West Sound Technical Skills Center  
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Hours: 7:30 a.m. – 3:00 p.m.

Engineering and Design Course Syllabus – January 2013

PROGRAM DESCRIPTION

West Sound Technical Skills Centers Engineering and Design Technology program is designed to prepare students for careers in Engineering and Design. Students will learn Engineering and Design using a variety of high-level, industry standard computer engineering programs.

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the fields of Engineering and Design, Mechanical Drafter or Technician, Technical Illustrator, and Technical Animator.

Coursework includes Engineering and Design, Drafting Skills, Sketching and Visualization, Applied Geometry, 3d Modeling, Ortho Graphic Projection, Auxiliary and Section Views, Dimensioning, Tolerancing, Working Drawings, Modeling Rendering and Animation.

Students will be required to read and comprehend professional technical manuals; perform required math skills; and communicate effectively in written and oral presentations. Students should have basic computer use skills and the ability to sit and work on a computer for extended periods of time. Good problem solving skills are helpful for student success.

This program is designed so students may enter the program at any time depending on existing skills and space availability. Students need at least 1 year or 540 hours of class time for minimum skill development.

There is a strong emphasis on employability skills, professionalism, leadership and teamwork. Attendance policies are strictly adhered to and have a direct link to grading. As with all hands-on training, you must be present and engaged in the learning process to be successful.

STUDENT-PROGRAM OUTCOMES

Upon successful completion of the program the student should be able to:

Unit 01 Engineering Design
  01.01 Compare aesthetic design and functional design.
  01.02 Summarize the engineering design process.
  01.03 Identify the typical members of a design team.
  01.04 Describe the role of engineering data management (EDM) and product data management (PDM) in drawing control.
  01.05 Summarize the modeling techniques used in design.
  01.06 Describe the important types of graphics used to support the engineering design process.
  01.07 Explain how documentation supports the engineering design process.
  01.08 Demonstrate an understanding of engineering design.
  01.09 Demonstrate an understanding of and be able to select and use information and communication technologies.

Unit 02 Systems Approach
  02.01 Compare the engineering design process and the universal systems model.
  02.02 Discuss the elements of the universal systems model.
  02.03 Identify the different types of input that are used in the universal systems model.
02.04 Explain the importance of using standard parts in the universal systems model.
02.05 Summarize the history of quality in manufacturing.
02.06 Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
02.07 Demonstrate abilities to apply the design process.
02.08 Demonstrate the abilities to use and maintain technological products and systems.
02.09 Demonstrate the abilities to assess the impact of products and systems

Unit 03 Drafting Skills
03.01 Identify the important parts of a CAD system used to create technical drawings.
03.02 Define the relevant terms related to CAD systems.
03.03 Recognize the traditional tools most often used to create technical drawings.
03.04 Recall the important terms related to traditional drawing tools.
03.05 Show the use of CAD to draw lines, circles, arcs, curves, and erase parts of a drawing.
03.06 Produce measurements and scale drawings through the use of scales, dividers, and CAD.
03.07 Identify standard pencil grades, and identify those most commonly used for technical drawings.
03.08 Recognize the types and thicknesses of the various lines in the alphabet of lines.

03.09 Demonstrate the abilities to apply the design process.

Unit 04 Sketching and Visualization
04.01 Define technical sketching
04.02 Understand how sketching fits into the design process.
04.03 Summarize the two types of sketches.
04.04 Identify and use sketching tools.
04.05 Describe the differences between pictorial and multiview projection.
04.06 Identify important practices when using CAD for lettering.
04.07 Recognize the need for visualization.
04.08 Apply the concepts of image planes and projection to visualize 3D objects.
04.09 Examine the role of color and rendering in visualizing 3D objects.
04.10 Differentiate between visualizing one object and visualizing a group of objects.
04.11 Recognize how visualization can be applied in a number of technical fields.

Unit 05 Applied Geometry
05.01 Describe the importance of engineering geometry in the design process.
05.02 Summarize coordinate geometry and coordinate systems and apply them to CAD.
05.03 Explain the right-hand rule.
05.04 Identify the major categories of geometric entities.
05.05 Explain and construct the geometric conditions that occur between lines.
05.06 Construct points, lines, curves, polygons, and planes.
05.07 Summarize and construct tangent conditions between lines and curves.
05.08 Construct conic sections, roulettes, double-curved lines, and freeform curves.
05.09 Describe surface geometric forms.
05.10 Explain and construct 3D surfaces.
05.11 Identify engineering applications of geometry.
05.12 Demonstrate mathematics knowledge and skills.

Unit 06 3D Modeling
06.01 Explain 3D modeling in a historical perspective.
06.02 Understand the terminology used in 3D modeling.
06.03 Define the most common types of 3D modeling systems.
06.04 Apply Boolean operations to 3D objects.
06.05 Understand how constraint-based and feature-based modeling affects 3D modeling strategy.
06.06 Produce building models by using common construction techniques.
06.07 Apply generalized sweeps and construction geometry to the creation of model features.
06.08 Construct part and assembly models by using feature duplication and geometric transformations.
06.09 Understand the role that projection theory plays in displaying 3D models on the computer screen.
06.10 Analyze the ways that 3D modeling integrates the design process.
06.11 Compare 2D CAD with 3D CAD.
06.12 Define different data exchange standards.

Unit 07 Orthographic Projection
07.01 Explain orthographic projection and multiview drawings.
07.02 Recognize frontal, horizontal, and profile planes.
07.03 Identify the six principle views and the three space dimensions.
07.04 Apply standard line practices to multiview drawings.
07.05 Produce a multiview drawing using hand tools or CAD.
07.06 Differentiate normal, inclined, and oblique planes in multiview drawings.
07.07 Produce lines, curves, surfaces, holes, fillets, rounds, chamfers, runouts, and ellipses in multiview drawings.
07.08 Apply visualization by solids and surfaces analysis to multiview drawings.
07.09 Explain the importance of multiview drawings.
07.10 Identify limiting elements, hidden features, and intersections of two planes in multiview drawings.

Unit 08 Auxiliary and Section Views
08.01 Produce auxiliary views of inclined planes and successive auxiliary views.
08.02 Show the use of reference planes and fold lines when creating auxiliary views.
08.03 Explain auxiliary view projection theory.
08.04 Define primary, secondary, tertiary, width, height, and depth auxiliary views.
08.05 Produce a partial auxiliary view and the plotting of curves in auxiliary views.
08.06 Understand the difference between 2D methods and 3D CAD in creating auxiliary views.
08.07 Apply the concept of cutting planes to create section views.
08.08 Construct cutting plane lines and section lines using conventional practices.
08.09 Produce full, half, offset, removed, revolved, broken-out, auxiliary, and assembly section views using conventional practices.
08.10 Produce conventional breaks for different materials and cross sections.
08.11 Construct aligned sectioned features and ribs, webs, and thin features in sections using conventional practices.
08.12 Apply section theory to computer models when designing.

Unit 09 Dimensioning
09.01 Define dimension.
09.02 Understand the different dimensioning terms.
09.03 Identify different types of size dimensions.
09.04 Explain location and orientation dimensions.
09.05 Apply the standard dimensioning practices for mechanical drawings.
09.06 Differentiate between current standards and past practices for dimensioning.
09.07 Produce a dimensioned drawing.
09.08 Compare contour and geometric breakdown dimensioning.

Unit 10 Tolerancing
10.01 Apply English and metric tolerances to dimensions.
10.02 Calculate standard tolerances for precision fits.
10.03 Apply tolerances using the basic shaft and basic hole systems.
10.04 Identify and draw geometric dimensioning and tolerancing symbols.
10.05 Produce a dimensioned drawing using geometric dimensioning and tolerancing.
10.06 Describe maximum and minimum material conditions.
10.07 Summarize and apply datums to technical drawings.
10.08 Identify inspection tools.

Unit 11 Working Drawings
11.01 Define working drawings.
11.02 Describe how working drawings are used in industry.
11.03 Summarize the major components of a complete set of working drawings.
11.04 Compare detail drawings and assembly drawings.
11.05 Examine how part numbers are assigned in an assembly drawing.
11.06 Identify important information in a title block and a parts list.
11.07 Explain how tabular drawings are used in industry.
11.08 Evaluate how standard parts are used in working drawings.
11.09 Analyze how CAD is used to create, store, and retrieve working drawings.
11.10 Demonstrate technical knowledge and skills for making working drawings.
11.11 Demonstrate technical knowledge and skills for making a basic residential drawing.
11.12 Demonstrate technical knowledge and skills for making a reverse engineered drawing (as built) from a solid object.
11.13 Demonstrate technical knowledge and skills for making technical illustrations.
11.14 Demonstrate technical knowledge and skills for making engineering drawings.
11.15 Demonstrate and present a research and design project.

Unit 12 Modeling and Rendering and Animation
12.1 Describe the different types of modeling: physical, computer, and mathematical.
12.2 Recognize the appropriate type of modeling to present different types of data.
12.3 Understand the importance of data visualization in engineering design.
12.4 Summarize the basic techniques used in creating animations.
12.5 Identify the components of the rendering process.

Unit 13 Presentation and Documentation
13.1 Compare informative and persuasive presentations.
13.2 Identify the types of slides to include in a formal presentation.
13.3 Produce and deliver a formal presentation.
13.4 Describe different types of documentation used by engineers.
13.5 Explain what types of graphs, diagrams, and tables to use in documentation.
13.6 Define a process by which to organize and store technical drawings.
13.7 Demonstrate and present a research and design project.

Unit 14 Technology
14.1 Demonstrate an understanding of the characteristics and scope of technology.
14.2 Demonstrate an understanding of the core concepts of technology.
14.3 Use information technology tools.

ASSESSMENT STRATEGIES
Students will be introduced to a variety of Drafting and Engineering programs. They will use these programs to create a variety of Engineering Design projects. Students will be assessed on their assignments and projects using a Virtual Learning Environment. The Virtual Learning Environment will be where the student will gather evidence of student learning by keeping samples of their completed assignments and projects.
The Engineering and Design program is 540 hours of training. The 540 hours is broken down to 6 grading periods of 90 hours each. Each 90 hours of training is called a term. Each term your grade will be based on the following percentages.

Classwork assignments and Applied Knowledge 30%
Engineering and Design Projects 40%
Employability Skills 30%

Assignments are competency based and are graded using the following rubric:

- 0 Not completed
- 1 Some Elements Shown
- 2 Some Elements Complete
- 3 Most Elements Complete
- 4 All Elements Complete

Projects are graded using the appropriate project evaluation rubric.

**INSTRUCTIONAL STRATEGIES**

Methods and activities for instruction include lecture, discussion, demonstration, online step by step tutorials, online visual training, small group/cooperative learning, and project based learning. Engineering and Design technology is individualized competency based class program and all assignments, projects, and class activities have industry competencies assigned to them.

**SESSIONS OFFERED:**

- Session 1 8:00am-10:30am
- Session 2 11:10am-1:40pm

**BEHAVIOR AND ATTENDANCE EXPECTATIONS**

**Behavior:** Please refer to the WST Student Handbook.

**Attendance:** The West Sound Technical Skills Center Engineering and Design program is professional preparatory in nature and follows an attendance policy similar to business and industry. The student is considered an employee or a professional and is expected to be in full daily attendance (2.5 hours) in order to assure that maximum learning and productivity are achieved.

Regular attendance is a workplace requirement. Regular school attendance is a state law in Washington. Attendance is especially important at WST because of the significant amount of computer and hands-on activities. If you are not present, you will not learn. This includes arriving late or leaving early. Chronic absences will be a negative factor in your overall success in your career field and may impact your ability to earn credit or stay in the program.

If extenuating circumstances result in an unexpected absence, you are expected to contact your teacher directly at 360-473-0585, just as you would in the workplace. When you return, you are expected to complete an absence report and you are expected to engage in an appropriate out of school activity to make up the missed time. Such opportunities are limited; avoid dilemmas by attending regularly.

An absence is not being in class for ANY reason when WST is operational which includes assemblies, field trips, sickness, family emergencies, etc.

**Chronic absences for any reason (missing three or more sessions) may result in removal from the program and transfer to the sending high school.**
Software and Instruction Materials
Students will be working with the following computer software
- Engineering Design Connect Online Learning System
- Rhinoceros NURBS Computer Aided Drafting and Modeling software
- Blender 3D Modeling Software
- Moodle a Virtual Learning Environment

Students will be using the following tutorials and guides
- Engineering Design 1st McGraw Hill
- Rhino Level 1 and 2 Training tutorials
- Rhino User Guide and Tutorials
- Blender Basics 4th Edition
- Blender 3d Design Course

Leadership
Leadership activities are embedded in curriculum, instruction and practice. Students will demonstrate leadership and entrepreneurship skills in classroom design projects, ASB decision making projects, NAVSEA underwater remote operated vehicle project, and mentoring of the K-8 STEM students at the only K-8 STEM Academy in Washington State.

ARTICULATION/EQUIVALENCY CREDIT

Student who successfully complete coursework to industry standard and demonstrate consistent professional behaviors are eligible to receive college credit through PC3 Connect (applicable at Bates and Clover Park Technical College.)

Equivalency credits which meet high school graduation requirements are available in math. However, not all sending schools acknowledge those credits, check with your high school counselor.