PLTW ENGINEERING DESIGN & DEVELOPMENT (EDD)	
CURRICULUM/CONTENT AREA	COURSE LENGTH
Applied & Technical Education (ATE)	*2 Terms*
GRADE LEVEL	DATE LAST REVIEWED
11-12	*2023*
PREREQUISITE(s) *if applicable*	BOARD APPROVAL DATE
previous completion of one of the PLTW foundation courses.	*9/10/2024*
PRIMARY RESOURCE *if applicable*	
PLTW EDD course materials	

DESIRED RESULTS

COURSE DESCRIPTION AND PURPOSE

Engineering Design and Development (EDD) is the capstone course in the PLTW high school engineering program. It is an open-ended engineering research course in which students work in teams to design and develop an original solution to a well-defined and justified open-ended problem by applying an engineering design process.
Students will perform research to select, define, and justify a problem. After carefully defining the design requirements and creating multiple solution approaches, teams of students select an approach, create, and test their solution prototype. Student teams will present and defend their original solution to an outside panel. While progressing through the engineering design process, students will work closely with experts and will continually hone their organizational, communication and interpersonal skills, their creative and problem solving abilities, and their understanding of the design process. EDD is appropriate for students who are interested in any technical career path.
This course may have a transferable college option. Visit PLTW.org to learn more.
WEIGHTED GRADE

ENDURING UNDERSTANDINGS *Students will understand that...*	ESSENTIAL QUESTIONS *Students will keep considering...*
Creativity, innovation, and critical thinking are essential for success in a technologically advanced world.	Why is creativity and innovation important? How is creativity and innovation used in [name of career pathway]?
	How do teams efficiently and effectively solve problems in an increasingly complex world?

	What strategies and processes can I use to become a more effective creator, thinker and problem solver?
The ability to communicate and collaborate with people with diverse backgrounds and perspectives is key to participation in a global economic society.	Why is communication and collaboration important? How do positive work behaviors and personal qualities impact communication and collaboration?
	What is effective teamwork? What strategies can I use/teams use to work better together? How can perspectives and experiences of a diverse group develop innovative solutions to a given problem?
Career and technical education provides pathways to high-demand, high-wage career opportunities, and personal fulfillment.	Why is career and life readiness important? What jobs and careers are available to meet individual and societal needs locally, regionally, and nationally?
	How might technical knowledge and skills influence one's employability and advancement opportunities within various work settings?
	What are employability skills? How do I prepare myself for a career that is in demand now and in 5, 10, or 20 years from now?

PRIORITY CAREER & TECHNICAL STANDARDS
Students will be skilled at...

Creativity, Critical Thinking, Communication and Collaboration
4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills.
a: I develop effective resolutions for a given problem, decision or opportunity using available information.
b: I develop and implement a resolution for a new situation using personal knowledge and experience.

Career Development
CD4: Students will identify and apply employability skills.
a: I identify and demonstrate positive work behaviors and personal qualities needed to be employable.
b: I demonstrate skills related to seeking and applying for employment to find and obtain a desired job.
c: I identify and exhibit traits for retaining employment.
d: I develop positive relationships with others.

Information, Media, Technology **IMT1: Students will access, interpret and evaluate information from a variety of sources in order to inform and support premises, arguments, decisions, ideas and initiatives.** a: I choose appropriate sources of data and information for a given purpose. b: I determine the relevance, validity and timeliness of data and information. c: I select relevant information necessary for making decisions and solving problems d: I apply data and information to communicate ideas and create new opportunities.

PRIORITY CONTENT STANDARDS *Students will know...*
Standard: BB1: Students will analyze the core concepts of technology.
Standard: ENG1: Students will analyze and demonstrate the attributes of design.
Standard: ENG3: Students will demonstrate and analyze the role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
Standard: ICT1: Students will analyze, select and use information and communication technologies.
Standard: MNF1: Students will be able to select and use manufacturing technologies.

Potential INDUSTRY-RECOGNIZED CREDENTIALS (IRCs) Opportunities associated with the course *(note- the list provides options but is not limited to the following so that students career interests can be leveraged)*	**Potential WORK BASED LEARNING (WBL) opportunities associated with the course**
Autodesk Inventor	LAUNCH project opportunities w/business & industry partners
Potential DUAL CREDIT Opportunties associated with the course	
This course may have a transferable college option. Visit PLTW.org to learn more or colleges of interest.	

Unit and Course Structure *Utilizing an activity-project-problem-based (APPB) environment, students will perform research to choose, validate, and justify a technical problem. After carefully defining the problem, teams of students will design, build, and test their solution. Finally, student teams will present and defend their original solution to an outside panel of experts in the various aspects of engineering and business. While progressing through the engineering design process, students will utilize community experts and will continually hone their organizational, communication, and interpersonal skills., their creative and problem solving abilities, and their understanding of the design process.*	
STAGE 1: Desired Unit Results *What will students understand as a result of the unit?*	**STAGE 2: Assessment Evidence** *By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?*
ESSENTIAL QUESTION (s) *What thought-provoking questions will foster inquiry, understanding, and transfer of learning?*	**Success Criteria with Standards** *The criteria for evaluating performance on standards is constant.*
Why is creativity and innovation important? How is creativity and innovation used in [name of career pathway]?	Standards-based Rubric: Throughout the course, students and teachers use the rubric for communication of success criteria, reflection, goal setting, and feedback.
How do teams efficiently and effectively solve problems in an increasingly complex world?	
What strategies and processes can I use to become a more effective creator, thinker and problem solver?	
Why is communication and collaboration important? How do positive work behaviors and personal qualities impact communication and collaboration?	
What is effective teamwork? What strategies can I use/teams use to work better together? How can perspectives and experiences of a diverse group develop innovative solutions to a given problem?	
Why is career and life readiness important? What jobs and careers are available to meet individual and societal needs locally, regionally, and nationally?	
How might technical knowledge and skills influence one's employability and advancement opportunities within various work settings?	
What are employability skills? How do I prepare myself for a career that is in demand now and in 5, 10, or 20 years from now?	

PRIORITY CAREER & TECHNICAL STANDARDS & Learning Targets		**Performance Tasks Options/ Assessment Strategies by Standard** *Students may be given options to show their learning in varied ways.*
Creativity, Critical Thinking, Communication and Collaboration **4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills.**		*Through the various components below that are an ongoing part of the course structure, students will use work from their in class learning and business partner projects to demonstrate learning through a standards reflection and conferring with the teacher.:*
a: I develop effective resolutions for a given problem, decision or opportunity using available information.	4C2.a.11.h: I can determine the information needed to address an identified problem.	
	4C2.a.12.h: I can contrast the benefits and drawbacks of various proposed resolutions to a given situation.	*Component O: Project Management* *Major focus is project management and professional skills required to successfully complete and document an engineering process. Topics students will student and demonstrate proficiency in include:* *- The EDD Design Process and Project Management* *-Documenting the Engineering Design Process* *-Teams, Timelines, and Contacting Experts* *-Project Evaluations and Classroom Management* *-Intellectual Property*
	4C2.a.13.h: I can predict how an action could result in unintended consequences, both positive and negative.	
	4C2.a.14.h: I can analyze the impact of a decision using a systems thinking model.	
	4C2.a.15.h: I can determine the best resolution for a problem, decision or opportunity based on given criteria.	
	C2.a.16.h: I can defend an action taken or a decision implemented.	*Component 1 – Research* *This component requires students to identify a problem for which they will design a solution during the remainder* *of the course. In the first lesson, students will write a clear problem statement and validate the problem by documenting credible sources that indicate that the problem exists. Validation is carried out through research and input from*
b: I develop and implement a resolution for a new situation using personal knowledge and experience.	4C2.b.5.h: I can apply past experience to develop a course of action for a new situation.	
	4C2.b.6.h: I can use existing knowledge to develop a resolution for a new situation, problem or opportunity.	

Career Development **CD4: Students will identify and apply employability skills.**		*the problem exists. Validation is carried out through research and input from experts and mentors. Once their work is defined, students are asked to perform additional research in order to justify the problem by confirming that the expense and effort involved with solving the problem is warranted based on need and cost. Students will explore and analyze prior solution attempts. Based on their research, student will create a testable design requirement which will be used to explore possible solutions. The students will present a project proposal to ensure the project is justified and that all prior solution attempts have been explored.* *Element A – Identification and Justification of the Problem* *Element B – Documentation and Analysis of Prior Solution Attempts* *Element C – Presentation and Justification of Solution Requirements*
a: I identify and demonstrate positive work behaviors and personal qualities needed to be employable.	CD4.a.6.h: I can evaluate how selfdiscipline, self-worth, positive attitude and integrity displayed in a work situation affect employment status.	
	CD4.a.7.h: I can assess how flexibility and willingness to learn new knowledge and skills affect employment status.	
	CD4.a.8.h: I can apply communication strategies when adapting to a culturally diverse environment.	
	CD4.a.9.h: I can use positive workqualities typically desired in each of the career cluster's pathways.	
	CD4.a.10.h: I can manage work roles and responsibilities to balance them with other life roles and responsibilities.	***Component 2 – Design*** *Based on the design requirement identified through research, students develop multiple solution possibilities. Through an evaluation process that involves feedback from experts and stakeholders and the application of a decision matrix or data-driven process, students will select the best potential solution to pursue. Students will refine the final selected solution path and provide evidence that the solution selected is viable.* *Element D – Design Concept Generation, Analysis, and Selection* *Element E – Application of STEM Principles and Practices* *Element F – Consideration of Design Viability*
b: I demonstrate skills related to seeking and applying for employment to find and obtain a desired job.	CD4.b.5.h: I can use multiple resources to locate job opportunities.	
	CD4.b.6.h: I can prepare a resume, cover letter, employment application.	
	CD4.b.7.h: I can employ critical thinking and decision-making skills to exhibit qualifications to a potential employer in an interview.	
c: I identify and exhibit traits for retaining employment.	CD4.c.4.h: I can model behaviors that demonstrate reliability and dependability.	
	CD4.c.5.h: I can maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite.	
	CD4.c.6.h: I can complete required employment forms and documentation.	***Component 3 – Prototype and Test*** *Student will create a testable prototype and an unbiased testing plan based on the defined design requirements to determine the effectiveness of the solution created.* *Element G – Construction of a Testable Prototype* *Element H – Prototype Testing and Data Collection Plan* *Element I – Testing, Data Collection, and Analysis*
	CD4.c.7.h: I can summarize key activities necessary to retain a job in an industry.	
d: I develop positive relationships with others.	CD4.d.5.h: I can participate in cocurricular and community activities to enhance the school experience.	
	CD4.d.6.h: I can evaluate the best method to assist co-workers in accomplishing goals and tasks.	
	CD4.d.7.h: I can examine the skills required to enable students to successfully transition to postsecondary opportunities.	***Component 4 – Evaluation of Project and Process*** *At this point in the design process, it is critical to seek and document feedback from all stakeholders. The designer(s) should reflect on all design decisions and the analysis that was generated from the testing process. Finally, the designer(s) can begin to formulate next steps.* *Element J – Documentation of External Evaluation* *Element K – Reflection on the Design Project* *Element L – Presentation of Designer's Recommendations*
	CD4.d.8.h: I can use a systematic approach to academic and career planning for students to achieve their learning, socio-cultural and work goals.	
Information, Media, Technology **IMT1: Students will access, interpret and evaluate information from a variety of sources in order to inform and support premises, arguments, decisions, ideas and initiatives.**		
a: I choose appropriate sources of data and information for a given purpose.	IMT1.a.6.h: I can justify the selection of various information sources for a given purpose.	***Component 5 – Reflection and Presenting the Design Process*** *At the conclusion of the design process, students will be asked to present and defend the process and decision.* *Element M – Presentation of the Project and Project Portfolio* *Element N – Writing Like an Engineer*
	IMT1.a.7.h: I can explain the level of objectivity for a given source of information.	

	IMT1.a.8.h: I can model how raw data can be applied differently to support opposing arguments or premises.	
b: I determine the relevance, validity and timeliness of data and information.	IMT1.b.7.h: I can use raw data and information appropriately to support an argument, idea or initiative.	*Component 6 – Going Beyond EDD* *Many opportunities exist for students to receive tangible value for their work beyond the classroom walls. These opportunities range from competitions, scholarships, and university admission notoriety, to interest from business representatives to further develop the ideas created in EDD classrooms. This section of the curriculum is dedicated to providing resources, examples, and suggestions for helping your students obtain tangible value for their work.*
	IMT1.b.8.h: I can compare and contrast validity of information from electronic and non-electronic sources.	
	IMT1.b.9.h: I can defend a position or decision using relevant, valid and timely data and information.	
c: I select relevant information necessary for making decisions and solving problems	IMT1.c.5.h: I can defend a solution or conclusion using appropriate data and information.	
	IMT1.c.6.h: I can interpret and select appropriate information to develop a resolution for a given situation.	
d: I apply data and information to communicate ideas and create new opportunities.	IMT1.d.6.h: I can defend a proposal for a new product or service based on data and information analysis.	
	IMT1.d.7.h: I can synthesize data and information from multiple sources to identify new trends.	
	IMT1.d.8.h: I can manage and share stored data and information for a specific purpose.	
PRIORITY CONTENT STANDARDS & Learning Targets		
Standard: BB1: Students will analyze the core concepts of technology.	**BB1.a.5.h:** I can describe how systems can fail because of design flaws, defect parts, poorly matched parts or they were used beyond their design capabilities.	
Standard: ENG1: Students will analyze and demonstrate the attributes of design.	**ENG1.a.9.h:** I can examine how the design needs to continually be evaluated and the ideas of the design must be redefined and improved.	
	ENG1.a.10.h: I can interpret design problems are seldom presented in a clearly defined form.	
	ENG1.a.11.h: I can argue design processes vary slightly. However, key elements of any design process include: defining a problem, identifying criteria, generating solutions, creating a model or prototype, testing and evaluating, refining the design and communicating processes and results.	
	ENG1.a.12.h: Requirements of a design, such as criteria, constraints and efficiency, sometimes compete with each other.	
Standard: ENG3: Students will demonstrate and analyze the role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.	**ENG3.a.5.h:** I can explain technological problems must be researched before they can be solved.	
	ENG3.a.6.h: Not all problems are technological and not every problem can be solved using technology.	
	ENG3.a.7.h: Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.	
	ENG3.b.5.h: I can describe how many technological problems require a multidisciplinary approach.	

Standard: ICT1: Students will analyze, select and use information and communication technologies.	**ICT1.a.15.h:** I can evaluate how information and communication systems can be used to inform, persuade, entertain, control, manage and educate.	
Standard: MNF1: Students will be able to select and use manufacturing technologies.	**MNF.1.b.6.h:** I can design and publish documents using advanced publishing software and graphic programs to defend and promote results.	
	MNF1.c.10.h: I can recognize how to bring together projects individually and in teams for effective performance and the achievement of objectives.	
	MNF1.e.7.h:I can use marketing to establish a product's identity, conduct research on its potential, advertise it, distribute it and sell it.	
	MNF1.f.8.h: I can recognize technologies provide a means for humans to alter or modify materials and to produce products.	

Stage 3: Learning Activities

A brief summary of the key learning activities- How will students build knowledge & develop skills? How will learning be relevant, accessible, and engaging? How will the learning unforld in a natural flow?

GUIDING UNIT QUESTIONS *Using Costas Level of Thinking, what questions will hook and hold students so that they develop a deep understanding of the desired results? The guiding questions are more topic-specific to the particular unit. They guide the exploration of the essential questions and rigor of the standards. This may include questions that guide project based/ problem based learning*	STRATEGIES/ACTIVITIES *What learning strategies and experiences will authentically engage students so that they gain understanding the desired results? This includes strategies and activities that help learners acquire targeted knowledge and skills, make meaning of important ideas, and transfer their learning to new situations. Consider how the learning will be tailored and flexible to address the interests and learning styles of all students.*	RESOURCES/MATERIALS *This includes an applicable textbooks, software, industry recognized certification software/tools, subcriptions (such asPLTW), etc.*
Examples (not a comprehensive list)	Writing, Inquiry, Collaboration, Organization, and Reading strategies used throughout the process	PLTW course guide and teacher resources
What are the roles and responsibilities of engineering in society?		PLTW student resources: Problem Solving and Critical Thinking Tools and Technology Engineering Math and Science Modeling Engineering Design and Applications Computational Thinking Systems Thinking Professionalism and Ethics Communication Collaboration Project Management Career Learning
What role does market place play in engineering design?		
What are the fundamental aspects of any engineering design process?		
Why is it important for engineers and designers to utilize known scientific and mathematical principles?		
Why do engineers implement well defined problem statements prior to beginning the solution process?		
What are the critical attributes of succesful project planning and management?		
Why is the intellectual property so important in engineering design?		
Why is teaming often more effective than individuals working alone when solving complex problems?		LAUNCH & other district business partnerships
What are the drawbacks to poor business communication?		
What are the general steps used to develop a solution testing procedure?		

What key points are most important to engineers when given limited time to present findings?		