Walker Career Center

Introduction to Engineering Design

DOE# 4802

Course Description and Outline

Introduction to Engineering Design is a fundamental pre-engineering course where students become familiar with the engineering design process. Students work both individually and in teams to design solutions to a variety of problems using industry standard sketches and current 3D design and modeling software to represent and communicate solutions. Students apply their knowledge through hands-on projects and document their work with the use of an engineering notebook. Students' progress from completing structured activities to solving open-ended projects and problems that require them to develop planning, documentation, communication, and other professional skills.
Ethical issues related to professional practice and product development are also presented.
NOTE: If PLTW curriculum is used, PLTW training is required of the teacher.

Teacher Information and Student Supports

Name: Jim Hanson
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Phone: 317-532-6165

Course Supplies

- Black or Blue Pen
- Pencil (Mechanical)
- Highlighter
- Engineering Notebook (Provided)
- Calculator

Suggested Course Supplies

- USB Mouse for Chromebook
- Colored Pencils
- Large Eraser
- Second Color Pen

Additional Supports

- Tutoring is available on Tuesdays and after school until 3pm

Journey of a Graduate Skills

Critical Thinking

- Demonstrate relevant safety practices when using tools and equipment as determined by task, materials, environment, and protective attire.
- Apply corrective action(s) to eliminate hazards.
- Formulate unbiased research questions to collect information/data
- Apply appropriate investigative strategies.
- Evaluate sources appropriate for academic research.
- Select resources relevant to the identified problem.
- Synthesize information collected during the research process
- Generate a valid and justifiable problem.
- Apply the steps of the design process as they are used to solve the problem.
- Assess and refine original design solutions based upon reflection, critique, practice, and research.
- Interpret and develop appropriate annotations for technical drawings.
- Differentiate between the various types of tolerances.
- Analyze types of fits in relation to mating parts.
- Determine the appropriate number of views, including alternate views (auxiliary, section, detail), to fully document the details of a design.
- Differentiate when the physical properties of geometric shapes can be utilized in order to optimize design solutions.
- Identify and produce multiview drawings in proper orientation, scale, and proportion through methods of orthographic projection.
- Illustrate and calculate mathematical problems related to real world situations involving characteristics of geometric shapes and solids.

- Differentiate between invention and innovation.
- Create an innovation to a system or product using information obtained from a product analysis.
- Evaluate the effectiveness of elements and principles in other design solutions and use analysis to revise original design
- Apply the design principles and elements.
- Examine a design (product) with respect to its quality and usability.
- Use the design principles and elements to meet the design criteria and constraints to solve a valid problem.
- Interpret the details of a sketch and generate physical or computer models using appropriate modeling materials and techniques.
- Recognize and utilize constraints such as dimensional, geometric, assembly and parametric constraints in regard to modeling.
- Analyze the remaining degrees of freedom of mating components after systematically applying assembly constraints until only desired components are allowed to move.
- Apply visual design principles to enhance the aesthetic appeal of a design solution.
- Analyze products or systems by identifying problematic features to generate potential solution(s).
- Choose appropriate symbols and metaphors from art and design and describe their origin, function, and value in the solutions

Communication

- Explain the importance of documentation.
- Apply sketching and annotation skills to document work.
- Produce working drawings using appropriate drawing styles and techniques.
- Document project components into an engineering notebook (digital or paper).
- Communicate technical knowledge in a variety of formats.
- Discuss how the design process impacts the outcome when designing solutions to problems.
- Maintain a working engineering notebook for the duration of the course.
- Implement design briefs in the problem solving process.
- Use engineering design equipment (3D modeling software, 3D printer, etc.) to create 3D and 2D models to document engineering design.
- Formulate methods of communicating designs using various forms of modeling such as conceptual, graphical, mathematical, physical or computer modeling.
- Create design solutions that use specific elements, principles, and functions that demonstrate skill and understanding of different communication processes to solve problems

Resilience

- Manage time and the progress of a project through effective use of a Gantt chart.
- Create multiple solutions that demonstrate and distinguish mastery in producing effective relationships between elements, media, and function.

Collaboration

- Create a presentation that outlines team or individual priorities for design and share with peers.
- Collaborate on engineering projects by working in design teams to solve valid problems.

Content Knowledge

- Identify engineering and technology occupations and the roles and responsibilities of each.
- Report job outlook, demand, and projected wages for engineering and technology careers.
- Explore job opportunities that are available in engineering and technology.
- Investigate post-secondary training opportunities and industry certifications that are available.
- Describe the steps in the design process.
- Create a design brief by constructing a problem and design statement and identifying problem constraints.
- Describe the iterative nature of the design loop.
- Distinguish between line types utilized on a technical drawing per industry standard (ANSI Line Conventions and Lettering Y14.2M-2008).
- Collect and display data related to the sizes and shapes of objects utilizing various measuring tools.
- Identify and produce various pictorial drawings including isometric, oblique, and perspective drawings for technical drawing representations.
- Apply industry accepted dimensioning practices to technical drawings in order to annotate design features
- Identify visual, functional and structural properties of a product.
- Describe the relationship between reverse engineering and product/system improvement.
- Perform mathematical calculations to identify structural properties of a product.
- Discuss historical and current events related to engineering and technology and analyze the impact on society.

- Identify the qualities of engineering design and their relationship to a design matrix
- Utilize appropriate modeling materials to construct a physical model such as a prototype or mock-up.
- Identify the six degrees of freedom of a component floating in space in the context of an assembly.
- Differentiate between assemblies and subassemblies and their appropriate use

Citizenship

- Discuss the importance of ethics in engineering design

Grade Calculation

MSD Warren Township Scale

Grade	Percentage
A	92.5 - 100
A-	89.5 - 92.4
B+	86.5 - 89.4
B	82.5 - 86.4
B-	79.5 - 82.4
C+	76.5 - 79.4
C	72.5 - 76.4
C-	69.5 - 72.4
D+	66.5 - 69.4
D	62.5 - 66.4
D-	59.5 - 62.4
F	Below 59.5

Grading Policies

Semester Grade
Your semester grade will be calculated in the following way:

90% Assignments and Challenges, Assessments (Tests, Quizzes, Projects)
10% Final Project/Exam

Warren Central Grading Policy

The high school grading policies will be explained here

Warren Central Homework Policy

The high school homework policies will be explained here.

Synergy Grades

Grades posted in Synergy reflect the students' academic performance in the course.

Credits/Pathways

CORE 40 Diploma
Course fulfills two credits of the elective requirement for the Core 40 diploma.

Academic/Technical Honors Diploma
Has potential to fulfill academic/technical honors diploma. - see counselor

CTE Graduation Pathway
Principles *– Introduction to Engineering Design (IED)*
Course A *– Principles of Engineering (POE)*
Course B *– Civil Engineering and Architecture (CEA)*
Or
Course B *– Computer Integrated Manufacturing (CIM)*
Or
Course B *– Digital Electronics (DE)*
Capstone *– Engineering Design & Development (EDD)*

Types of Assignments and Assessments

Assignments
Assignments will include classwork, and homework. These items are opportunities for students to practice the concepts learned in class.

Labs and Challenges
Each unit will have one or more larger activities. These activities are designed to demonstrate "real world" applications of the class concepts and help students develop a deeper understanding of the learning objectives.

Assessments
Tests/projects cover Indiana State Standards.

Quizzes may be given throughout a unit. There may or may not be a quiz for each unit.