

Elective Course Description

Course Name	Engineering and Design
Course Number	TBD after Board approval
Length of Course	One Semester
Grade Level	7-8, 9-12
Credit Type	0.5 Elective Per Semester (for high school students)
Grading Scale	A-F
Course Prerequisite	None
Course Summary	<p>Given a specific set of materials or project parameters, students will be presented with a series of challenges in which they must employ the engineering and design process to propose, construct, and, if appropriate, test a model/prototype. In some instances the prototype will act as a solution to a hypothetical or real world problem. This course fosters creativity and problem solving skills, and will emphasize connections to the local culture and other subject areas such as science, mathematics, history, art, and technology.</p> <p>*Depending on availability of materials and differences in student populations, substitutions of design challenges may be allowed.</p> <p>*Challenges can be adapted to align to specific themes or school-specific units of study.</p>

<p>Primary Materials</p>	<p>A variety of consumable and non-consumables will be required. Design challenges can be adapted to use available materials.</p> <p><u>Suggested Supply List:</u> Tape (painter, duct, clear packing, double sided, scotch), scissors, glue (Elmer's, wood, hot glue sticks, superglue), rulers/yardsticks, hot glue guns, paper (newspaper, craft paper, tag board), cardboard, poster board, cardboard tubes, foam pipe insulation, pool noodles, cotton balls/swabs, paper/plastic/foam plates, cups, and bowls, paper clips, alligator clips, magnets, brads, screws, bolts, yarn, netting, bubble wrap, string, fabric scraps, ribbon, felt, thread, balloons, straws, paper/plastic bags, wooden dowels, foam/wooden shapes, pipe cleaners, pom poms, googly eyes, rubber bands, craft sticks, Legos/wooden blocks, staples, washers, pulleys, empty jugs and/or bottles/bottle caps, wire, binder rings, foam sheets, tinfoil, saran wrap, wax paper, play dough, clay, paper circuit materials, plastic eggs, marbles, fishing line, skewers, safety pins, toothpicks, spaghetti noodles, marshmallows, paint, zip ties, PVC pipe, batteries.</p>
<p>Standards</p>	<p>Science: MS-ETS1-1 Define the criteria and constraints of a design problem... MS-ETS1-2 Evaluate competing design solutions... MS-ETS1-3 Analyze data from tests... MS-ETS1-4 Develop a model to generate data... HS-ETS1-2. Design a solution... HS-ETS1-3. Evaluate a solution... Math: G-CO.12. Make formal geometric constructions... G-MG.1. Use geometric shapes... G-MG.3. Apply geometric methods to solve design problems...</p>
<p>Assessment</p>	<p>Project Based Assessment: Students will be graded on fulfillment of the engineering and design process (including planning, construction, and reflection) rather than the product. Each stage of the challenge will be assessed using a rubric.</p>

Activities

Week 1	Intro to Engineering & Design process & simple introductory challenge. Suggested activity: Paper airplane design challenge.
Week 2	Flotation/Archimedes' Principle. Suggested Challenges: Build a Model raft/boat that will hold the most weight. Activities: Complete plan/blueprint, gather supplies, begin building.
Week 3	Continuation of raft or boat challenge. Finish construction, test, redesign, & reflect.
Week 4	Real World Issues. Using given materials, design a prototype that can be used to solve a problem in the real world. Suggested challenges: Snow shovel or robotic hand prototypes. Complete plan/blueprint & begin construction.
Week 5	Continuation of build challenge from previous week. Finish build, test, reflect, & redesign.
Week 6	Egg Drop - Given specific materials & a time constraint, design & build a structure to protect a raw egg from a fall
Week 7	Transportation/Propulsion. Suggested Challenges: Balloon Car; Mars Landing Rover; Egg Car Challenge; Rocket.
Week 8	Continuation of previous week's challenge. Build, test prototype (if applicable), reflect & redesign.
Week 9	Complete construction of final design improvements. Complete reflection pages & self-scoring rubric.
Week 10	Fabrication/Structural Integrity. Suggested Challenges: Paper Tower (using only paper and tape, build the highest structure you can); Rolled Newspaper (using what you know about geometric shapes, build a structure you can sit inside of); Ferris Wheel (construct a Ferris Wheel that spins on an axis), Bridge Building (using predetermined materials, build a bridge that can hold the most weight); Mini-Greenhouse Challenge (using [predetermined materials] build a structure that can be used to grow plants); Spaghetti Noodle/Marshmallow Structure (using predetermined materials, construct a structure such as a house or tower.
Week 11	Continuation of project from previous week. Begin structure assembly. Adjust design as necessary.
Week 12	Finish construction of previous challenge, including testing (if applicable). Complete reflection sheet & self evaluation rubric.

Week 13	Newton's Laws/Simple Machines <u>OR</u> Electricity. Suggested Challenges: Marble Run; Rube Goldberg Machine; Newton's Cradle; Roller Coaster Challenge;; Paper Circuit Challenge...
Week 14	Continuation of challenge from previous week. Begin project assembly. Introduce project for week 16 so students can begin researching, gathering supplies, & planning ideas.
Week 15	Finish construction of structural integrity challenge, including testing. Complete reflection sheet & self evaluation rubric. Complete planning sheet for final challenge.
Week 16	Repurposing. Suggested Challenge: Junk Sculptures (Tin Can Robots, Jug Totems); Upcycling