

**Rangeview High School**  
**Introduction to Engineering Design**  
**Course Syllabus**  
**2022-2023**

**Course Title: Introduction to Engineering Design**

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Office Hours: Mr. Mills is available after 7th hour. The other options are from 7 to 7:30 most days or after school on most days.

**Course Description :**

**Concepts Addressed by Quarter**

**Quarter 1: Design Process**

- There are many design processes that guide professionals in developing solutions to problems.
- A design process most used by engineers includes defining a problem, brainstorming, researching, identifying requirements, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, refining, making, and communicating results.
- Design teams use brainstorming techniques to generate large numbers of ideas in short time periods.
- Engineers conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.
- A designer uses an engineer's notebook to chronologically document all aspects of a design project.
- Engineers create sketches to quickly record, communicate, and investigate ideas.
- Pictorials and tonal shading techniques are used in combination to give sketched objects a realistic look.
- Designers use isometric, oblique, perspective, and multiview sketching to maintain an object's visual proportions.
- A multiview projection is the most common method of communicating the shape and size of an object that is intended for manufacture.
- Measurement systems were developed out of the need for standardization.
- Engineers apply dimensions to drawings to communicate size information.
- Manufactured parts are often created in different countries, where dimensional values are often converted from one standard unit to another.
- The amount of variation that can be measured depends on the precision of the measuring tool.
- Statistical analysis of measurements can help to verify the quality of a design or process.
- Engineers use graphics to communicate patterns in recorded data.
- Three-dimensional forms are derived from two-dimensional shapes.
- The results of the design process are commonly displayed as a physical model.
- Engineers develop models to communicate and evaluate possible solutions.
- Geometric and numeric constraints are used to define the shape and size of objects in Computer Aided Design (CAD) modeling systems.
- Engineers use CAD modeling systems to quickly generate and annotate working drawings.
- Packaging not only protects a product, but contributes to that product's commercial success.

**Quarter 2: Design Exercises**

- Geometric shapes describe the two or three dimensional contours that characterize an object.
- The properties of volume and surface area are common to all designed objects and provide useful information to the engineer.

- CAD systems are used to increase productivity and reduce design costs.
- Solid CAD models are the result of both additive and subtractive processes.
- Working drawings should contain only the dimensions that are necessary to build and inspect an object.
- Object features require specialized dimensions and symbols to communicate technical information, such as size.
- There is always a degree of variation between the actual manufactured object and its dimensioned drawing.
- Engineers specify tolerances to indicate the amount of dimensional variation that may occur without adversely affecting an object's function.
- Tolerances for mating part features are determined by the type of fit.
- Solid modeling programs allow the designer to create quality designs for production in far less time than traditional design methods.
- Engineers use CAD models, assemblies, and animations to check for design problems, verify the functional qualities of a design, and communicate information to other professionals and clients.
- Auxiliary views allow the engineer to communicate information about an object's inclined surfaces that appear foreshortened in basic multiview drawings.
- Designers use sectional views to communicate an object's interior features that may be difficult to visualize from the outside.
- As individual objects are assembled together, their degrees of freedom are systematically removed.
- Engineers create mathematical formulas to establish geometric and functional relationships within their designs.
- A title block provides the engineer and manufacturer with important information about an object and its creator.
- A parts list and balloons are used to identify individual components in an assembly drawing.
- Design solutions can be created as an individual or in teams.
- Engineers use design briefs to explain the problem, identify solution expectations, and establish project constraints.
- Teamwork requires constant communication to achieve the goal at hand.
- Engineers conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.
- Engineers use a design process to create solutions to existing problems.
- Engineers use CAD modeling systems to quickly generate and annotate working drawings.
- Fluid Power Concepts could be used to enhance design solutions.

### **Quarter 3: Reverse Engineering**

- Visual design principles and elements constitute an aesthetic vocabulary that is used to describe any object independent of its formal title, structural, and functional qualities.
- Tangible design elements are manipulated according to conceptual design principles.
- Aesthetic appeal results from the interplay between design principles and elements.
- Though distinctly different, a design's visual characteristics are influenced by its structural and functional requirements.
- Visual appeal influences a design's commercial success.
- Graphic designers are concerned with developing visual messages that make people in a target audience respond in a predictable and favorable manner.
- Mechanisms use simple machines to move loads through the input of applied effort forces.
- Engineers perform reverse engineering on products to study their visual, functional, and structural qualities.
- Through observation and analysis, a product's function can be divided into a sequence of operations.
- Products operate as systems, with identifiable inputs and outputs.
- Objects are held together by means of joinery, fasteners, or adhesives.
- Precision measurement tools and techniques are used to accurately record an object's geometry.
- Operational conditions, material properties, and manufacturing methods help engineers determine the material makeup of a design.

- Engineers use reference sources and computer-aided design (CAD) systems to calculate the mass properties of designed objects.
- Engineers analyze designs to identify shortcomings and opportunities for innovation.
- Design teams use brainstorming techniques to generate large numbers of ideas in short time periods.
- Engineers use decision matrices to help make design decisions that are based on analysis and logic.
- Engineers spend a great deal of time writing technical reports to explain project information to various audiences.

#### **Quarter 4: Open-Ended Design Problems**

- The material of a product, how the material is prepared for use, its durability, and ease of recycling all impact a product's design, marketability, and life expectancy.
- All products made, regardless of material type, may have both positive and negative impacts.
- In addition to economics and resources, manufacturers must consider human and global impacts of various manufacturing process options.
- Laws and guidelines have been established to protect humans and the global environment.
- A conscious effort by product designers and engineers to investigate the recyclable uses of materials will play a vital role in the future of landfills and the environment.
- Teams of people can accomplish more than one individual working alone.
- Design teams establish group norms through brainstorming and consensus to regulate proper and acceptable behavior by and between team members.
- Engineers develop Gantt charts to plan, manage, and control a design team's actions on projects that have definite beginning and end dates.
- Virtual teams rely on communications other than face-to-face contact to work effectively to solve problems.
- Each team member's strengths are a support mechanism for the other team members' weaknesses.
- Conflict between team members is a normal occurrence, and can be addressed using formal conflict resolution strategies.

<b>Grades</b>	<b>Grade book marks are converted to a single letter grade for eligibility and quarterly reports. Grades are recorded on an official student transcript.</b>
A 90% to 100%	The student consistently and independently demonstrates proficient and advanced understanding in course concepts and skills in a variety of assessments.
B 80% to 89%	The student independently demonstrates proficiency in course concepts and skills in a variety of assessments.
C 70% to 79%	The student demonstrates proficiency in course concepts and skills with teacher and peer support.
D 60% to 69%	The student demonstrates limited understanding and application of course content and skills and is making progress toward proficiency.
F Below 60%	The student has shown insufficient evidence to gauge understanding or progress.

## **Class Expectations**

**Make up work and Office Hours:** It is the responsibility of the student to make up assignments as soon as you return to class after an absence. In some cases an alternative assignment may be given to the student. A student has two days for each day missed. No credit will be given for work missed during unexcused absences. Please see Mr. Mills for times for appointment. Completing work in a timely manner is a component of proficiency.

**Passes:** Students may exchange their Rangeview ID for the hall pass provided:

- I have already taken roll
- The student has asked me for the pass
- There is a pressing need to leave the room.

No ID, no pass, no exceptions. Nothing may be substituted for the Rangeview ID.

**Tardies -** Class starts when the bell rings. Three tardies will be asked to make up time. 5 or more tardies for the semester will result in Saturday school being assigned.

**Student Handbook and Classroom Policies:**

- **Bullying:**

**Definition:** Any written, verbal or pictorial expression, physical or electronic act or gesture, or a pattern thereof by a student that is intended to coerce, intimidate or cause any physical, mental, or emotional harm to any student. This includes the creation of an intimidating, hostile, or significantly offensive environment that interferes with the learning or performance of school-sanctioned activities of any student.

- **Examples of Bullying:**

- Derogatory written or pictorial communications in any media (e.g., letters, notes, cellphones, social networks, voicemail, text messages, pager messages, newspaper articles, invitations, posters, photos, cartoons);
- Derogatory verbal comments (e.g., name-calling, taunting, hostile teasing, spreading rumors, epithets, jokes or slurs);
- Threats of force or violence against a person's body, possessions or residence (e.g., obtaining food or money by threats of force); or
- Physical conduct (e.g., provocative gestures, overly rough horseplay, restricting freedom of action or movement, violence, defacing or destruction of property).

Any student engaged in bullying will face disciplinary action. All concerns of threats or rumors must be reported to a staff member as soon as possible.

- **Cyberbullying:**

**Definition:** Being cruel to others by sending or posting harmful material using the Internet, cell phone, or any social media. Spreading or forwarding rumors or threats or photos via social media is a serious offense.

Any student engaged in cyberbullying will face disciplinary action. All concerns of threats or rumors must be reported to a staff member as soon as possible. Cyberbullying is a criminal offense and police will be notified.

**Academic Dishonesty**

Academic dishonesty as defined by our safe schools policy is: Untruthful or deceptive behavior in connection with academics, including plagiarism, cheating on tests or assignments or changing grades without authorization.

**FIRST OFFENSE**

A zero on the assignment, test, or quiz with no opportunity to make up the work for credit.

**SUBSEQUENT OFFENSES**

A zero on the assignment, test, or quiz with no opportunity to make up the work for credit AND referral by an RHS Faculty member to the Dean of Students and documentation into the Infinite Campus conference log.

Parent notification will be made in all circumstances. Multiple offenses of any of the above may result in failing a class.