

 

Statewide Framework Document for: 151302

CAD/CADD

Standards may be added to this document prior to submission but may not be removed from the framework to meet state credit equivalency requirements. Performance assessments may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. This course is eligible for 1.0 ART credit.

The Arts learning standards describe what students should know and be able to do in the arts. The final and approved Arts Learning Standards are now available for use and implementation. The standards include five disciplines: dance, media arts, music, theater, and visual arts.

The standards are arranged under four artistic processes for each discipline: creating, performing/presenting/producing, responding, and connecting. Each standard also contains suggestions and examples of tasks students can perform to demonstrate proficiency.

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| School District Name |
| Course Title: CADD/ART | Total Framework Hours: 180 |
| CIP Code: 151302 | ☒ Exploratory ☐ Preparatory  | Date Last Modified: March 22, 2023 |
| Career Cluster: Architecture & Construction (2) | Cluster Pathway: Design/Pre-Construction  |
| Course Summary: A course that prepares individuals to apply technical skills and advanced computer software and hardware to the creation of graphic representations and simulations in support of engineering projects. Includes instruction in engineering graphics, two-dimensional and three-dimensional engineering design, solids modeling, engineering animation, computer-aided drafting (CAD), computer-aided design (CADD), and techniques. |
| Eligible for Equivalent Credit in: Visual Arts | Total Number of Units: 6 |
| Course Resources: <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17761.wba>

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| Unit | Hours |
| 1. Safety in CADD Lab
 | 5 |
| 1. Career Research and Development
 | 10 |
| 1. Basic CAD Skills
 | 40 |
| 1. 2D Design
 | 40 |
| 1. 3D Design & Realistic Modeling/Rendering
 | 50 |
| 1. Capstone Art/CAD + Classroom-Based Assessment (CBA)
 | 35 |
|  | 180 |

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| Unit 1: Safety in CADD Lab | Total Learning Hours for Unit: 5 |
| Unit Summary:The safe use of the CADD Lab equipment is essential to the successful completion of projects. This includes safety, use, and storage of light hand tools,laser cutter, vinyl cutter, CNC Machine, and 3D printer.  |
| Performance Assessments: (Districts to complete for each unit)Example assessments for this unit include:* Students demonstrate understanding of computer usage and ergonomics through a teacher assessment.
* Students pass a shop specific assessment with proficiency, including basic hand tool, 3D Printer, Laser, UV/Vinyl Printer safety.
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| Leadership Alignment: (Districts to complete for each unit)Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills. Example: * Students demonstrate safe use of CADD Lab equipment.
* Students demonstrate an ability to work with a variety of technologies, identify or solve problems with equipment, including computers and other technologies. Students can select equipment and tools, apply technology to specific tasks, and maintain and troubleshoot equipment.

21st Century Skills:  2.A Reason Effectively 6.A Apply Technology Effectively 9.A Interact Effectively with Others 10.A Manage Products12.D Health Literacy |
| Industry Standards and/or Competencies:Engineering Principles 11 – Students will follow safety practices |
| Aligned Washington State Academic Standards |
| Arts | Visual ArtsAnchor Standard 2: Proficient: Organize and develop artistic ideas and work. VA:Cr2.2.I a. Explain how traditional and non-traditional materials may impact human health and the environment and demonstrate safe handling of materials, tools, and equipment.VA:Cr2.2.II a. Demonstrate awareness of ethical implications of making and distributing creative work |

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| Unit 2: Career Research and Development | Total Learning Hours for Unit: 10 |
| Unit Summary: Students will research and analyze career paths and employment opportunities within the Computer Aided Drafting (CAD) and Design fields. This includes researching and creating documents that reflect the skills and knowledge needed for employment in the industry. |
| Performance Assessments: (Districts to complete for each unit)Example assessments for this unit include:* Students research and present different careers related to architecture, engineering or Computer Aided Drafting and Design (CAD). Students may create an artistic rendering of a significant work in those career fields.
* Students evaluate the differences in career paths for architecture/engineering/design. Through a digital timeline (flowchart), a student will establish a career path in that chosen field that will assess personal strengths for success in that particular field.
* Students write a cover letter, resume, and thank you letter to a potential employer in the CAD or architecture/engineering design field.
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| Leadership Alignment: (Districts to complete for each unit)Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills. Example: * Students will work in groups to research career paths for CAD/ architecture/engineering/design

21st Century Skills:8.A.2 Balance tactical (short-term) and strategic (long-term) goals9.A.1 Know when it is appropriate to listen and when to speak9.A.2 Conduct themselves in a respectable, professional manner10.A.1 Set and meet goals, even in the face of obstacles and competing pressures10.A.2 Prioritize, plan and manage work to achieve the intended result10.B.1. Manage time and projects effectively |
| Industry Standards and/or Competencies:Engineering Principles 12 – Students will investigate career opportunities within the world of Engineering4 – Students will identify the qualities of successful engineering design, recognize its role in society, and develop projects using an engineering design processObjective 4 – Recall education requirements for professional success as a designer/engineer. |
| Aligned Washington State Academic Standards |
| Arts | Visual ArtsAnchor Standard 1: Generate and conceptualize artistic ideas and work. VA:Cr1.2.III a. Choose from a range of materials and methods of traditional and contemporary artistic practices, following or breaking established conventions, to plan the making of multiple works of art and design based on a theme, idea, or concept.Anchor Standard 2: Organize and develop artistic ideas and work. (VA:Cr2.2.II): a. Demonstrate awareness of ethical implications of making and distributing creative work.Anchor Standard 10: Synthesize and relate knowledge and personal experiences to make art. (VA:Cn10.1.I): a. Document the process of developing ideas from early stages to fully elaborated ideaAnchor Standard 11: Relate artistic ideas and works with societal, cultural, and historical context to deepen understanding. (VA:Cn11.1.I): a. Describe how knowledge of culture, traditions, and history may influence personal responses to art. |

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| Unit 3: Basic CAD Skills | Total Learning Hours for Unit: 40 |
| Unit Summary: Students will learn basic CAD skills and industry drafting standards through 2D and 3D CAD drawings. Design elements such as line weights, line types, shape and form will be taught and utilized. Other concepts such as structures, materials, texture and rendering skills will be applied.  |
| Performance Assessments: (Districts to complete for each unit)Example assessments for this unit include:* Students will learn basic functions within 2D/3D CAD software including creating, editing shapes, dimensioning, and text. Students will produce drawings from sketches.
* Students will implement industry expectations for CAD file management. Students will be able to create 3D models using a combination of primitive shapes, extruded polygons, and blended surfaces.
* Students will create complex shapes using multiple tools including Boolean operations.
* Students will have an opportunity to take a CAD IRC certification test at the end of the course of study

(Note: This unit can be split into a scope and sequence that focuses on 2D first and then moves into 3D solids) |
| Leadership Alignment: (Districts to complete for each unit)Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills. Example: * Students will work independently to learn the basic commands, functionality, and file management of CAD Software.

21st Century Skills:2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems6.A.2 Use digital technologies (computers, PDAs, media players, GPS, etc.),8.B.1 Monitor, define, prioritize and complete tasks without direct oversight8.C.1 Go beyond basic mastery of skills and/or curriculum to explore and expand one’s own learning and opportunities to gain expertise |
| Industry Standards and/or Competencies:CAD Architectural Design 12 – Students will be able to understand, demonstrate, and apply mathematics and measuring skills.4 – Students will be able to demonstrate sketching and cad drawing techniques.Engineering Principles 14 – Students will identify the qualities of successful engineering design, recognize its role in society, and develop projects using an engineering design processObjective 6 – Understand the concept of a problem statement and design requirements.4.2.1 Describe and utilize the Cartesian Coordinate System to create geometric shapes and objects4.2.4 Utilize appropriate coordinate entry methods (i.e., absolute, relative, and polar)4.3.1 Define geometric terms and recognize various geometric shapes by name 4.3.2 Use lines, circles, and arcs to construct regular and irregular geometric shapes 4.3.3 Construct angles, to include acute, obtuse, and right angles 4.3.4 Divide lines and bisect angles and arcs 4.3.5 Construct tangent, concentric, and perpendicular geometric relationships 4.3.6 Calculate area, perimeter, and volume of geometric shapes to include circle, square, rectangle, and triangle4.4.1 Utilize templates 4.4.2 Set drafting and modeling settings (e.g., grid, snap, and modes) 4.4.3 Utilize multiple entry methods to invoke CADD/BIM commands (e.g., hot keys, icons, and menus) 4.4.4 Utilize geometric relationships to ensure accuracy (e.g., endpoint, midpoint, and center) 4.4.5 Create and modify objects using CADD/BIM commands 4.4.6 Assign properties to objects (e.g., line weight, line types, scale factors, and colors)  |
| Aligned Washington State Academic Standards |
| Arts | Visual ArtsAnchor Standard 1: Generate and conceptualize artistic ideas and work.VA:Cr1.1.I a. Use multiple approaches to begin creative endeavors.VA:Cr1.2.I a. Shape an artistic investigation of an aspect of present-day life using a contemporary practice of art or design.VA:Cr1.2.III a. Choose from a range of materials and methods of traditional and contemporary artistic practices, following or breaking established conventions, to plan the making of multiple works of art anddesign based on a theme, idea, or concept.Anchor Standard 2: Organize and develop artistic ideas and work . VA:Cr2.1.II a. Through experimentation, practice, and persistence, demonstrate acquisition of skills and knowledge in a chosen art form.Anchor Standard 7: Perceive and analyze artistic work. VA:Re7.1.I: a. Hypothesize ways in which art influences perception and understanding of human experiences. |

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| Unit 4: 2D Design | Total Learning Hours for Unit: 40 |
| Unit Summary: Students apply 2D sketching to their basic CAD skills to design and develop 2D architecture and mechanical CAD drawings. |
| Performance Assessments: (Districts to complete for each unit)Example assessments for this unit include:Sketching:* Students draw 2D sketches using oblique and isometric techniques
* Students draw multi-views using orthographic projection techniques

Architecture:* Design and draft a basic floor plan and two elevations views using drafting standards, layers, blocks and architectural dimensions and annotations then present the drawings on architectural templates for a design critique.

Mechanical Design:* Design and draft a 2D shop drawings for a 3D object using drafting standards, engineering dimensions, part lists and assembly drawings
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| Leadership Alignment: (Districts to complete for each unit)Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills. Example: * Students work in groups to design their CAD projects; they must identify challenges and limitations to their designs. Students critique others' work and provide successful feedback as part of the design process.

21st Century Skills:3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member7.A.1 Adapt to varied roles, jobs responsibilities, schedules and contexts7.A.2 Work effectively in a climate of ambiguity and changing priorities7.B.1 Incorporate feedback effectively7.B.2 Deal positively with praise, setbacks and criticism environments9.A.1 Know when it is appropriate to listen and when to speak9.A.2 Conduct themselves in a respectable, professional manner10.A.1 Set and meet goals, even in the face of obstacles and competing pressures10.A.2 Prioritize, plan and manage work to achieve the intended result |
| Industry Standards and/or Competencies:CAD Architectural Design 13 – Utilize geometric relationships to ensure accuracy (e.g., endpoint, midpoint, and center) 4.4.5 Create and modify objects using CADD/BIM commands 4.4.7 Produce drawings from sketchesEngineering Principles 13 – Students will understand and develop positive work ethics, communication skills, and leadership skills4 – Students will identify the qualities of successful engineering design, recognize its role in society, and develop projects using an engineering design process |
| Aligned Washington State Academic Standards |
| Arts | Anchor Standard 1: Generate and conceptualize artistic ideas and work. VA:Cr1.1.II a. Individually or collaboratively formulate new creative problems based on student’s existingartwork.Anchor Standard 2: Organize and develop artistic ideas and work. VA:Cr2.1.II a. Through experimentation, practice, and persistence, demonstrate acquisition of skills andknowledge in a chosen art form.VA:Cr2.2.I a. Explain how traditional and non-traditional materials may impact human health and theenvironment and demonstrate safe handling of materials, tools, and equipment.Anchor Standard 4: Proficient: Select, analyze and interpret artistic work for presentation. VA:Pr4.1.I: a. Analyze, select, and curate artifacts and/or artworks for presentation and preservation.Anchor Standard 4: Select, analyze and interpret artistic work for presentation. VA:Pr4.1.II a. Analyze, select, and critique personal artwork for a collection or portfolio presentation.Anchor Standard 5: Develop and refine artistic techniques and work for presentation. (VA:Pr5.1.I): a. Analyze and evaluate the reasons and ways an exhibition is presented.VA:Pr5.1.II: a. Evaluate, select, and apply methods or processes appropriate to display artwork in a specific place.Anchor Standard 10: Proficient: Synthesize and relate knowledge and personal experiences to make art. VA:Cn10.1.I a. Document the process of developing ideas from early stages to fully elaborated ideas.VA:Cn10.1.II a. Utilize inquiry methods of observation, research, and experimentation to explore unfamiliar subjects through artmaking. |

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| Unit 5: 3D Design | Total Learning Hours for Unit: 50 |
| Unit Summary: Students will be able to create three dimensional objects, drawings and renderings through skills and performance in both independent and collaborative settings.  |
| Performance Assessments: (Districts to complete for each unit)Example assessments for this unit include:Students will have an opportunity to take a CAD IRC certification test at the end of the unit as a form of summative assessment. Architecture:* Students design and draft a 3D drawing of a house using a CAD program.
* Students work in a team to create all of the needed 3D objects to put into the scene as well as develop the materials and views needed to render several views of a single structure.
* Students create a realistic 3D rendered view of an architectural scene, interior or exterior of a house. Students will use complex 3D models, materials, lighting, and rendering.

Mechanical Design: * Students design and create a product using simple machines (pulleys, wheels, gears, screws, inclined planes, levers, etc.) in CAD and articulate how this product solves a problem.
* Students design individual components of all of the needed 3D objects to put into their group’s assembly. Students as part of a team will develop the materials needed to render several views of a completed mechanical design.
* Students build a multi-piece assembly with pieces that connect into one large object. Students must incorporate into their design moving parts and then present their design to the class for feedback.
* Students create a motion-study of their mechanical assembly to ascertain functionality.

 Industrial Design:* Students create a printable wearable object that fits to the scale of the human body. They will identify constraints and limitations of 3D printing (If 3D printing is available). Students will wear their objects and demonstrate the functionality and application of their design to others.
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| Leadership Alignment: (Districts to complete for each unit)Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills. Example: * Students will analyze, critique, refine, and apply decision-making skills through classroom and lab experiences that incorporate design and industry standards to maintain or improve their product. Students will communicate information through design.

21st Century Skills:1.A.1 Use a wide range of idea creation techniques (such as brainstorming)1.A.2 Create new and worthwhile ideas (both incremental and radical concepts)1.A.3 Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts1.B.1 Develop, implement and communicate new ideas to others effectively1.B.2 Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work1.B.3 Demonstrate originality and inventiveness in work and understand the real-world limits to adopting new ideas3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts3.A.2 Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal8.C.1 Go beyond basic mastery of skills and/or curriculum to explore and expand one’s own learning and opportunities to gain expertise8.C.2 Demonstrate initiative to advance skill levels towards a professional level10.A.1 Set and meet goals, even in the face of obstacles and competing pressures10.A.2 Prioritize, plan and manage work to achieve the intended result |
| Industry Standards and/or Competencies: Engineering Principles 14 – Students will identify the qualities of successful engineering design, recognize its role in society, and develop projects using an engineering design process5 – Identify and explain the elements of an engineering design process. 1. Identify & define the design problem 2. Brainstorm solutions 3. Create models & build a prototype 4. Test the prototype 5. Redesign and optimize |
| Aligned Washington State Academic Standards |
| Arts | Visual ArtsAnchor Standard 1: Accomplished: Generate and conceptualize artistic ideas and work. VA:Cr1.1.II a. Individually or collaboratively formulate new creative problems based on student’s existingartwork.VA:Cr1.2.III: a. Choose from a range of materials and methods of traditional and contemporary artistic practices, following or breaking established conventions, to plan the making of multiple works of art and design based on a theme, idea, or concept.Anchor Standard 2: Organize and develop artistic ideas and work. VA:Cr2.3.II a. Redesign an object, system, place, or design in response to contemporary issues.Anchor Standard 3: Proficient: Refine and complete artistic work. VA:Cr3.1.):a. Apply relevant criteria from traditional and contemporary cultural contexts to examine, reflect on, and plan revisions for works of art and design in progress.Anchor Standard 3: Refine and complete artistic work. VA:Cr3.1.II a. Engage in constructive critique with peers, then reflect on, reengage, revise, and refine works of art and design in response to personal artistic vision.Anchor Standard 4: Select, analyze and interpret artistic work for presentation. VA:Pr4.1.II a. Analyze, select, and critique personal artwork for a collection or portfolio presentation.Anchor Standard 7: Perceive and analyze artistic work. VA:Re7.1.I a. Hypothesize ways in which art influences perception and understanding of human experiences.VA:Re7.2.Ia. Analyze how one’s understanding of the world is affected by experiencing visual imagery. Anchor Standard 10: Synthesize and relate knowledge and personal experiences to make art. VA:Cn10.1.I a. Document the process of developing ideas from early stages to fully elaborated ideas. |

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| Unit 6: Capstone Art/CAD + Classroom-Based Assessment (CBA)Realistic Modeling/Rendering | Total Learning Hours for Unit: 35 |
| Unit Summary: Students will create and present a final capstone project, based upon their portfolio, to showcase their skills and conceptual application of CAD skills in architecture and engineering. Key concepts and skills from 2D and 3D design (graphics, solids modeling, engineering animation, computer-aided drafting (CAD), computer-aided design (CADD) as well as 21st Century Skills, career connections and industry standards should be represented and demonstrate proficient, accomplished or advanced levels. |
| Performance Assessments: (Districts to complete for each unit)Example assessments for this unit include:Note, choose only one of the example assessments for this unit:* Students build a physical model/object based on a previously created artistic design.
* Students design and create a mixed media/digital representation, to scale, of their project for final assessment
* Students display their capstone project at a community showcase, with assessment done by an outside jury.
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| Leadership Alignment: (Districts to complete for each unit)Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills. Example: * Students utilize their prior artistic, CAD, and engineering skills to display their final summative project.

21st Century Skills:10.A.1 Set and meet goals, even in the face of obstacles and competing pressures10.A.2 Prioritize, plan and manage work to achieve the intended result10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to:10.B.1.a Work positively and ethically10.B.1.b Manage time and projects effectively10.B.1.c Multi-task10.B.1.d Participate actively, as well as be reliable and punctual10.B.1.e Present oneself professionally and with proper etiquette10.B.1.g Respect and appreciate team diversity10.B.1.h Be accountable for results |
| Industry Standards and/or Competencies:Engineering Principles 14 – Students will identify the qualities of successful engineering design, recognize its role in society, and develop projects using an engineering design processObjective 13 – Build and test designs against design specifications, evaluate the results of those tests, and present their analyses.Objective 14 – Demonstrate that design is an iterative process, subject to continuous evolutionary improvement. |
| Aligned Washington State Academic Standards |
| Arts | Visual ArtsAnchor Standard 1: Generate and conceptualize artistic ideas and work. VA:Cr1.1.II a. Individually or collaboratively formulate new creative problems based on student’s existingartwork.VA:Cr1.2.III: a. Choose from a range of materials and methods of traditional and contemporary artistic practices, following or breaking established conventions, to plan the making of multiple works of art and design based on a theme, idea, or concept.Anchor Standard 2: Organize and develop artistic ideas and work. VA:Cr2.3.I a. Collaboratively develop a proposal for an installation, artwork, or space design that transforms the perception and experience of a particular place.Anchor Standard 3: Refine and complete artistic work. VA:Cr3.1.II: a. Engage in constructive critique with peers, then reflect on, reengage, revise, and refine worksof art and design in response to personal artistic vision.VA:Cr3.1.III a. Reflect on, re-engage, revise, and refine works of art or design considering relevant traditionaland contemporary criteria as well as personal artistic vision.Anchor Standard 4: Select, analyze and interpret artistic work for presentation. VA:Pr4.1.I: a. Analyze, select, and curate artifacts and/or artworks for presentation and preservation.VA:Pr4.1.II a. Analyze, select, and critique personal artwork for a collection or portfolio presentation.Anchor Standard 5: Develop and refine artistic techniques and work for presentation. VA:Pr5.1.II: a. Evaluate, select, and apply methods or processes appropriate to display artwork in a specific place.Anchor Standard 10: Synthesize and relate knowledge and personal experiences to make art. VA:Cn10.1.I a. Document the process of developing ideas from early stages to fully elaborated ideas. |