Winthrop High School

Science Technology Engineering Art Mathematics - STEAM Syllabus

Course Overview

STEAM is a course that integrates components of **S**cience & **T**echnology through **E**ngineering and **A**rtistic design all based in **M**athematical elements. Students will learn and then apply technology skills to solve problems, communicate with others, locate information, teach, entertain and inspire. The contextual curriculum coordinates each subject area to support one another in a formal educational structure. The STEAM curriculum is a standard based NGSS curriculum with a focus on science and engineering practices and core concepts in science education as well as an introduction to computer science. The curriculum will be delivered through several curriculum offerings including but not limited to CS First by Google Education, Genius Hour and FUSE, an interest-driven learning experience developed at Northwestern University and through a two year grant with the Winthrop Public Schools.

Materials

Chromebook
Headphones
2 Pocket Folder
Pen/Pencil/ Highlighters/ Sharpies
Composition Notebook
Expo Markers

Accounts needed to set-up for use in the class

FUSE Account
Google CS First Account
Genius Hour Account
Schoology (Set-up using Winthrop Public School e-mail)

Curriculum Content Map

Course Structure

Content	Description	Honors	College Prep
FUSE	FUSE challenges, the learning activities of the program, are designed to introduce STEAM concepts and skills in a engaging and enjoyable way. Students choose the challenges they want to work on and progress at their own pace, working alone or with others. Challenges are based in STEAM topics likes 3D design and printing, robotics, architecture, music mixing, animation and more.	X	X
Coding	Coding weeks are intended to introduce students to coding and fun projects/ websites devoted to teaching	X	X

	various forms of coding in a student driven learning environment.		
Genius Hour	The objective of this time will be for students to develop a project over the course of the year on any topic of their choosing. Genius hour is a movement that allows students to explore their own passions and encourages creativity in the classroom. It provides students a choice in what they learn during a set period of time during school.	X	X
Weekly Reading and Writing Assignment	Each week you will have to read/watch/listen to a science text (video, article, audio file). Some weeks the article will be assigned to you. Other weeks, you will have the opportunity to find an article that interests you. Each visual assignment will be accompanied with a writing assignment.	X	
Science Research or Engineering Design Project	Curriculum is provided by the Google Education - Science Fair. The objective of the STEAM project is to find a scientific question or engineering problem you are interested in and conduct an independent research project to answer the question or solve the problem. Students will utilize the Google Education - Science Fair Curriculum to organize their project. Each STEAM project will be presented at a school wide STEAM Project Expo in January. The top 5 projects will be chosen to represent Winthrop at the Massachusetts State Region IV Science Fair at Somerville High School in March.	X	
STEAM Project and Exploration	Each quarter students will participate in a STEAM project and or exploration. The objective of the Project and or exploration will be to expose students to different STEAM topics and experiences.	X	X
Portfolio Website	Students will create a Portfolio Google Site as a formal assessment of their work in the STEAM course.	X	X

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FUSE Challenges

Your work in this course will center around a set of leveled challenges designed by the FUSE program. The challenges have been organized in the following groups. Each semester will have FUSE cycles. During the cycle you will have 2 weeks to work on projects in one challenge group. When the cycle ends you will move on to the next challenge group.

Challenge Groups	Scale	Energy	Cause and Effect	Structure
Driving Question	How does real-world scale, proportion and quantity play a role in designing your digital and physical artifacts?	How does the conservation of energy play a role designing solutions to your challenges?	How did the cause and effect of your design choices impact your final solution?	How did the structure of your designs impact their real-world function?
Challenges	3D You	Coaster Boss	Ringtones	Eye Candy
	Dream Home	Electric Apparel	Game Designer	Just Bead It
	Dream Home 2	LED Color Lights	Get in the Game	Selfie Stickers
	Jewelry Designer	Music Amplifier	How to Train Your Robot	Spaghetti Structures
	Keychain Customizer	Party Lights	Mini Me Animation	Laser Defender
	Print my Ride	Solar Roller	Wind Commander	

Challenge Completion Requirements

Within each challenge group you must meet one of the following requirements per quarter:

- Depth: Complete all levels in two challenges.
- Breadth: Complete all levels in one challenge and the first level in three other challenges.

Coding

Google Education - CS First Club is a free web-based program that exposes students to computer science through video tutorials and modules that students participate in as after-school, in-school and summer programs. Designed as an introduction to computer science, the clubs teach students about computer science and coding in a hands-on, learning-by-doing way.

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Scratch is a visual programming language and online community targeted primarily at children. Using Scratch, users can create online projects and develop them into almost anything by using a simple block-like interface. Scratch is often used in teaching coding, computer science, and computational thinking.

Code Avengers is an interactive learning platform where you can learn cool things like programming, game development, web and app development, computer science and more.

Codemoji uses emojis as the on ramp to coding. While enjoying the learning process, the codemoji platform is able to give, even the youngest students, a high level of understanding of **HTML** ,**CSS** and **Javascript**.

Code.org is a non-profit organization and eponymous website led by Hadi Partovi that aims to encourage people, particularly school students in the United States, to learn computer science.

Codecademy is an online interactive platform that offers free coding classes in 12 different programming languages including Python, Java, JavaScript (jQuery, AngularJS, React.js), Ruby, SQL, and Sass, as well as markup languages HTML and CSS.

STEAM Project and Exploration

Q1 STEAM Career Exploration Project

Q2 Novartis Biotechnology Unit and Field trip to the Community Exploration Learning Lab (CELL) in Cambridge - An Exploration of Genotype and Clinical Trial Decisions

Q3 STEAM Project

Q4 Crystal Technologies of Today and Tomorrow - Engineering Design project; Growing Crystals of Alum with accomaning Crystal Baby Book formal assessment.

Midterm Project **Create an Infomercial to "Sell your favorite FUSE Challenge"**

Final Project **Design your own FUSE Challenge Level**

Pacing

Each Quarter

Timing	Content
2 wks	FUSE Challenge Rotation
1 wk	Coding
2 wks	FUSE Rotation
1 wk	Genius Hour
2 wks	STEAM Project and Exploration

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Grading Information

STEAM is offered in an open honors class environment. An open honors course offers students the choice to take the science elective for CP or Honors level credit towards their GPA calculation. The following table outlines expectations for each curriculum level within course.

Honors - Quarter Grades

Category	Weight
Individual Learning: Weekly reading and writing assignment. Science Research or Engineering Design Project	**20%**
Project-Based Learning: FUSE challenge completion Coding Modules Genius Hour Work STEAM Project and Exploration	**60%**
Work Habit:	**10%**
Formal Assessments: Portfolio Google Website	**10%**

College Prep - Quarter Grades

Category	Weight
Project-Based Learning: FUSE challenge completion Coding Modules Genius Hour Work STEAM Project and Exploration	**75%**
Work Habit:	**15%**
Formal Assessments: Portfolio Google Website	**10%**

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NGSS and Common Core Standards Alignment

KEY of NGSS Terms

CCC Cross Cutting Concepts

DCI Disciplinary Core Ideas

SEPs Science Engineering Practices

Genius Hour

Integration of Knowledge and Ideas

CCSS.ELA-Literacy.CCRA.R.7 Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

CCSS.ELA-Literacy.CCRA.R.10 Read and comprehend complex literary and informational texts independently and proficiently.

Research to Build and Present Knowledge

CCSS.ELA-Literacy.WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

CCSS.ELA-Literacy.WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

CCSS.ELA-Literacy.WHST.6-8.9 Draw evidence from informational texts to support analysis reflection, and research.

Range of Writing

CCSS.ELA-Literacy.WHST.6-8.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Science and Technical Subjects

CCSS.ELA-Literacy.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

CCSS.ELA-Literacy.RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks.

Standards for Mathematical Practice

CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.

CCSS.Math.Practice.MP4 Model with mathematics.

NGSS Alignment

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Students participating in a Genius Hour Project independently work on all eight practices of science and engineering that the NGSS framework identifies as essential for all students to learn:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

FUSE

Challenge Alignment to NGSS Standards:

Challenge Name	Description	CCC	DCI	SEPs
3D You	Use 3D scanner and 3D design software to create models of your head.	Scale, proportion, and quantity	PS4	• Developing and using models • Analyzing and interpreting data
Coaster Boss	Design a roller coaster that can meet various design goals given material and space constraints.	Energy and matter	PS2	• Defining problems • Analyzing and interpreting data • Designing solutions
Dream Home	Design a home using 3D design software that meets various design goals given space constraints.	Scale, proportion, and quantity	ETS1	• Using mathematics and computational thinking • Designing solutions
Dream Home 2	Design a home for a client using 3D design software that balances the competing needs of your clients and space	Scale, proportion, and quantity	ETS1	• Defining problems • Using mathematics and computational thinking • Designing solutions
Electric Apparel	Use e-textile components to design wearable circuits and modify a garment to be interactive and light up.	Energy and matter	PS4	• Developing and using models • Designing solutions • Planning and carrying out investigations

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Eye Candy	Design a pair of eyeglasses frames that can be printed out on a 3D printer.	Structure and function	ETS1	● Developing and using models ● Designing solutions ● Using mathematics and computational thinking
Game Designer	Use a powerful game design software to fix a broken game and create your own levels that meet various design goals.	Cause and effect	ETS2	● Defining problems ● Using mathematics and computational thinking
Get in the Game	Use a Makey Makey to design and build embodied controllers for online games.	Cause and effect	ETS1	● Defining problems ● Developing and using models ● Designing solutions
How to Train Your Robot	Use block based coding to program a robot to complete various goals.	Cause and effect	ETS2	● Defining problems ● Analyzing and interpreting data ● Using mathematics and computational thinking
Jewelry Designer	Use 3d design software to design your own jewelry and print them out on a 3D printer.	Scale, proportion, and quantity	ETS1	● Developing and using models ● Designing solutions ● Using mathematics and computational thinking
Just Bead It	Create gel beads using the same technique scientists use to grow human cells.	Structure and function	LS1	● Planning and carrying out investigations ● Designing solutions
Keychain Customizer	Use 3D design software to create custom keychain designs that can be printed out on a 3D printer	Scale, proportion, and quantity	ETS1	● Developing and using models ● Designing solutions ● Using mathematics and computational thinking
Laser Defender	Use mirrors and a laser pointer to create a laser defense grid.	Structure and function	PS4	● Developing and using models ● Designing solutions ● Analyzing and interpreting data
LED Color Lights	Build a circuit capable of lighting up three LED's.	Energy and matter	PS3	● Developing and using models ● Designing solutions
MiniMe Animation	Use 3D animation	Cause and	ETS2	● Developing and using

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	software to bring a CGI figure to life and meet various design goals.	effect		models ● Using mathematics and computational thinking
Music Amplifier	Using electrical components to build a circuit capable of playing music from your phone.	Energy and matter	PS4	● Developing and using models ● Designing solutions
Party Lights	Use a programmable micro-controller to build and control a light display.	Energy and matter	PS3	● Developing and using models ● Designing solutions ● Using mathematics and computational thinking
Print my Ride	Use 3D design software to build a model of your favorite car that can be 3D printed.	Scale, proportion, and quantity	ETS1	● Developing and using models ● Designing solutions ● Using mathematics and computational thinking
Ringtones	Use a music mixing software to create your own custom tracks.	Cause and effect	ETS2	● Developing and using models ● Using mathematics and computational thinking
Spaghetti Structures	Use spaghetti and marshmallows to build a tower that can pass various tests.	Structure and function	PS2	● Planning and carrying out investigations ● Designing solutions
Selfie Sticker	Use 2D design software and a vinyl cutter to create custom multi-layer vinyl stickers.	Structure and function	ETS2	● Developing and using models ● Designing solutions
Solar Roller	Design and engineer a solar powered car to meet various design goals.	Energy and matter	PS3	● Planning and carrying out investigations ● Analyzing and interpreting data ● Designing solutions
Wind Commander	Design and engineer a wind turbine to achieve various design goals.	Cause and effect	PS2	● Planning and carrying out investigations ● Analyzing and interpreting data ● Designing solutions