



PLTW Engineering

Engineering Essentials | Course Resume

Course resumes showcase the technical skills students obtain in each PLTW course. Each resume outlines the computational skills, analytical skills, and knowledge acquired in the course. Course resumes also detail student experience with tools, software, lab work, and engineering design. The detailed skills listed within course resumes illustrate the immediate, applicable contributions that students can make within a workplace.

Design Process Experience

- Solve a problem using an iterative engineering design process
- Work collaboratively on a team to design a product or solve a problem
- Document in detail the engineering design process used to solve a problem or design a product
- Develop a detailed and comprehensive design brief
- Brainstorm to generate creative ideas and potential solutions to a problem
- Carry out a plan to compare alternate solutions and select the best solution path
- Evaluate a design solution with respect to design requirements

Experimental Design and Testing Experience

- Design an experimental protocol to investigate a phenomenon and gain knowledge
- Develop a test plan to compare alternate solutions
- Collect and analyze data to draw conclusions
- Accurately represent experimental data using proper visualization techniques and statistical models

CAD and Drafting Experience

- Create concept sketches to represent ideas
- Create hand-drawn and scaled technical drawings of simple objects
- Create and/or modify 3-D solid computer models of complex parts

Geographic Information System (GIS) Experience

- Use GIS technology to interpret spatial information, collect geocoded data, and identify patterns
- Construct and use maps to make engineering decisions
- Conduct a feasibility study for the location of a facility
- Design a story map to present GIS-informed design solutions

Systems Thinking

- Apply systems thinking to consider how an engineering problem and its solution may be thought of as containing subsystems and as being a subsystem of a larger system
- Assess the sustainability of an engineering solution based on the impacts – within the system or interrelated systems – that result from implementation of the solution

Project Management Experience

- Apply project management tools – including a project schedule and collaborative tools – when designing and developing a solution
- Act as a project lead to solve an engineering problem



Modeling Experience

- Develop models (including conceptual, graphical, mathematical, physical, and computer) and simulations to represent information, objects, electrical circuits, systems, and processes
- Identify the purpose and limitation of a given model
- Use models to inform a design process and create solutions
- Develop physical models (including 3-D printed parts) to represent natural phenomenon, mechanical systems, and electromechanical systems

Computational and Analytical Skills

- Apply problem decomposition skills to break problems and processes into manageable parts
- Use algorithms to create solutions with or without computer programs
- Use Excel to calculate summary statistics, create histograms, and find trend lines
- Formulate solutions that use automation and programming to solve a problem
- Collect, organize, and analyze data to help define a problem
- Apply abstraction to generalize a problem and solutions
- Use data to inform decisions and make predictions

Electronics Experience

- Build a circuit physically and virtually
- Measure circuit parameters
- Perform circuit calculations using Ohm's Law
- Build truth tables and assemble logic circuits
- Program a microcontroller
- Design and build an electromechanical system

Professional Skills

- Team collaboration
- Peer review and feedback
- Project management
- Problem-solving
- Oral communication and presentation
- Technical writing
- Ethical reasoning



Course Knowledge

Careers

- Engineering disciplines, including mechanical, electrical/electronics, industrial, and civil, as well as blended and sub-disciplines
- STEM careers related to engineering
- Current global challenges and real-world engineering projects and research
- Awareness of the education and skills required for professional practice
- Professional understanding of the need for multidisciplinary solutions to complex global challenges

Design Process

- Research
- Define the problem using a design brief
- Generate concepts by brainstorming and using decision matrices
- Develop a solution
- Construct and test a working model
- Evaluate a solution
- Present a solution

Experimental Design

- Steps of experimental design
- Hypothesis, variables, and controls
- Conclusions and limitations

Collaboration

- Team norms
- Conflict resolution strategies
- Collaborative problem-solving

Professional Ethics

- Ethical perspectives
- Professional Code of Ethics

Communication

- Engineering notebooks
- Effective feedback
- Effective oral presentations
- Effective technical writing
- Active listening

Project Management

- Leadership
- Project scheduling



Data Analysis

- Measures of central tendency
- Measures of variation
- Box plots and comparing data sets
- Trend lines (mathematical modeling) and prediction

Modeling in Engineering

- Conceptual modeling
- Graphical modeling
- Mathematical modeling
- 3-D solid computer modeling
- Physical modeling and prototyping
- Geospatial modeling
- Electrical circuit simulations

Technical Drawing

- Isometric views

Mechanical Concepts

- Simple and compound machines
- Types of motion and changes in motion
- Gear ratio

Electrical Circuits

- Electrical components
- Measure current, voltage, and resistance
- Ohm's Law

Electronics

- Truth tables and logic expressions
- Microcontroller programming
- Sensors

Contemporary Engineering Issues

- Grand Challenges for Engineering
- UN Sustainable Development Goals