



Engineering Design At-A-Glance

Intended Audience: Grades 11-12

Course Length: 36 weeks

This course focuses on how engineers apply their creativity, resourcefulness, mathematical, scientific, and technical knowledge and skills in the creation or refinement of technological products/systems. A key approach will be the employment of a sophisticated, sequential, and iterative design and development process to solve authentic engineering tasks/problems.

Fundamentals of Design Engineering: There are fundamental principles that impact human thinking and actions when engaged in the process of designing technological products. A combination of personal qualities such as creativity and resourcefulness and design constraints imposed by numerous factors are employed in a formal process to create new or refined technologies.

- Human Factors Affecting Design and Environmental Factors Affecting Design
- Industrial Factors Affecting Design
- Design through Research
- Market and Profit Influence
- Design – A Formal Process
- Analyzing and Interpreting Data – Prioritizing Design Constraints

Elements of Design: There are core technologies involving systems within a range of sophistication that are critical to all technological innovations, including mechanical, structural, fluid, optical, electrical, electronic, thermal, bio-technical, and material. Mathematical and scientific calculations and concepts are documented and used by engineers and designers for specific applications in all engineering fields. These documents are valuable reference materials used to ensure high quality designs.

- Design Requirements: Product design always includes requirements (criteria, constraints and efficiency) that require “trade-offs.”
- Technology Systems – Using Models Requirements: There are nine “Core Technologies” that are fundamental to all technology systems that must be recognized and understood.

Structural Design: Modeling, Prototyping, and Protecting Ideas: A combination of personal abilities such as creativity, resourcefulness, and abstract thinking applied to a formal engineering design process, supported by full testing with documentation, can result in dynamic and dramatic technological invention or innovation.

- Patent Process: Technological innovation can lead to unintended, yet very useful, applications in other industries resulting in a “technological transfer.”
- Mathematical and Computational Resources: Engineers use numerous and diverse resources to ensure accurate and appropriate calculations in all design work.
- Materials Science: Materials (natural, synthetic, or blended) provide many options for final product designs across all industries.
- Creativity in Design: Creativity varies in individuals, but can be enhanced and refined in all people.

Product and Systems Engineering and Analysis Management: Project management involves research-based techniques and strategies designed to control major business functions and ensure efficiency in the design and quality of a final product. A primary goal of any engineering enterprise is to identify problems to solve, predict overall value and success of the project, and then manage that project in the most cost-effective way.

- Managing Engineering Design, Quality Assurance, Evaluating, and Communicating Information.

