design of rocket engines and how the creation of an action results in thrust that enables rockets to move to construct a stable model rocket.
3. Investigate the requirements for life support systems at ground level, during high-speed atmospheric travel, and in the zero-pressure, microgravity environment of space to design and videotape experiments that create a positive g-force.
4. Measure the stiffness of various composite materials and designs and determine the modulus of elasticity to design composite (layered) plastic test samples using various engineering composite materials.
5. Use equations to calculate an orbiting body's orbital period, orbital gravitational potential energy, orbital kinetic energy, and total orbital energy to define a satellite's orbit, allowing the accurate prediction of the precise location of the satellite at a given time.
6. Use concepts relevant to aerospace engineering to design alternate aerospace system technologies such as wind turbines and/or parachutes.

End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify): Project Lead The Way End of Course Assessment – AE
- Other (specify):

Course title:

*Civil Engineering and Architecture (CEA)

Course description (include prerequisites):

The Civil Engineering and Architecture course provides an overview of the fields of civil engineering and architecture, while emphasizing the interrelationship and dependence of both fields. Students use state of the art software to solve real world problems and communicate solutions to hands-on projects and activities.

Prerequisites: Introduction to Engineering Design and Principles of Engineering

Course knowledge and skills (what students will know and be able to do):

By the end of this course, students will:

1. Understand the history, influence and impact of engineering and architecture; the relationship of civil engineering and architecture; and the responsibilities of both fields, including ethics and values to connect modern structural and architectural designs to historical architectural and civil engineering achievements.
2. Apply basic math skills to calculate the quantity and cost of materials; choose an appropriate building location on a site based on orientation and site-specific information; and document and design a home or commercial property using 3D architectural design software to maximize the potential of a property, minimize impact on the environment, and incorporate universal design concepts to create an attractive and functional space.
3. Apply structural data to formulas and tables, perform calculations, and add the results in the form of structural details in design models and use building codes and other resources to design structures that withstand and transfer all applied loads and forces to the Earth.
4. Prepare presentations and have peer reviews of team and individual work to prove a means to effectively promote the implementation of a project.

End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify): Project Lead The Way End of Course Assessment – CEA
- Other (specify):

Course title:

Engineering Design and Development (EDD)

Course description (include prerequisites):

The Engineering Design and Development course enables students to apply what they have learned in academic and Engineering courses to complete a challenging and self-directed project. Students work in teams to design and build solutions to authentic engineering problems. An engineer or professional

from the school's partnership team will mentor each student team. Students document all work in an engineering journal and make progress reports to their peers, industry-mentor, and instructor. At the end of the course, teams present their research paper and defend their projects to a panel of engineers, business leaders, and faculty from engineering colleges for professional review and feedback. This course equips students with the independent study skills that they will need in post-secondary education and careers in engineering and engineering technology.

Prerequisites: Introduction to Engineering Design, Principles of Engineering, and Digital Electronics

Course knowledge and skills (what students will know and be able to do):

By the end of this course, students will:

1. Define and justify a design problem, and express the concerns, needs, and desires of the primary stakeholders; and present and justify design specifications, and clearly explain the criteria and constraints associated with a successful design solution to write a design brief to communicate the problem, problem constraints, and solution criteria.
2. Describe the design process used in the solution of a particular problem and reflect on all steps of the design process; justify and validate a problem solution; and identify limitations in the design process and the problem solution to recommend possible improvements or caveats.
3. Organize and express thoughts and information in a clear and concise manner; support design ideas using a variety of convincing evidence; use an engineering notebook to clearly and accurately document the design process according to accepted standards and protocols to prove the origin and chronology of a design to document information sources using appropriate formats.
4. Generate and document multiple ideas or solution paths to a problem through brainstorming; analyze the performance of a design during testing and judge the solution as viable or non-viable with respect to meeting the design requirements; and create drawings or diagrams as representations of objects, ideas events, or systems to complete a design project utilizing all steps of a design process, and find a solution that meets specific design requirements.

End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify):
- Other (specify): Project Lead The Way Innovation Portal –Engineering Design Process Portfolio Scoring Rubric (EDPPSR)

PROGRAM OF STUDY CURRICULUM

Identify the method of technical and academic curriculum development (adopted, adapted, or developed in accordance with guidance from the program advisory committee).

POS technical and academic curriculum will be:

- Adopted (specify source): State-model program of study
- Adapted (specify source):
- Developed locally (describe):
- Other (specify):

TEACHER CERTIFICATION

Provide valid teacher certification(s), candidate experience, pre-requisite and requisite licensure or certification requirement(s) for POS teachers.

POS teacher requirements include:

- Teacher certification(s) (list): Technology Education; Physics; Mathematics (Secondary); or Skilled and Technical Sciences (STS) Engineering and Technology (Engineering)
- Candidate experience (describe): Candidate may have experience applying mathematical and scientific principles to solve a wide variety of practical problems in industry, social organization, public works, and commerce. This candidate should have experience with both undifferentiated and individualized programs in engineering. For more information, please see the Bureau of Labor Statistics: Architecture and Engineering Occupations.
- Pre-requisite professional licensure or certification requirement(s) (list): Before teaching PLTW courses, teachers must attend PLTW licensed training.
- Requisite professional licensure or certification requirement(s) (list):
- Other (describe):

VALUE-ADDED OPPORTUNITIES

List extended early career and college credit opportunities available during the student's senior year. Document transition services, cooperative learning experiences, additional dual enrollment, or other.

Opportunities for extended and accelerated learning include:

- Cooperative education (describe):
- Structured internship (describe):
- Dual enrollment (list):
- Advanced Placement (list):
- Transition services (describe):
- Other (describe):

CAREER AND TECHNICAL STUDENT ORGANIZATIONS

Indicate the Career and Technical Student Organization (CTSO) affiliation by checking the appropriate box.

- SkillsUSA

PROGRAM OF STUDY MATRIX

Complete the program of study matrix to demonstrate the alignment of academic and technical courses, culminating early career and/or early college experiences. Identify appropriate certification and licensure options, opportunities for obtaining early college credit (courses with articulated or dual

enrollment credit agreements should be appropriately designated within the matrix), the post-secondary program sequence, and potential career options. *Attach the Program of Study Matrix.*

Access the [Program of Study Matrix](#).

DEPARTMENT OF EDUCATION PROGRAM OF STUDY APPROVAL		
The following section will be completed by staff from the Delaware Department of Education, CTE & STEM Office and reported to the LEA as part of the CTE program of study approval process.		
Date Delaware CTE Program of Study Application Received:		
Local Education Agency (LEA): School(s):		Program of Study Start Date:
LEA CTE Coordinator Name:	Phone:	E-Mail Address:
Career Cluster & CIP Code: STEM / 15	Career Pathway & CIP Code: Engineering Technology / 15.01	Program of Study Title & CIP Code: Engineering - 6 credit / 15.01803
CTE Program of Study Course Titles, Course Codes, and Funding Levels:		
1. Introduction to Engineering Design (IED) / 15.0180311 / 2 2. Principles of Engineering (POE) / 15.0180322 / 2 3. Digital Electronics (DE) / 15.0180333 / 3 4. Aerospace Engineering (AE) / 15.0180344 / 2 5. Civil Engineering and Architecture (CEA) / 15.0180355 / 2 6. Engineering Design and Development (EDD) / 15.018036 / 3		
CTE Concentrator/Completer Course Titles:		
Concentrator Course: <u>Digital Electronics (DE)</u> Completer Course: <u>Engineering Design and Development (EDD)</u>		
CTE Program of Study Request:		
<input checked="" type="checkbox"/> State-model CTE Program of Study <input type="checkbox"/> Local CTE Program of Study		
CTE Program of Study Attachments:		
<input checked="" type="checkbox"/> Labor Market Information (LMI) Review; <input checked="" type="checkbox"/> Articulation/Dual Enrollment Agreement(s); and <input checked="" type="checkbox"/> Program of Study Matrix.		
DDOE CTE & STEM Director Signature:		Date:
DDOE Chief Academic Officer Signature:		Date: