

ENGINEERING DESIGN AND DEVELOPMENT (PLTW)

Engineering Design and Development is an engineering research course in which students work in teams to research, design, test and construct a solution to an open-ended engineering problem. The product development life cycle and a design process are used to guide the team to reach a solution to the problem. The team presents and defends their solution to a panel of outside reviewers at the conclusion of the course. The EDD course allows students to apply all the skills and knowledge learned in previous pre-engineering courses. The use of 3D design software helps students design solutions to the problem their team has chosen. This course also engages students in critical thinking and problem-solving skills, time management and teamwork skills, a valuable set for students' future careers. **NOTE: Use of the PLTW Course number is limited to schools that have agreed to be part of the Project Lead the Way network and follow all training and data collection requirements.**

- DOE Code: 4828
- Recommended Grade Level: Grade 12
- Recommended Prerequisites: Introduction to Engineering Design, Principles of Engineering Design, and one specialty course
- Credits: 1 credit per semester, maximum of 2 credits
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

Dual Credit

This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

Application of Content and Multiple Hour Offerings

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences.

Content Standards

Domain – Defining a Problem

Core Standard 1 Students integrate research and documentation skills from a design process to identify problems.

Standards

- EDD-1.1 Create documentation to support a design process and results
- EDD-1.2 Summarize research findings in visual and verbal form
- EDD-1.3 Analyze current and past products to inform the creation of a problem statement
- EDD-1.4 Identify research that validates and justifies problem statements
- EDD-1.5 Distinguish between credible and non-credible sources while conducting research
- EDD-1.6 Analyze the market to justify whether solving the problem is necessary
- EDD-1.7 Validate data collected during market research

Domain – Design & Prototype to a Solution

Core Standard 2 Students design and build a prototype solution for the problem.

Standards

- EDD-2.1 Identify criteria and constraints for the design of a product
- EDD-2.2 Create multiple potential solutions to a problem
- EDD-2.3 Distinguish between practical and potentially successful design solutions
- EDD-2.4 Refine and optimize conceptual ideas to effectively solve a problem
- EDD-2.5 Communicate design concepts using visual and written documentation
- EDD-2.6 Verify the product design based on a variety of design factors and implement design changes to improve the product
- EDD-2.7 Create a set of drawings to document proposed product design
- EDD-2.8 Compare the consequences of the product design to determine the ethical implications of product development
- EDD-2.9 Develop a document to present the proposed design and provide justification for further development of a product
- EDD-2.10 Apply engineering concepts to design a prototype
- EDD-2.11 Evaluate types of materials and assembly procedures for a prototype design
- EDD-2.12 Create designs of the prototype using a 3D software package
- EDD-2.13 Develop document resources needed to build prototype
- EDD-2.14 Choose methods for testing a prototype
- EDD-2.15 Create a plan for building prototype
- EDD-2.16 Construct an operational prototype
- EDD-2.17 Evaluate and document prototypes for modifications

Domain – Test, Evaluate & Refine Solution

Core Standard 3 Students choose the appropriate statistical analysis tools to test and evaluate prototype for results on how to refine prototype for a viable solution.

Standards

- EDD-3.1 Choose testing criteria to evaluate the prototype for success of solution
- EDD-3.2 Create a valid method for testing accurately the effectiveness of the design solution
- EDD-3.3 Develop documentation for test procedures to be used on the design solution
- EDD-3.4 Justify the validity of the selected test procedures
- EDD-3.5 Perform testing on prototype
- EDD-3.6 Identify modifications to the design based upon test data

Domain – Communicate Results

Core Standard 4 Students validate the design process used to solve the problem for presentation of the final product.

Standards

- EDD-4.1 Organize data and information compiled throughout the process of the design solution
- EDD-4.2 Utilize presentation aids to enhance and clarify the presentation
- EDD-4.3 Discuss research findings on the chosen solution in a formal presentation

Process Standards

Common Core Literacy Standards for Technical Subjects

Reading Standards for Literacy in Technical Subjects 11-12

The standards below begin at grade 11 and define what students should understand and be able to do by the end of grade 12. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Key Ideas and Details

- 11-12.RT.1 Cite specific textual evidence to support analysis of technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
- 11-12.RT.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- 11-12.RT.3 Follow precisely a complex multistep procedure when performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure

- 11-12.RT.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context relevant to *grades 11-12 texts and topics*.
- 11-12.RT.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- 11-12.RT.6 Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Idea

- 11-12.RT.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- 11-12.RT.8 Evaluate the hypotheses, data, analysis, and conclusions in a technical subject, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- 11-12.RT.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Range of Reading and Level of Text Complexity

- 11-12.RT.10 By the end of grade 12, read and comprehend technical texts in the grades 11-CCR text complexity band independently and proficiently.

Writing Standards for Literacy in Technical Subjects 11-12

The standards below begin at grade 11 and define what students should understand and be able to do by the end of grade 12. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Text Types and Purposes

- 11-12.WT.1 Write arguments focused on *discipline-specific content*.
- 11-12.WT.2 Write informative/explanatory texts, including technical processes.

- 11-12.WT.3 Students will not write narratives in technical subjects. *Note: Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In technical, students must be able to write precise enough descriptions of the step-by-step procedures they use in their technical work that others can replicate them and (possibly) reach the same results.*

Production and Distribution of Writing

- 11-12.WT.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- 11-12.WT.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
- 11-12.WT.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

- 11-12.WT.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- 11-12.WT.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation
- 11-12.WT.9 Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

- 11-12.WT.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Career and Technical Student Organizations

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in a Career and Technical Student Organization, such as **Business Professional of America, DECA, or Future Business Leaders of America.**