Project Lead the Way: Engineering Design and Development

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Welcome!!!

Course Description:

Engineering Design and Development (EDD) is the capstone course in the PLTW high school engineering program. It is an engineering research course in which students work in teams to design and develop an original solution to a valid open-ended technical problem by applying the engineering design process. Students will work in teams to solve a problem of their choosing. EDD is not focused on producing a marketable process or product, though this can and does happen using the design process. EDD is not intended to be an "invention class" or a "patent generating class" but rather a class that centers on using, documenting, and working through the engineering design process to address a problem. The end result should always be driven by the process rather than an individual or team's skill sets, opinions, or personal preferences.

Utilizing the activity-project-problem-based (APPB) teaching and learning pedagogy, 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. While progressing through the engineering design process, students will work closely with a community mentor and 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 Course of Study:

- Engineering Design Processes
- Project Management
- Documenting an Engineering Design Process
- Teamwork and Professional Skills
- Problem Identification and Justification
- Research
- Intellectual Property
- Design Requirements
- Project Proposals
- Design
- Virtual Design and Testing
- Preliminary Design Reviews
- Prototyping
- Testing a Prototype
- Presenting the Process and Results

Enduring Understandings:

1. The work of engineers has an impact on our society.
2. An open-ended design process involves identifying a justifiable problem and developing an original solution that attempts to solve it.
3. The engineering design process is typically non-linear. Designers may need to re-visit steps in the process or take next steps based on feedback from previous steps.
4. The engineering design process is both a guide and a series of waypoints for effective problem solving. It is a tool for self-evaluation as an engineer moves through the process.
5. There are principles and practices related to academic research. Topic selection and design decisions should be research driven and driven by data whenever possible.
6. There are principles, practices, and techniques related to technical writing.
7. There are principles and practices related to documenting an engineering design process that allow teams to work effectively, preserve the work allowing continuation at a later date, and protect the designer's intellectual property.
8. Project management is the discipline of planning, organizing, motivating, utilizing resources to achieve specific goals.
9. Relevant principles and practices of Science, Technology, Engineering, and Mathematics (STEM) should be used to inform and justify design choices. They should be evident and well documented in an engineering design process.
10. Individuals and other entities put extraordinary effort into protecting their intellectual property so they can control who has access to and use of their work. Intellectual property protections allow individuals or companies to maintain rights to profit from their ideas.
11. There are many stakeholders involved in an open ended engineering design process.
12. The ability to communicate as a professional is a critical skill for engineers.
13. Measurable design requirements are developed from a problem statement. Design requirements guide engineers through the design process and help determine if the solution is successful at solving the identified problem.
14. Multiple design possibilities should be explored in an engineering design process.
15. Testing is a critical component to any engineering design process. A plan and process for testing the proposed solution both qualitatively and quantitatively against design requirements should be created and carried out.
16. Engineering design projects are typically peer reviewed. Stakeholder feedback and design reviews help guide engineers through the design process.

17. Presentation of this design process and project findings are critical to the engineering design process.

Essential Questions:

1. What are the global challenges facing our world?
2. What are the roles and responsibilities of engineering in society?
3. What justifies expenditure of resources to try and solve a problem?
4. What role does the market place play in engineering design?
5. Why is it crucial to use a design process when trying to solve complex problems?
6. What are the fundamental aspects of any engineering design process?
7. What determines the next step in a design process?
8. Why is documenting a design process important?
9. What are the attributes of successful project planning and management?
10. Why is it important for engineers and designers to utilize known scientific and mathematical principles?
11. Why should I do independent research before contacting stakeholders or seeking expert support?
12. Why is the intellectual property so important in engineering design?
13. What is the difference between invention and innovation?
14. Why is teaming often more effective than individuals working alone when solving a complex problem?
15. How do you decide what key points are most important when given limited time to present findings?
16. Do I need to create a solution that solves the problem to successfully complete this course?
17. Should I design an authentic solution, what steps could I take beyond this course?

It is expected that students will:

1. Apply ethical standards recognized by the engineering community in all aspects of design.
2. Use an engineering design process to help guide them through an open-ended design problem.
3. Create documentation to support understanding of a design process that captures critical waypoints in the design process.
4. Develop professional and project planning skills to complete a design process successfully.
5. Identify a problem and justify development of a solution from an academic, ethical, or market perspective.
6. Identify and evaluate current and past solution attempts.
7. Develop multiple possible solutions ideas.
8. Create a prototype with a valid testing plan.
9. Interpret testing results and summarize.
10. Present the design process to a technical group with an understanding of the design process or the identified problem. Students will present their findings and defend process decisions.

Materials/Supplies Needed:

Class Engineering Notebook
Your mypltw.org username and password (No textbook is required; curriculum is online)
Your school email/google account

Grading Scale:

Range	Grade
100 – 93 %	A
92 – 90 %	A-
89 – 87 %	B+
86 – 83 %	B
82 – 80 %	B-
79 – 77 %	C+
76 – 73 %	C
72 – 70 %	C-
69 – 67 %	D+
66 – 63 %	D
63 – 60 %	D-
Below 60 %	F

Activities/Notebook	60%
Assessments/Presentations	40%

Come to class every day and be on time.
Work not finished in class is HOMEWORK!
Grades are updated every day. You can always check your grade online.