Spokane Public Schools
Drafting and Design Technology

Course: Drafting and Design Technology		**Total Framework Hours up to: 180 hours**
CIP Code: 140102	☒**Exploratory** ☐**Preparatory**	**Date Last Modified: 4/2/2015**
Career Cluster: STEM		**Cluster Pathway: Engineering & Technology**

COMPONENTS AND ASSESSMENTS

Performance Assessments:
Students use the nomenclature of engineering graphics and are able to identify and describe types of views, projections, and lines.

Leadership Alignment:
Think Creatively

Classroom Focus:

- Use knowledge of historical development to innovate design

Community Focus:

- JFRCR (Journal of FRC Engineering Research)
- Robotics – Students work as a team with engineering and mechanical mentors to brainstorm possible solutions to design and develop a robot to perform specific tasks. Solutions must be wildly creative in order to compete in regional events. Students will work through many design iterations, analyzing, evaluating and refining their ideas until a final prototype is built.

Standards and Competencies

Standard/Unit: 1 History of Engineering Graphics

Competencies	**Total Learning Hours for Unit: 10 Hours**

- Appreciate the history of Engineering Graphics
- Knowledge of the coordinate system
- Understand Geometric entities
- Comprehend free hand sketches
- Recognize alphabet of lines and precedence of line types
- Grasp the concept of multi-view drawings
- Comprehend orthographic projection/glass box
- Identify categories and disciplines related to engineering graphics
- Apply 2D and 3D coordinate system
- Points, Circles, Arcs, Planes, etc.
- Solid Primitives

- Generate basic 2D shapes and objects
- Create 2D and 3D freehand sketches
- Create and Understand correct line precedence
- Select the proper front view
- Explain first and third angle projection type
- Identify the six principal views

Aligned Washington State Standards		
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Educational Technology	1.1:	Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology.
	1.2:	Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others.
	2.2:	Operate Systems: Understand technology systems and use hardware and networks to support learning.
	2.3:	Select and Use Applications: Use productivity tools and common applications effectively and constructively.
Health and Fitness		
Language	RST 11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*.
Math	G-MG.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).★
	G-MD.4	Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
Reading		
Science	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.
	HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
Social Studies		
Speaking and Listening	SL 11-12.4	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
Writing	WHST 11-12.2e	Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).
	WHST 11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
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COMPONENTS AND ASSESSMENTS

Performance Assessments:

Students are able to hand sketch and isometric projection from orthographic projections and vice versa.

Students are able to identify and describe different drawing views (section, detail, broken, auxiliary, etc.).

Leadership Alignment:

Standards and Competencies

Standard/Unit: 2 Isometric Projection and Multi-View Drawings

Competencies	**Total Learning Hours for Unit: 10 hours**

- Create one and two view drawings
- Understand Isometric Projection and 2D sketching.
- Knowledge of additional Projection views and arrangement of drawing views.
- Comprehend the history and evolution of CAD.
    - Recognize operations and feature based modeling
    - Identify the three main projection divisions in freehand engineering sketches and drawings:
- Axonometric, Oblique, and Perspective
- Identify the development of in historic CAD systems, parameters and design intent of a sketch, part, assembly and drawing.
    - Apply the operation: Union, Difference and Intersection.

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COMPONENTS AND ASSESSMENTS

Performance Assessments:
Students are able to create a drawing of any given object using industry standards for dimensioning and tolerancing.

Leadership Alignment:

Use Systems Thinking

Classroom Focus:

- Understand how standards benefit innovation in systemic applications within and across sectors

Community Focus:

- Robotics – Students consider, design, test, analyze and evaluate how a robot's sub-systems interact with each other to produce the overall effectiveness of the robot.

Standards and Competencies

Standard/Unit: 3 Dimensioning Practices, Tolerancing, and Fasteners

Competencies	**Total Learning Hours for Unit: 10 hours**

- Knowledge of dimensioning
- Awareness of measurement units
- Understand Scale type
- Understand tolerancing for drawing
- Comprehend fasteners and hole dimensioning
- Recognize fit type
- Ability to correctly dimension the following features, objects and shapes: rectangle, cone, sphere, hole, cylinder, angle, point or center, arc, chamfer and more
- Apply the following measurements system:
- Apply the following measurements system: Metric System, English System
- Engineer's scale, Architect's scale, linear scale, Vernier scale, and linear encoder
- Apply dimension and drawing tolerances
- Read and understand general fasteners and hole annotation
- Apply fit type

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COMPONENTS AND ASSESSMENTS	
Performance Assessments: Students are able to create and edit parts using basic features (extruded boss/base, extruded cut, fillet).	
Leadership Alignment: Apply Technology Effectively Classroom Focus: Part Modeling introduction to CAD software	
Standards and Competencies	
Standard/Unit: 4 Introduction to Part Modeling	
Competencies	**Total Learning Hours for Unit: 10 Hours**
• A comprehensive understanding of software • Address file management with file folders	

- Create two part templates
- Create two parts: battery, battery plate
- Ability to establish a software session
- Aptitude to create file folders for various projects and templates
- Skill to address system options and document properties
- Specific knowledge and understanding of 2D sketching and the following 3D features; extruded boss/base, extruded cut, fillet and instant 3D

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Performance Assessments:
Students are able to create and edit parts using revolved boss/base, shell, dome, and circular pattern features.

Leadership Alignment:		
Standards and Competencies		
Standard/Unit: 5 Revolved Features		
Competencies		**Total Learning Hours for Unit: 10 Hours**
• Two flashlight parts: lens, bulb • Insert the following: Geometric relations, equal, coincident, symmetric, intersection, and perpendicular • Specific knowledge and understanding of the following features: extruded boss/base, extruded cut, revolved base, revolved boss thin, revolved thin cut, dome, shell, hole wizard, and circular pattern • Ability to insert multiple geometric relations to a model • Ability to apply design intent in sketches, features, parts and assemblies		
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COMPONENTS AND ASSESSMENTS	
Performance Assessments: Students are able to create and edit parts using swept base, loft base, thread path, rib, and linear pattern features.	
Leadership Alignment:	
Standards and Competencies	
Standard/Unit: 6 Swept, Loft, and Additional Features	
Competencies	**Total Learning Hours for Unit: 20 hours**
• Create four flashlight parts: O-ring, switch, lens cap, housing • Establish geometric relations: pierce, tangent, equal, intersection, coincident, and midpoint • Specific knowledge and understanding of the following features: extruded boss/base, extruded cut, swept base, loft base, loft boss, mirror, draft, dome, rib, and linear pattern • Ability to apply multiple geometric relations to a model • Skill to apply design intent to 2D sketches, 3D features, parts and assemblies	
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COMPONENTS AND ASSESSMENTS

Performance Assessments:
Students are able to create, edit, and manage sub-assemblies and assemblies.

Leadership Alignment:
Use Systems Thinking
Classroom Focus:
Flashlight Assembly-sub assessment relationships

Standards and Competencies

Standard/Unit: 7 Assembly Modeling

Competencies	**Total Learning Hours for Unit: 20 Hours**

- Create four assemblies in this project: lens and bulb, cap and lens, battery and plate, flashlight
- Create an inch and metric assembly template
- Develop an understanding of assembly modeling techniques
- Combine the lens and bulb assembly, cap and lens assembly, battery and plate assembly, housing part, and switch part to create the flashlight assembly
- Ability to use the following tools: insert component, hide/show, suppress/unsuppress, mate, move component, rotate component, exploded view, and interference detection
- Ability to apply document properties and to create custom assembly templates

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COMPONENTS AND ASSESSMENTS	
Performance Assessments: Students are able to create and edit drawings for parts and assemblies including proper title block, dimensioning, drawing views, annotations, and bill of materials.	
Leadership Alignment:	
Standards and Competencies	
Standard/Unit: 8 Fundamentals of Drawing	
Competencies	**Total Learning Hours for Unit: 15 Hours**

- Custom drawing and sheet template
- Three drawings: battery, flashlight, and O-ring-design-table
- Design table
- Define dimensioning standards, units, and precision
- Create title block information and a company logo
- Skill to create the following drawing views: standard, detail, section and exploded
- Proficiency to insert, and modify dimensions, BOM, balloon text and annotations
- Capability to create three configurations in a design table: small, medium, and large

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COMPONENTS AND ASSESSMENTS
Performance Assessments: Students are able to design and original assembly with moving parts; creating CAD assemblies and proper drawings.
Leadership Alignment: Think Creatively Communicate Clearly Manage Goals and Time Work Independently

Be Self-Directed Learners
Classroom Focus:
Engineering Design project design sketches
Design Project
Design Review
Design Project Timeline

Standards and Competencies

Standard/Unit: 9 Advanced CAD

Competencies	**Total Learning Hours for Unit: 45 Hours**

- Able to develop professional drawing templates
- Streamline repetitive tasks
- Apply revolved boss/base, revolved cut, linear, and circular pattern features
- Build an advanced part from a detailed, dimensioned illustration

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COMPONENTS AND ASSESSMENTS	
Performance Assessments: Students will be able to identify and understand practices of CAD used by professionals.	
Leadership Alignment:	
Standards and Competencies	
Standard/Unit: 10 CAD Practices	
Competencies	**Total Learning Hours for Unit: 30 Hours**
• Specify document properties • Calculate the material, measurements, mass properties, and section properties • Understand how to create a drawing from a part or an assembly • Read and understand an engineering drawing document • Identify the reference plane and part origin, and apply design intent • Build a part from a detailed, dimensioned illustration • Apply geometric relations and dimensions	
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Health and Fitness	
Language	
Math	G-MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).★ G-MD.4 Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
Reading	RST 11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a

		specific scientific or technical context relevant to *grades 11–12 texts and topics*.
Science	HS-ETS1-2 HS-ETS1-4	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
Social Studies		
Speaking and Listening	SL 11-12.4	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
Writing	WHST 11-12.2e WHST 11-12.4 WHST 11-12.5	Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

21st Century Skills		
Check those that students will demonstrate in this course:		
LEARNING & INNOVATION **Creativity and Innovation** ☒Think Creatively ☐Work Creatively with Others ☐Implement Innovations **Critical Thinking and Problem Solving** ☐Reason Effectively ☒**U**se Systems Thinking ☐Make Judgments and Decisions ☐Solve Problems **Communication and Collaboration** ☒Communicate Clearly ☐Collaborate with Others	**INFORMATION, MEDIA & TECHNOLOGY SKILLS** **Information Literacy** ☐Access and /evaluate Information ☐Use and Manage Information **Media Literacy** ☐Analyze Media ☐Create Media Products **Information, Communications and Technology (ICT Literacy)** ☒Apply Technology Effectively	**LIFE & CAREER SKILLS** **Flexibility and Adaptability** ☐Adapt to Change ☐Be Flexible **Initiative and Self-Direction** ☒Manage Goals and Time ☒Work Independently ☒Be Self-Directed Learners **Social and Cross-Cultural** ☐Interact Effectively with Others ☐Work Effectively in Diverse Teams **Productivity and Accountability** ☐Manage Projects ☐Produce Results **Leadership and Responsibility** ☐Guide and Lead Others ☐Be Responsible to Others