SCHOOL DISTRICT OF THE CHATHAMS
CURRICULUM PROFILE

CONTENT AREA(S): Design & Technology **GRADE LEVEL(S):** 9-12

COURSE: Intro. To Design & Innovation **TIME FRAME:** Half Year (2.5 Credits)

I. Course Overview

The Introduction to Design & Innovation course provides students with opportunities to apply knowledge and skills through hands-on, problem-solving learning experiences. Students apply the engineering design process and design principles while developing skills in the following areas: hand sketching, engineering and technical drawings, Computer Aided Drawing/Design (CAD), materials processing, and the design and fabrication of working prototypes and models. Students engage in an in-depth study and application of technological processes to solve real-world problems and challenges while learning how to use 2D CAD software, such as AutoCAD, which is used in the engineering and design industries. Furthermore, the course also develops students' ability to present their designs for testing, feedback and critique.

II. Units of Study

Unit 1: Safety *[will be reviewed and embedded within the units listed below, as most appropriate]*

- Overall Safety Expectations & Regulations
- Machine/Tool Safety Considerations, Parts, Safe Use, and Demonstration
    - Followed by written and hands-on assessments
    - Documentation of demonstration/lesson dates, as well as passing of written and hands-on assessment with notes (as well as any reassessments)
- Machines/Tools/Practices:
    - General Safety Practices
    - Eye Safety
    - Hot Glue Gun
    - X-Acto Knives
    - Drill Press
    - Bandsaw
    - Belt & Disc Sanders

Unit 2: Technology & Design

- Engineering Design Process and Problem-Solving Review
- Seven Resources of Technology & Design
- Systems Designing

Unit 3: Engineering Drawings & Computer Aided Drafting/Design (CAD) *[will be embedded within the Problem-Solving Design Challenges - Unit 4]*

- Orthographic Projection Theory
- 3rd Angle Drawings and Dimensioning
- Isometric and Oblique Drawings
- CAD Tools & Operations
    - Toolbar
    - Command Bar
    - Typing Functions

- Hotkeys
- Line Tool
- Erase Tool
- Trim Tool
- Copy Tool
- Move Tool
- Elliptical Arc Tool
- Layers
- Line Types

Unit 4: Problem-Solving Design Challenges

- Application of the Engineering Design Process/Design Principles
- Sketching & Engineering/Technical Drawing
- Modeling and Prototyping
- Testing, Evaluation & Redesign
- Potential Topics:
  - Bridges & Structures
    - *Tension*
    - *Compression*
    - *Racking*
    - *Shearing*
  - Transportation & Aerodynamics
    - *Air Flow*
    - *Resistance*
    - *Lift*
    - *Drag*

III. Essential Questions *(The open-ended, provocative questions that help frame inquiry)*

Unit 1: Safety

- Why is it important to comply with the rules, regulations, and procedures in a lab environment?
- Why is it important to pass tool and machine safety exams (both written and hands-on) with a score of 100%?

Unit 2: Technology & Design

- What is technology and design and what role do they play in the engineering design process?
- How can we create the best possible solution to a problem?
- What does one need to know in order to design a solution to a given problem?
- What are technological systems?

Unit 3: Engineering Drawings & Computer Aided Drafting/Design (CAD)

- What are the various ways in which ideas or thoughts can be conveyed to others?
- How can we clearly convey a design idea or possible solution to someone unfamiliar with the original problem or design?
- How is engineering drawing similar to and different from artistic drawing?

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- How does CAD assist with the modeling, manufacturing, and prototyping industry?
- How can assembly models (exploded and/or animated) of a proposed design be used in the design and problem solving process, as well as beyond the design and problem solving process?
- How does a designer or engineer decide what to include in a set of working drawings, what views are needed, and other additional information that may be important?

Unit 4: Problem-Solving Design Challenges

- How might we create the best possible solution to a problem?
- What does one need to know in order to design the solution to a problem?
- How do I apply knowledge of various tools/machines, materials, systems, and the engineering design process in the development of a solution and design?
- What role do models and prototypes play in the design and problem solving process?
- How do I use this feedback or data to revise my design?

IV. Learning Objectives

8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
8.2.12.A.1	Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.
8.2.12.A.2	Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.
8.2.12.B.4	Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants
8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.

8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
CRP4.	Communicate clearly and effectively and with reason.
CRP6.	Demonstrate creativity and innovation.
CRP8.	Utilize critical thinking to make sense of problems and persevere in solving them.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
9.3.12.AC-DES.1	Justify design solutions through the use of research documentation and analysis of data.
9.3.12.AC-DES.2	Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
9.3.12.AC-DES.6	Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
9.3.12.AC-DES.7	Employ appropriate representational media to communicate concepts and project design.
9.3.ST.3	Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-ET.3	Apply processes and concepts for the use of technological tools in STEM.
9.3.ST-ET.4	Apply the elements of the design process.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.

V. Instructional Materials

- Safety Resources & Exams
- Teacher created design briefs and rubrics
- Use of videos, DVD's, computer software, online resources, posters, and other audio-visual materials as appropriate

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- Computer Aided Design Software (AutoDesk Suite)
- Adobe Creative Cloud Suite
- G-Suite for Education (Google Docs, Sheets, Slides, etc.)

VI. Key Performance and Benchmark Tasks

- Safety demonstration & assessments.
- Communicate through the use of engineering drawings and sketching.
- Develop 2D drawings.
- Properly place dimensions for orthographic views.
- Draw and design objects in isometric and oblique views
- Use section planes and hatch patterns when drawing auxiliary views from isometric and orthographic views.
- Utilize CAD software to design solutions to problems.
- Utilize CAD software to develop professional drawings that adhere to engineering principles and design formats.
- Analyze a product's visual and functional characteristics.
- Develop an understanding of resources, processes, and products and their relationship within the technological environment.
- Develop a student's creative problem solving techniques to solve real world problems.
- Use educational technology as a bridge to an interdisciplinary approach to learning.
- Develop communication skills by identifying and solving problems as well as presenting documented solutions.

Student Outcomes and Methods of Assessment:

- Design Challenges/Projects
- Exams & Hands-On Assessments
- Sketches and Engineering Drawings
- Digital Portfolio