

# STEAM Shop 2

## COURSE OUTLINE - UC

### **DESCRIPTION:**

STEAM = Science & Technology interpreted through Engineering & the Arts, all based in Mathematical elements.

STEAM Shop 2 will build on the fundamentals of the product design process, used by designers, engineers, manufacturers, and inventors to address opportunities, meet needs, or develop solutions to problems. Emphasis in this course will be placed on “the business of innovation,” as students will tie entrepreneurship to the design process in various projects across all industry sectors. Students will work on projects that involve designing, building, and testing products, repeating steps, and making product improvements along the way. Students will follow the design process to strengthen their understanding of open-ended design and emphasize creativity and problem solving. Activities will challenge and support the critical thinking, communication, collaboration, and creativity skills required of the 21st Century learner. Activities in this course include work-based learning that connects students to industry and the local community.

### **INFORMATION:**

PRE-REQUISITE:	STEAM Shop 1
LENGTH:	One Year
SECTOR:	Manufacturing and Product Development
PATHWAY:	Product Innovation and Design
ARTICULATED:	Yes
UC A-G APPROVAL:	Yes: College-Preparatory Elective (G) – Interdisciplinary Requirement

### **O\*NET SOC CODES:**

17-2112.00	Industrial Engineering
17-2199.04	Manufacturing Engineers
17-3026.00	Industrial Engineering Technicians
17-3029.06	Manufacturing Engineering Technologists

<b>Orientation</b>
<ul style="list-style-type: none"> <li>A. Introduce the course and facilities.</li> <li>B. Discuss the syllabus and major objectives.</li> <li>C. Explain applicable classroom management procedures, the ROP Student Rules of Conduct, and any operational guidelines.</li> <li>D. Review instructor/student expectations.</li> <li>E. Explain enrollment and attendance requirements and procedures.</li> <li>F. Review grading and student evaluation procedures.</li> <li>G. Discuss the community classroom aspect of the program if applicable.</li> <li>H. Discuss the “next steps” related to additional education, training, and employment.</li> <li>I. Review classroom safety, emergency and disaster procedures.</li> </ul>
<b>1. Communication Skills</b>
<ul style="list-style-type: none"> <li>A. Demonstrate positive verbal communication skills using appropriate vocabulary, demeanor, and vocal tone in the classroom and/or worksite.</li> <li>B. Read and interpret written information and directions.</li> <li>C. Practice various forms of written communication appropriate to the occupation.</li> <li>D. Practice positive body language skills.</li> <li>E. Practice professional verbal skills for resolving a conflict.</li> <li>F. Demonstrate active listening skills including techniques for checking for understanding, and for obtaining clarification of directions.</li> </ul>
<b>2. Interpersonal Skills</b>
<ul style="list-style-type: none"> <li>A. Demonstrate positive teamwork skills by contributing to a group effort.</li> <li>B. Practice the importance of diversity awareness and sensitivity in the workplace.</li> <li>C. Define sexual harassment in the workplace and identify the employee’s role and responsibility.</li> <li>D. Practice participation skills.</li> <li>E. Identify different personality types and strategies for working effectively with each type.</li> <li>F. Practice business and social etiquette skills appropriate to the occupation.</li> <li>G. Discuss the role of business and personal ethics in the decision-making process.</li> <li>H. Evaluate various job-related scenarios and justify decisions based on ethics.</li> <li>I. Demonstrate flexibility and adaptability in working with others.</li> <li>J. Demonstrate the use of time management skills.</li> </ul>

**3. Employability Skills**

- A. Demonstrate appropriate attendance and punctuality practices for the classroom and worksite if applicable.
- B. Prepare a resume, cover letter, and job application forms.
- C. Demonstrate interviewing techniques using appropriate tone and body language.
- D. Demonstrate appropriate dress and grooming standards in seeking employment and for the workplace.
- E. Identify strategies for employment retention.
- F. Analyze the impact of social networking on employability.
- G. Identify the need for continuing education, professional development, and professional growth in chosen field.
- H. Identify appropriate procedures for leaving a job.
- I. Identify sources of job information, including electronic sources.
- J. Review company policies and current trends in employee compatibility screening, drug screening, and background checks.

**4. Leadership**

- A. Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
- B. Work with peers to promote divergent and creative perspectives.
- C. Demonstrate how to organize and structure work, individually and in teams, for effective performance and the attainment of goals.
- D. Explain multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
- E. Employ ethical behaviors and actions that positively influence others.
- F. Use a variety of means to positively impact the direction and actions of a team or organization.
- G. Analyze the short-term and long-term effects a leader's actions and attitudes can have on productivity, morale, and organizational culture.

**5. Personal and Occupational Safety**

- A. Demonstrate procedures to be followed in the case of emergencies.
- B. Discuss ways to report a potential safety hazard to a supervisor.
- C. Identify and discuss cyber ethics, cyber safety, and cyber security.
- D. Apply personal safety practices to and from the job.
- E. Describe the procedure for reporting a work-related hazard or injury.
- F. Recognize the effects of substance abuse in the workplace.

<b>6. The Business of Innovation</b>
<ul style="list-style-type: none"> <li>A. Identify and research both modern and historical innovators.</li> <li>B. Define entrepreneurship and identify common characteristics of successful entrepreneurs.</li> <li>C. Define social entrepreneurship and analyze current real-world examples.</li> <li>D. Define market demand and explain how it influences product development.</li> <li>E. Demonstrate how to collect data and use it to interpret customer needs.</li> <li>F. Identify ways to market products to different types of customers.</li> </ul>
<b>7. Researching and Defining the Problem</b>
<ul style="list-style-type: none"> <li>A. Explain and identify the scientific method.</li> <li>B. Gather and organize relevant information to identify and define an area of opportunity, need, or problem that can be resolved through design.</li> <li>C. Identify what a product/service/system is meant to do.</li> <li>D. Identify who a product/service/system is meant to serve.</li> <li>E. Identify why it is important to address an opportunity, meet a need, or solve a problem.</li> <li>F. Identify the short- and long-term effects of missing an opportunity, not addressing a need, or not solving a problem.</li> <li>G. Identify the cause of the opportunity, need or problem.</li> <li>H. Identify the required characteristics of the product/service/system.</li> <li>I. Analyze the barriers that might prevent the product/service/system from meeting the designer's goal.</li> </ul>
<b>8. Developing Design Concepts and Selecting Solutions</b>
<ul style="list-style-type: none"> <li>A. Apply ideation techniques when collaborating with team members to explore and produce multiple design concepts.</li> <li>B. Identify tools used to assist in the decision-making process (e.g., Pugh Matrix, PMI, Pros and Cons).</li> <li>C. Debate the merit of each concept to refine ideas.</li> <li>D. Edit concepts by identifying key ideas that address an opportunity, meet a need, or solve a problem.</li> <li>E. Assess the impact (short and long-term) of possible design solutions on multiple stakeholders.</li> <li>F. Identify materials, mechanisms, technologies, and other requirements the concepts may require.</li> <li>G. Synthesize information and experiment with non-traditional and innovative design solutions.</li> <li>H. Analyze and assess the strengths and weaknesses in the design, function, ergonomics, features, and benefits.</li> <li>I. Recognize the safety issues related to the reliability, functionality, and use of proposed concepts.</li> <li>J. Identify possible resolutions for improvement.</li> </ul>

<b>9. Constructing a Prototype</b>
<ul style="list-style-type: none"> <li>A. Build a looks-like, works-like prototype using the appropriate techniques or technologies.</li> <li>B. Assess the outcome of the prototype.</li> <li>C. Analyze any issues that need redesigning or refining.</li> <li>D. Resolve and/or redesign issues with a prototype.</li> <li>E. Design multiple iterations, if applicable.</li> </ul>
<b>10. Testing and Evaluating Solutions</b>
<ul style="list-style-type: none"> <li>A. Create performance criteria and a quality standard to measure and evaluate the prototype.</li> <li>B. Test the features of the prototype against the performance criteria.</li> <li>C. Evaluate the results of the prototype testing to determine if it meets the requirements and objectives.</li> <li>D. Identify any redesigning or additional corrections required to improve the overall quality, look, and performance of the prototype.</li> <li>E. Determine if multiple iterations are required.</li> </ul>
<b>11. Communicating Results</b>
<ul style="list-style-type: none"> <li>A. Create a presentation of the design solution that effectively communicates its success or failure to select audiences.</li> <li>B. Develop and utilize technical vocabulary to describe and explain design processes.</li> <li>C. Produce electronic media to promote/market the design solution.</li> <li>D. Provide analysis in all relevant mediums (i.e. cost, schedule, materials).</li> </ul>
<b>12. Portfolio Design</b>
<ul style="list-style-type: none"> <li>A. Develop personal marketing and computer skills by refining your digital portfolio for post-secondary and employment acceptance.</li> <li>B. Compile best samples of original works and documents for a variety of purposes, which shows a progression in the acquisition of knowledge and/or skills.</li> <li>C. Demonstrate knowledge of competencies through journaling or summary of selected works or documents.</li> <li>D. Revise professional resume and cover letter to align with skills and objective statements of the relevant industry.</li> <li>E. Dress professionally and practice interviewing techniques using portfolio materials.</li> <li>F. Assemble industry and employability documents (resume, cover letter, certifications, recommendation letters, etc.).</li> <li>G. Create a “leave behind” book or folder.</li> <li>H. Display portfolio materials during a fair, community event, competition, or professional panel review.</li> <li>I. Evaluate and utilize feedback to improve portfolio.</li> </ul>

## Key Assignments

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
1. Students will participate in mock interviews that represent current industry practices (e.g., skills demonstrations, resumes, applications, portfolios, personal websites, etc.).	1A, B, D 3B, C, D, I, J 12A-I	2 3	2 3		LS 11-12.6 SLS 11-12.2
2. Using the design process, students will create a product to address a safety or quality of life issue for the elderly. Based on market research, students will design and build a prototype, testing it appropriately to ensure it meets the desired design goal(s). Students will assess the success and failures of the prototype, making necessary alterations to improve design and function. Students will present their product, articulating the impact their concept could have on the quality of life of their target market, the benefits their product would have on the community, and the money making potential the concept might have. Students will produce an advertisement to promote the product appropriately to the target market, presenting to the class why the elements of the advertisement would appeal to their target market.  Example: "Give Me a Hand" <a href="https://drive.google.com/drive/folders/0Bzm8D1yH2vdZR2o2VVI6MS1qcVk">https://drive.google.com/drive/folders/0Bzm8D1yH2vdZR2o2VVI6MS1qcVk</a>	1A, C 2A, D, J 4C, F 6D-F 7B-E, G-I 8A-I 9A-E 10A-E 11A-C	2 5 9 10	2 4 5 6 9 10	D2.0 D3.0 D6.0 D7.0 D8.0 D10.0	HS-ESS3-4 HS-ETS1-2 S-IC 6 WHSST 11-12.7 SLS 11-12.2
3. Using the design process, student teams will create a product for an infant or child's room that represents a popular piece of children's literature. Students will design and build a prototype, testing it appropriately to ensure it meets the desired design goal(s). Students will assess the success and failures of the prototype, making necessary alterations to improve design and function. Students will present their product, articulating how the piece of literature influenced the design and concept of the product. They will identify the product's price, where it would be sold, and develop a promotional campaign for the product directed to the appropriate audience.	1A, C 2A, D, J 4B, C, F 6D-F 7B-I 8A-I 9A-E 10A-E	2 5 9 10	2 4 5 9 10	D2.0 D3.0 D6.0 D7.0 D8.0 D10.0	HS-ESS3-4 HS-ETS1-2 S-IC 6 WHSST 11-12.7 SLS 11-12.2

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
Example: "The Three Little Bears" <a href="https://www.youtube.com/watch?v=ttwC9Cn-Nkw">https://www.youtube.com/watch?v=ttwC9Cn-Nkw</a>	11A-D				
4. Students will research the impact of natural disasters on communities. Students will seek to identify one specific need that communities have difficulty meeting during those events, and will create a product that can meet that need. Students will design and build a prototype, testing it appropriately to ensure it meets the desired design goal(s). Students will assess the success and failures of the prototype, making necessary alterations to improve design and function. Students will develop and implement a sales presentation to a hypothetical local government agency, providing written reports and data to substantiate their claims.  Example: "Water Filtration Challenge" <a href="https://www.jpl.nasa.gov/edu/teach/activity/water-filtration-challenge/">https://www.jpl.nasa.gov/edu/teach/activity/water-filtration-challenge/</a>	1A-D 2A, D, J 4B, C, F 6C-F 7B-I 8A-I 9A-E 10A-E 11A-D	1 2 5 9 10 11 12	2 4 5 7 9 10	D2.0 D3.0 D6.0 D7.0 D8.0 D10.0	HS-ESS3-4 HS-ETS1-2 S-IC 6 WHSST 11-12.7 SLS 11-12.2
5. Using the design process, student teams will create a fashion or home product that can serve more than one purpose. Students will design and build a prototype, testing it appropriately to ensure it meets the desired design goal(s). Students will assess the success and failures of the prototype, making necessary alterations to improve design and function. Students will identify the target audience that would most likely purchase the product, and write a comprehensive promotional plan appropriate to that audience.  Example: "The EMPWR Coat" <a href="http://www.empowermentplan.org/">http://www.empowermentplan.org/</a>	1C 2A, D, J 4B, C, F 6D-F 7B-I 8A-I 9A-E 10A-E 11A-D	2 5 9 10 11	2 4 5 9 10	D2.0 D3.0 D6.0 D7.0 D8.0 D10.0	HS-ESS3-4 HS-ETS1-2 S-IC 6 WHSST 11-12.7 SLS 11-12.2
6. Using the design process, student teams will create a product to fill a particular health care need in a third world country. The products	1A, C, D 2A, D, J	1 2	2 4	D2.0 D3.0	HS-ESS3-4 HS-ETS1-2

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
<p>being developed would not be sold, but donated as part of a humanitarian effort. Based on research, students will write a product proposal, design and build a prototype, assess the success and failures of the prototype, and make alterations to improve design and function. Students will write a basic business plan and develop a sales presentation to secure funding for the product's production and distribution. Students will present their proposal and product, articulating the impact their product could have on the health of third-world citizens.</p> <p>Example: "Embrace Baby Warmer"  <a href="https://www.gsb.stanford.edu/insights/sarah-soule-how-design-thinking-can-help-social-entrepreneurs">https://www.gsb.stanford.edu/insights/sarah-soule-how-design-thinking-can-help-social-entrepreneurs</a></p>	4B, C, E, F 6C-F 7B-I 8A-I 9A-E 10A-E 11A-D	5 9 10 11 12	5 6 8 9 10	D6.0 D7.0 D8.0 D10.0	S-IC 6 WHSST 11-12.7 SLS 11-12.2
<p>7. Students will create a booth and appropriate marketing materials to present one of their products to the school/community at a STEAM/Makers fair.</p>	1A, D 2A, D, F, J 4C 6F 11A-D	2 5 9 10	2 4 5 9	D2.0 D3.0 D10.0	LS 11-12.6 SLS 11-12.2



Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
<p>8. UC HONORS PROJECT:</p> <p>Students will create an e-portfolio highlighting their work for prospective financiers/employers/educational institutions. This electronic online learning record will help students develop the self-awareness required of entrepreneurs in the fields of engineering, manufacturing, and design as they reflect on the business of innovation and the role small business plays in the local and global economy. It will be a collection of reflections, work samples, and extended learning experiences that best illustrate the student's preparedness for further education and employment. The online portfolios will be reviewed and scored at the end of the course, and will include:</p> <ul style="list-style-type: none"> <li>• Cover page</li> <li>• Letter of introduction</li> <li>• Table of contents</li> <li>• Resume</li> <li>• Work samples (video demonstrations of skills)               <ul style="list-style-type: none"> <li>○ Product presentations</li> <li>○ Promotional campaign(s)/plan(s)</li> <li>○ Sales pitches</li> <li>○ Business plan</li> <li>○ Maker Fair participation</li> </ul> </li> </ul>	1A, C, D 2F, G 3B-D 4B, C 6B-F 7B-I 8A-I 9A-E 10A-E 11A-D	2 8 10 12	2.0 4.0 9.0	D8.0 D10.0	LS 11-12.6 SLS 11-12.2 WHSST 11-12.7

## Standards Assessed in this Program

### Career Ready Practices

1. Apply appropriate technical skills and academic knowledge.
2. Communicate clearly, effectively, and with reason.
3. Develop an education and career plan aligned to personal goals.
4. Apply technology to enhance productivity.
5. Utilize critical thinking to make sense of problems and persevere in solving them.
6. Practice personal health and understand financial well-being.
7. Act as a responsible citizen in the workplace and the community.
8. Model integrity, ethical leadership, and effective management.
9. Work productively in teams while integrating cultural/global competence.
10. Demonstrate creativity and innovation.
11. Employ valid and reliable research strategies.
12. Understand the environmental, social, and economic impacts of decisions.

### Anchor Standards

#### 2.0 Communications

- Acquire and use accurately sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

#### 3.0 Career Planning and Management

- Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

#### 4.0 Technology

- Use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the sector workplace environment.

#### 5.0 Problem Solving and Critical Thinking

- Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

#### 6.0 Health and Safety

- Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the sector workplace environment.

#### 7.0 Responsibility and Flexibility

- Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the sector workplace environment and community settings.

#### 8.0 Ethics and Legal Responsibilities

- Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

## 9.0 Leadership and Teamwork

- Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution.

## 10.0 Technical Knowledge and Skills

- Apply essential technical knowledge and skills common to all pathways in the sector following procedures when carrying out experiments or performing technical tasks.

## Pathway Standards

### Manufacturing and Product Development – Product Innovation and Design Pathway

**D2.0** Understand and apply research methodologies as a means to identify a need, problem, or opportunity for a new product, product line, system design, or service.

**D3.0** Understand and apply various ideation techniques to develop ideas and concepts.

**D6.0** Produce a prototype of a product.

**D7.0** Evaluate the prototype to determine if it meets the requirements and objectives.

**D8.0** Understand and apply basic business and entrepreneurial principles and identify potential markets and/or other business opportunities for distribution of the product.

**D10.0** Produce a presentation of the product, product line, system design, or service.

## Common Core State Standards

### ENGLISH LANGUAGE ARTS

#### Language Standards

**LS 11-12.6:** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the (career and college) readiness level, demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

#### Speaking and Listening Standards

**SLS 11-12.2:** Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make

informed decisions, and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

## **Writing Standards**

**WHSST 11-12.7:** Conduct short as well as more sustained research projects to answer a question (including self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

## **MATHEMATICS**

**S-IC** Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

**6.** Evaluate reports based on data.

## **SCIENCE**

**HS-ESS3-4** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

**HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.