



Delaware Department of Education
CTE & STEM Office
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Dover, DE 19901
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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: Manufacturing	Career Pathway Title: Manufacturing Production Process Development	Program of Study Title: Manufacturing Engineering Technology
CTE Pathway Course Sequence: 1. Foundations of Technology (FOT) 2. Advanced Design Applications (ADA) 3. Engineering Design (ED)		
CTE Program of Study Request: ☒ State-model CTE Program of Study ☐ 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

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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	

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), and 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.

Engineering by Design identifies and develops the skills people and businesses need to thrive in a changing economy. Engineering by Design has created courses that prepare students for the future and 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://www.iteea.org/EbD/ebd.htm>.

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 the content for technology education programs in grades K-12 by setting forth a consistent expectation that ensures 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.

Engineering byDesign (EbD) is a national Career & Technical Education instructional program that incorporates the International Technology & Engineering Educators Associate (ITEEA) Standards for Technological Literacy. A standards and objectives alignment tool is available for EbD network schools by contacting the Engineering byDesign STEM Center for Teaching and Learning at:

<http://www.iteea.org/EbD/ebd.htm>.

[National Academy of Engineering \(NAE\) Grand Challenges for Engineering](#)

The profession of engineering and engineering technology is about invention and innovation. For the last one hundred years, the most important achievements have been dominated by devices, e.g. planes and spacecraft, cars and agricultural machines, lasers and PET scanners. The Engineering Grand Challenges address complex social issues that require innovative technology and a systems approach, including making solar energy economical, preventing nuclear terror, advancing health informatics, clean water, and reverse engineering the human brain. They will require engineers and engineering technologists to shape public policy, transfer technical innovation to the market place, and be informed by social science and the humanities. These challenges will “change the world,” and have a global impact. For more information on the Grand Challenges for Engineering, please visit the link above.

Within the Manufacturing Engineering Technology program of study, the NAE Grand Challenges have been embedded in the courses in order to: strengthen the STEM pipeline; develop technical literacy and provide motivation to be successful as a society; and educate the populace on the engineering mindset and the role of engineering in addressing and improving the quality of life. The Manufacturing Engineering Technology program of study includes opportunities to apply Science, Technology, Engineering, and Mathematics (STEM) specifically to address the [NAE Grand Challenges](#).

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 includes 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 Manufacturing and the STEM Career Cluster are reflected inside the courses for the Manufacturing Engineering Technology program of study. The program has students apply the CCTC Manufacturing and STEM standards, specifically the Manufacturing Production Process Development and the Engineering and Technology Career Pathway standards. For more information on the CCTC, please visit the link above. CCTC standards and objectives alignment tools for the Manufacturing Engineering Technology program of study are in development by the Engineering by Design STEM Center for Teaching and Learning™.

[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 describes 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 Engineering byDesign (EbD) 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):

The Engineering byDesign (EbD) Manufacturing Engineering Technology program is a three (3) credit program of study that engages students in open-ended problem solving where they learn and apply the engineering design process, use industry-standard technology and software, and apply math, science, and engineering standards to hands-on projects. Students 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. The CTE program consists of three courses: Foundations of Technology (FOT), Advanced Design Applications (ADA), and the capstone course Engineering Design (ED). 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 Committee to further identify opportunities to engage the community.

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

Engineering byDesign (EbD) provides industry-based pre- and post-assessments known as course level assessments for participating network schools. EbD will report valid and reliable scores on overall student performance for each course. These assessments 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 EbD courses.

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:

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

- MET115- Introduction to Mechanical Engineering Technology (3 credits). This course is offered as part of the following certificate or degree programs:
 - Mechanical Engineering Technology

Delaware students who successfully complete ALL THREE COURSES in the pathway and who have demonstrated college readiness in math and ELA will receive advanced credit at **University of Maryland Eastern Shore** for:

- EDTE121- Principles of Technology and Engineering Education (3 credits). This course is offered as part of the following certificate or degree programs:
 - Technology and Engineering Teacher Education

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):

☒ Advanced standing (specify):

Delaware Technical Community College:

MET115-Introduction to Mechanical Engineering Technology

University of Maryland Eastern Shore:

EDTE121- Principles of Technology and Engineering Education

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 Engineering byDesign (EbD) Manufacturing Engineering Technology program of study is a three (3) course Career & Technical Education (CTE) instructional program that engages students in open-ended problem solving where they learn how to apply skills, knowledge, documentation, and processes with modern, industry-leading technology and software. The program provides students with a wide range of skills and concepts in design, invention, and innovation to meet project goals. Hands-on activities provide students with the knowledge and skills needed for solving real world problems and prepares students for continued education and careers in manufacturing engineering technology.

- **Foundations of Technology (FOT)** prepares students with the ability to innovate, improvise, and invent solutions to engineering problems. Students explore how technological innovations result when ideas, knowledge, and skills are shared within a technological cluster and amongst other fields of study. In this course, students develop foundational skills in engineering design and documentation as a formal process to transform ideas into products or systems.
- **Advanced Design Applications (ADA)** prepares students with the skills needed to apply advanced applications in design with a focus on systems thinking, the impacts of technological development, and the use of industry-leading technologies in the creation of models, mock-ups, and prototypes to create engineered solutions.
- **Engineering Design (ED)** is the capstone course that provides students with the knowledge and skills needed to transform concepts into products with fully developed engineering design documentation to meet consumer requirements. Students will practice the engineering design process by creating, synthesizing, iterating, and presenting solutions.

End-of-Program Assessment(s):

- ☐ Certification/credentialing exam (specify):
- ☐ Licensing exam (specify):
- ☒ Nationally recognized exam (specify): Engineering by Design (EbD)– Foundations of Technology (FOT), Advanced Design Applications (ADA), and Engineering Design (ED) Course Level Assessments
- ☐ Other (specify):

Course title:

Foundations of Technology (FOT)

Course description (include prerequisites):

Foundations of Technology (FOT) prepares students with the ability to innovate, improvise, and invent solutions to engineering problems. Students explore how technological innovations result when ideas, knowledge, and skills are shared within a technological cluster and amongst other fields of study. In this course, students develop foundational skills in engineering design and documentation as a formal

process to transform ideas into products or systems.

Pre-requisite 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. Analyze technological innovations and inventions to: create mathematical representations that illustrate the rapidly increasing rate of technological development and diffusion; develop an invention or innovation as a result of goal-oriented research and design; debate an example of a technology in which the development was driven by the profit motive; and discuss how technology transfer occurs and how it can be applied toward existing innovations for a different function.
2. Research and discuss the patenting process in order to: interpret how the patenting process is used to protect technological ideas and develop examples of an evolutionary technology that has resulted from a series of refinements to a basic invention.
3. Apply advertising, economic analysis, and production considerations to: determine how advertising, the strength of the economy, the goals of the company, and market analysis contribute to influence design criteria and constraints; develop success versus failure rubrics for products; and determine impacts of technologies other than those intended by the design.
4. Illustrate the research and development process to: construct problem-solving approaches; prepare proposals for devices and systems to meet the needs of the marketplace; and present research and development criteria in the development of a new invention or innovations that meets a market need.
5. Analyze precision and accuracy of measurement to: construct and modify components of a product based upon design constraints; discuss systems that are embedded within larger technological, social, and environmental systems; debate how technological progress is advanced through the application of science and mathematics; and apply scientific and mathematic analysis techniques to evaluate a product.
6. Analyze the application of a technology to: determine trade-offs between positive and negative impacts and predict positive and negative effects of a technology on the environment.
7. Apply the steps of the engineering design process to: define a problem to be solved that includes brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, and communicating results and draw conclusions about a situation being modeled based on data.

8. Analyze and create three-dimensional objects in order to: define objects and spaces from different perspectives; demonstrate how to test a design in order to redefine and improve the design; and select design requirements to redefine and improve a product within the design criteria.
9. Determine principles used in a current design to: analyze data on the effectiveness of the design principles used; propose a redesign using the design process; apply mathematical modeling aids to simulate how a proposed system might behave; and apply scientific laws, engineering principles, properties of materials, and construction techniques to design engineered solutions to problems.
10. Use symbolic algebra to: represent and explain mathematical relationships; apply geometric ideas to solve problems; apply mathematics to visualize engineering design solutions; draw and construct representations of two- and three-dimensional geometric objects using a variety of tools; collect data and information and use computers and calculators to organize, process, and present the information; and make decisions about units and scales that are appropriate for problem situations involving measurement.
11. Communicate technological solutions through: observations, processes, and results of the design process through a final solution; the use of appropriate verbal, graphic, quantitative, virtual, and written means to communicate a solution; and presentations to a target audience using appropriate oral and written techniques.

End-of-Course Assessment(s):

- ☐ Teacher designed assessment
- ☐ LEA designed assessment
- ☐ Certification/credentialing exam (specify):
- ☐ Licensing exam (specify):
- ☒ Nationally recognized exam (specify): Engineering byDesign (EbD) Course Level Assessment – Foundations of Technology (FOT)
- ☐ Other (specify):

Course title:

Advanced Design Applications (ADA)

Course description (include prerequisites):

Advanced Design Applications (ADA) prepares students with the skills needed to apply advanced applications in design with a focus on systems thinking, the impacts of technological development, and the use of industry-leading technologies in the creation of models, mock-ups, and prototypes to create engineered solutions.

Prerequisite: Foundations of Technology

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

By the end of this course, students will:

1. Apply concepts, knowledge and skills related to architecture, construction and design to: use different scales and be able to convert measurements; develop a design and create a scale drawing and a scaled three-dimensional model of the design; determine physical characteristics that promote or hinder interaction among residents of a neighborhood; create features for a new or existing neighborhood to encourage community interaction; determine the infrastructure needed for a community; debate choices for how infrastructure elements are chosen, designed, and regulated; and create a system of infrastructural elements, including water and parking.
2. Employ common techniques for residential housing design to: apply framing, roofing, and sheathing techniques; sketch construction details such as floor plans, foundations plans, elevations, etc.; demonstrate appropriate residential building techniques; demonstrate key techniques of green building; describe the process and requirements for LEED certification; and design/model buildings that utilize optimum value engineering (OVE).
3. Apply concepts, knowledge and skills related to energy to: assess the ethical, environmental, social, and political influences of energy sources local, regional and global uses; construct working electronic circuits using basic electronics; use digital multimeters (DMM) to measure circuits; draw electronic schematics of circuits; define the functions and purposes for resistors, capacitors, diodes, transistors; as well as assemble and construct electrical circuits that utilize parallel and series connections.
4. Apply efficiency and the laws of conservation to mechanical devices to: analyze how simple machines are used both independently and as a combination of machines in mechanical devices; and design and build working devices based on mechanical principles and tools.
5. Apply concepts, knowledge and skills related to manufacturing to: apply design constraints to the design of a product before it is manufactured; research and design a spinoff technology; debate the function of trade-offs within a designed technological solution; create a production planning chart to identify the people, materials, tools, and training needed to produce high quality products; and apply measures of quality control throughout input and output processes in a manufactured product.
6. Generate solutions to a technological problem using the engineering design loop model to: determine production characteristics within a design as they pertain to a set of design principles; and apply research and design concepts to the development of new products and systems.
7. Use microprocessors to: control manufacturing devices and systems to write program controls for a “position-able” motor; use sensors in manufacturing to control technological systems and devices; program controls through inputs to achieve a desired a manufacturing output; understand how relays work; create a model of a working relay; and construct circuits using a commercial relay to control a manufacturing output.

8. Apply principles of appropriate technology in order to: determine how to analyze the risks and benefits of a design; calculate distance; determine distance using a transit; describe how structural systems in a personal vehicle affect passenger and cargo safety; describe how suspension systems in a personal vehicle affect passenger and cargo safety; apply systems for controlling distance and direction of vehicles; analyze the relationship between force and distance using mechanical systems; select appropriate control systems for a given application; design gear systems to increase and decrease the torque of an electric motor; and calculate relationships between speed, torque, and direction of power.

End-of-Course Assessment(s):

- ☐ Teacher designed assessment
- ☐ LEA designed assessment
- ☐ Certification/credentialing exam (specify):
- ☐ Licensing exam (specify):
- ☒ Nationally recognized exam (specify): Engineering byDesign (EbD) Course Level Assessment – Advanced Design Applications (ADA)
- ☐ Other (specify):

Course title (select one and delete all other language):

Engineering Design (ED)

Course description (include prerequisites):

Engineering Design (ED) is a capstone course that provides students with the knowledge and skills needed to transform concepts into products with fully developed engineering design documentation to meet consumer requirements. Students will practice the engineering design process by creating, synthesizing, iterating, and presenting solutions.

Prerequisite: Advanced Design Applications

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

By the end of this course, students will:

1. Use units and conversion factors needed for solving engineering problems; apply basic physical science and math concepts in the solution of technical problems; present and analyze technical data in an organized manner through the use of tables, graphs, and charts; use a scientific calculator while solving technical problems; use a scientific calculator to solve engineering problems involving the use of arithmetic and basic algebra.
2. Define basic concepts of solids, liquids and gases, and discuss the following properties of liquids: density, specific weight, specific gravity, viscosity, pressure, and incompressibility; discuss the behavior of solids under external forces and stresses, as applied to a tensile test lab project; discuss the behavior of liquids under external forces and stresses, as applied to Pascal's law and a simple fluid power lab project.

3. Generate lab reports that include a title page, objective, procedure, calculations, answers to related questions, and a conclusion; present data in graphical form using Excel graphing techniques to document basic physical science properties; use simple correlation and regression techniques; use basic units and dimensions and their applications to problem solving; discuss a practical industrial process that embodies basic principles of mechanical engineering technology.
4. Apply the engineering design process to: develop technological products and systems; determine requirements of an engineering design, such as criteria, constraints, and efficiency; apply logic and creativity with appropriate compromises in complex engineering problems; develop and produce a product or system using a design process; apply optimization techniques as an ongoing methodology for designing and making a product; and demonstrate the ability to make decisions about the use of technology while weighing the trade-offs between the positive and negative effects;
5. Compare and contrast between the competing influences of social, cultural, and corporate pressures on the development of new technological systems and products to: determine resources and materials for development of new technological products and systems; demonstrate the ability to apply the design process by defining a problem, brainstorming, researching and generating ideas, identifying criteria, and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results;
6. Use established design principles and techniques to: evaluate existing designs, collect data, and guide the design process; demonstrate the ability to use creativity, resourcefulness, and the ability to visualize and think abstractly; define energy and energy conversions using appropriate terminology and mathematical operations; identify technological products that utilize thermal, radiant, electrical, mechanical, chemical, and nuclear energy systems and differentiate between them; and demonstrate the ability to apply the process of engineering design while taking into account a multiple of design constraints.
7. Demonstrate the ability to conduct goal-oriented and/or outcomes-based research to: generate ideas to improve products and systems; illustrate sustainable techniques for reusing, reducing, and recycling through the engineering design process; summarize the consideration of resource reduction and tradeoffs in an engineering design project; develop and produce a product or system using a design process; use established design principles to evaluate existing designs, collect data, to guide the design process; defend ethical considerations and decisions made during the development of technological products and systems; and critique the role of technology transfer in causing cultural, social, economic, and political changes.

8. Measure the thermal energy released from various engines under load and predict the "work to emissions" ratio; demonstrate the ability to apply the process of engineering design while taking into account a number of related factors; demonstrate how the interchangeability of parts increases the effectiveness of manufacturing processes using interchangeable parts; and determine criteria and constraints to predict their affect in the design process.
9. Compare methods used to protect intellectual and technological property including patents, trademarks, and copyrights; prepare samples to justify profit motives and the consumer market in the development of technological innovations; critique an engineering design product or system by redefining and improving the idea; refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product; demonstrate the ability to make decisions about the use of technology while weighing the trade-offs between the positive and negative effects; and collect information and evaluate its quality while developing physical engineering design solutions through scientific models, mathematical models, mock-ups, and prototypes;
10. Test an engineering design concept by: constructing working models and making observations and necessary adjustments; using design principles to evaluate existing designs, collect data, and guide the design process; selecting appropriate material based on their qualities and classifications for producing durable and non-durable goods; and communicate and summarize the results of a model designed to solve a given engineering design problem using mathematical representations.
11. Identify quality control mechanisms in a planned process to: ensure that a product, service, or system meets established criteria; manage an engineering design project by using the processes of planning, organizing, and controlling work; apply technological control systems and feedback loops used to provide information during technological design applications; and use established design principles to evaluate existing designs, collect data, and guide the design process.
12. Communicate using symbols, measurement conventions, icons, technologies, and graphics to: prepare plans for the manufacturing of models and prototypes; identify appropriate manufacturing methods needed to efficiently produce quantities of finished products; demonstrate the ability to apply research and development in a problem-solving approach to improve an existing product or system; evaluate design solutions using conceptual, physical, and mathematical models at various intervals of the design process and check for proper design and note areas where improvements are needed; demonstrate technology transfer by applying an existing innovation developed for one purpose in a different function; and evaluate final solutions and communicate observation, processes, and results of the entire design process using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.

End-of-Course Assessment(s):

- ☐ Teacher designed assessment
- ☐ LEA designed assessment
- ☐ Certification/credentialing exam (specify):
- ☐ Licensing exam (specify):
- ☒ Nationally recognized exam (specify): Engineering byDesign (EbD) Course Level Assessment – Engineering Design (ED)
- ☐ Other (specify):

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; or Skilled and Technical Sciences (STS) Manufacturing Production Process Development (Manufacturing Engineering Technology)
- ☒ Candidate experience (describe): Candidate may have experience in engineering to apply principles and technical skills in the design and development phases of a wide variety of projects involving the principles of mechanics, applications to specific engineering systems, design and testing procedures, prototype and operational testing, inspection procedures, manufacturing system-testing procedures, test equipment operation maintenance, and report preparation. For more information, please see the Bureau of Labor Statistics: Mechanical Engineers.
- ☒ Pre-requisite professional licensure or certification requirement(s) (list): Bachelor's degree in Electrical, Manufacturing, Material, Mechanical, or Industrial, Engineering from an ABET accredited educational institution; and/or DOE-approved equivalent.
- ☐ 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.

- | |
|--|
| ☒ Technology Student Association (TSA) |
|--|

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 & Code: Manufacturing / 13	Career Pathway & Code: Manufacturing Production Process Development / 13.02	Program of Study Title & Code: Manufacturing Engineering Technology / 13.02603
CTE Program of Study Course Titles, Course Codes, and Funding Levels: 1. Foundations of Technology / 13.0260311 / 2 2. Advanced Design Applications / 13.0260322 / 2 3. Engineering Design / 13.0260333 / 3		
CTE Concentrator/Completer Course Titles: Concentrator Course: <u>Advanced Design Applications (ADA)</u> Completer Course: <u>Engineering Design (ED)</u>		
CTE Program of Study Request: ☒ State-model CTE Program of Study ☐ Local CTE Program of Study		
CTE Program of Study Attachments: ☒ Labor Market Information (LMI) Review; ☒ Articulation/Dual Enrollment Agreement(s); and ☒ Program of Study Matrix.		
DDOE CTE & STEM Director Signature:		Date:
DDOE Chief Academic Officer Signature:		Date: