Western Technical College

10606115 Parametric Design 1

Course Outcome Summary

Course Information

Description	This course is designed to introduce students to the concepts, commands, and techniques of parametric modeling. The student will construct "intelligent" solid models, create and constrain assemblies and create 2D drawings, balloons, parts lists and reference dimensions from the 3D models.
Career Cluster	Science, Technology, Engineering and Mathematics
Instructional Level	Associate Degree Courses
Total Credits	3
Total Hours	90

Textbooks

Autodesk Inventor 2023 Essentials Plus. Copyright 2023. Banach, Daniel T., Travis Jones, and Shawna Lockhart. Publisher: Schroff Development Corporation. **ISBN-13**: 978-1-63057-510-6. Required.

Learner Supplies

Mechanical scale. **Vendor:** To be discussed in class. Required.

Scientific calculator (recommend T1-36x Solar). **Vendor:** Campus Shop. Required.

Success Abilities

1. Cultivate Passion: Enhance Personal Connections
2. Cultivate Passion: Expand a Growth-Mindset

3. Live Responsibly: Embrace Sustainability
4. Live Responsibly: Foster Accountability
5. Refine Professionalism: Act Ethically
6. Refine Professionalism: Improve Critical Thinking
7. Refine Professionalism: Participate Collaboratively
8. Refine Professionalism: Practice Effective Communication

Program Outcomes

1. Prepare detail and assembly drawings for documentation of mechanical components and products
2. Create CAD geometry, parts, and assemblies
3. Design mechanical components and products
4. Analyze mechanic engineering problems
5. Produce and revise supporting engineering documentation
6. Evaluate manufacturing processes and materials for product development
7. Demonstrate awareness of product liability and industry standards
8. Meet design and production deadlines
9. Interpret and communicate technical concepts, designs, and documentation

Course Competencies

1. Accept responsibility for attending class and completing all learning activities.

Assessment Strategies

1.1. Class Attendance

Criteria

You will know you are successful when

1.1. you attend lecture, demos, and lab with no unexcused absences.
1.2. you obtain missed information and assignments from other students and/or instructor.
1.3. you read missed technical information.
1.4. you practice missed demonstrations.
1.5. you make up excused lab time.

Learning Objectives

1.a. Develop good work habits.
1.b. Fulfill job expectations and requirements.

2. Cooperate and establish a good working relationship with other students in the class.

Assessment Strategies

2.1. By presenting ideas to others in group
2.2. By completing assigned tasks within group.
2.3. By completion of group project for instructor.

Criteria

Criteria - Performance will be satisfactory when:

2.1. you perform tasks and assignments within group.
2.2. you contribute to the group interaction without prompting.
2.3. you prepare for group meetings.
2.4. you listen to group members.

Learning Objectives

2.a. Help group members understand and complete assigned tasks.
2.b. Identify roles and responsibilities of individual group members.
2.c. Respect the ideas and opinions of others.

3. Explore user interface, command entry and sequence, file preferences and options of different software.

Assessment Strategies

3.1. Upon completion of demonstration by instructor
3.2. After guided practice with instructor.
3.3. Upon independent practice during scheduled and open lab hours.
3.4. Upon successful completion of tutorials.
3.5. Upon successful completion of lab assignments.

Criteria

You will know you are successful when

3.1. you use software.

Learning Objectives

3.a. Differentiate between wireframe, surface and solid modeling.
3.b. Describe advantages of parametric modeling over other design tools and develop an appreciation for software abilities.
3.c. Identify and use screen layout options: Title Bar, Pull-down menus, Drawing Window, Command Line, Status Bar.
3.d. Use right-click menus.
3.e. Differentiate between existing layers; create and utilize new layers when needed.
3.f. Familiarize self with menu bars, toolbars and tool tips.
3.g. Utilize browser or feature manager tree.
3.h. Change part settings (options) when creating models.
3.i. Setup and use existing part, assembly and drawing template files.
3.j. Differentiate between part, assembly and drawing files.

4. Sketch 2D geometry using 3D parametric software.

Assessment Strategies

4.1. Upon completion of demonstration by instructor
4.2. After guided practice with instructor.
4.3. Upon independent practice during scheduled and open lab hours.
4.4. Upon successful completion of tutorials.
4.5. Upon successful completion of lab assignments.

Criteria

You will know you are successful when

4.1. you determine geometry required to sketch part.
4.2. you draw sketch outline (profile) of geometry using software.

Learning Objectives

4.a. Select and draw an outline that best represents the part.
4.b. Select sketch plane that best meets the orientation of the model.
4.c. Master sketch commands: point, line, arc, circle, polygons, centerlines, splines.
4.d. Create sketches proportional to the finished shape.
4.e. Draw geometry without gaps and overlapping geometry.
4.f. Change drafting settings in Options dialogue box.
4.g. Convert a 2D sketch into a profile when using Mechanical Desktop.

5. Constrain 2D geometry using dimensions and geometric constraints.

Assessment Strategies

5.1. Upon completion of demonstration by instructor
5.2. After guided practice with instructor.
5.3. Upon independent practice during scheduled and open lab hours.

5.4. Upon successful completion of tutorials.
5.5. Upon successful completion of lab assignments.

Criteria

You will know you are successful when

5.1. you profile a sketch.
5.2. you constrain a profile using dimensions.
5.3. you constrain a profile using geometric constraints.

Learning Objectives

5.a. Differentiate between dimensions, constraints and construction lines.
5.b. Familiarize self with dimensioning commands options.
5.c. Examine types of geometric constraints.
5.d. Add appropriate constraints to profile: geometric and dimensioning.
5.e. Show, add, and remove constraints to profile.
5.f. Determine if sketch or profile is fully, under or over-constrained.
5.g. Edit sketch using grips.
5.h. Edit dimensions when required.
5.i. Differentiate between numeric, Variable and Equations when dimensioning.
5.j. Apply equations to dimensions.
5.k. Use construction lines, points, and circles to define profile.
5.l. Edit, add and delete geometry of sketch and re-solve or rebuild sketch when needed.

6. Create a basic parametric model.

Assessment Strategies

6.1. Upon completion of demonstration by instructor
6.2. After guided practice with instructor.
6.3. Upon independent practice during scheduled and open lab hours.
6.4. Upon successful completion of tutorials.
6.5. Upon successful completion of lab assignments.

Criteria

You will know you are successful when

6.1. you create 3D models from profiles.
6.2. you view the 3D model.

Learning Objectives

6.a. Know options of each command.
6.b. Determine method of modeling to be used to create 3D part.
6.c. Determine shape of sketch (profile).
6.d. Create sketch of cross-sectional shapes and profile.
6.e. Extrude a profile to create a 3D part.
6.f. Revolve a profile to create a 3D part.
6.g. Use the Sweep command to create 3D part.
6.h. Create and solve a 2D path.
6.i. Create and solve a 3D path.
6.j. View a part using viewpoints.
6.k. View and rotate the 3D object using 3D Orbit.
6.l. Shade 3D model using Toggle Shading/Wireframe.
6.m. Edit features using the Browser or Feature Manager Tree.
6.n. Update or rebulid model.
6.o. Work with multiple viewports.

7. Create features on model.

Assessment Strategies

7.1. Upon completion of demonstration by instructor
7.2. After guided practice with instructor.
7.3. Upon independent practice during scheduled and open lab hours.
7.4. Uponsuccessful completion of tutorials.
7.5. Upon successful completion of lab assignments.

Criteria

You will know you are successful when

7.1. you add features to models using Extrude, Loft and Sweep.
7.2. you add fillets and chamfers to model.
7.3. you add holes to model.
7.4. you control feature visibility.
7.5. you copy sketches, edges and features of model to create a new model.
7.6. you use workplanes, work axis and work points.

Learning Objectives

7.a. Differentiate between options of each command.
7.b. Place sketch plane on model surface.
7.c. Draw profiles on sketch plane.
7.d. Differentiate between parametric/non-parametric work planes and command options of work planes.
7.e. Create work planes.
7.f. Create a work axis through a cylindrical feature to dimension, establish work planes or add features.
7.g. Dimension to work axis.
7.h. Establish work planes using work axis.
7.i. Add features using work axis.
7.j. Establish a work point.
7.k. Use work points for defining locations.
7.l. Control work feature visibility.
7.m. Join, cut, or intersect material using the Extrude, Extrude-Boss or Extrude-Cut commands.
7.n. Join, cut or intersect material using the Revolve command.
7.o. Join, cut, or intersect material using the Sweep command.
7.p. Use methods of terminations for Extrude, Sweep and Revolve.
7.q. Add chamfers to model.
7.r. Add fillets to model.
7.s. Add holes to model.
7.t. Copy edges and faces from a model to create new features or models.
7.u. Copy sketches and features of a model.

8. Assemble parts using parametric assembly concepts.

Assessment Strategies

8.1. Upon completion of homework and reading assignments.
8.2. Upon completion of guided practice in lab.
8.3. After attending all lectures, demos and labs.

Criteria

You will know you are successful when

8.1. you produce models components of an assembly.
8.2. you produce an assembly model using the component models.
8.3. you produce a set of drawings with an exploded view and bill of material.

Learning Objectives

8.a. Differentiate between local (bottom-up) and external (top-down) assemblies.
8.b. Bring component parts into Assembly file.
8.c. Analyze relationships between parts.
8.d. Differentiate types of constraints and conditions.
8.e. Use Browser or Feature-Manager Tree to list and control parts and assemblies.
8.f. Place components together using assembly constraints and conditions.
8.g. Control the visibility of a part.
8.h. Display or hide work features of the current part, work objects and parts of the assembly.
8.i. Differentiate between six degrees of freedom: translational and rotational.
8.j. Control the visibility of the Degrees of Freedom symbol.
8.k. Create multiple local parts in the assembly file (bottom-up).
8.l. Create multiple instances in the same file.
8.m. Edit external parts.
8.n. Create a new part based on existing parts.

8.o. Differentiate between local and external parts.
8.p. Create parts in individual files and External Reference component files to assembly file (top-down).
8.q. Check for interference.
8.r. Edit constraints.

9. Conceptualize and model components of a given assembly.

Assessment Strategies

9.1. After attending all lectures, demos and labs.
9.2. Upon successful completion of all prior tutorials and lab assignments.
9.3. After measuring existing assembly in Engineering Design and Communication course.
9.4. Upon successful completion of sketches in Engineering Design and Communication course.
9.5. After determining correct modeling procedure for each part.

Criteria

You will know you are successful when

9.1. you complete accurate models of each component.

Learning Objectives

9.a. Disassemble an existing assembly (Introduction to Engineering Communication).
9.b. Measure each part (Introduction to Engineering Communication).
9.c. Sketch each part (Introduction to Engineering Communication).
9.d. Decide on best method to create 3D part: Extrude, Revolve, Sweep.
9.e. Create fully constrained profiles, and paths and create models of each component of the assembly.
9.f. Create constrained sub-assemblies and assemblies using bottom-up and top-down assembly methods.

10. Differentiate between dimensioning and tolerancing methods and understand the effect of each.

Assessment Strategies

10.1. After attending all lectures, demos and labs.
10.2. Upon completion of sketching assignments and worksheets.
10.3. Upon attending class in Engineering Design and Communication course
10.4. Upon successful completion of assignments in Engineering Design and Communication course.

Criteria

You will know you are successful when

10.1. you compare types of dimensioning and tolerancing methods.
10.2. you prepare correctly dimensioned layouts of component models.

Learning Objectives

10.a. Interpret and use ANSI Y14.5 drafting standards and symbology on all drawing layouts.
10.b. Identify dimensioning terminology.
10.c. Evaluate dimensioning systems.
10.d. Dimension a series of working drawings based on a required engineering function of the part.
10.e. Differentiate between unilateral, bilateral tolerancing and limits.
10.f. Interpret tolerancing methods.

11. Complete working drawings and views of parametric models using acceptable industry standards.

Assessment Strategies

11.1. Upon completion of demonstration by instructor
11.2. After guided practice with instructor.
11.3. Upon independent practice during scheduled and open lab hours.
11.4. Upon successful completion of tutorials.
11.5. Upon successful completion of lab assignments.

Criteria

You will know you are successful when

11.1. you draw dimensioned views of models.
11.2. you produce a complete set of printed drawings of assembly components.

Learning Objectives

11.a. Differentiate and switch between modeling, assembly, drawing and scene mode.
11.b. Set up a drawing layout for a sheet size and plotter device.
11.c. Identify types of views required to define part.
11.d. Extract base view and other orthographic, isometric, and, sectional views as required.
11.e. Move views.
11.f. Delete views.
11.g. Change a view.
11.h. Hide and unhide drawing features.
11.i. Hide and move parametric dimensions.
11.j. Align parametric dimensions.
11.k. Set up dimension styles.
11.l. Add reference dimensions.
11.m. Edit parametric and reference dimensions.
11.n. Use tolerance modeling.
11.o. Add titleblock, notes and other annonations.
11.p. Add centerlines.
11.q. Add symbols.
11.r. Add balloons and insert a parts list.
11.s. Edit balloons and parts list.

12. Revise and update working drawings.

Assessment Strategies

12.1. Upon successful completion of lab assignments.
12.2. Upon independent practice during scheduled and open lab hours.
12.3. Return of marked up prints from instructor.

Criteria

You will know you are successful when

12.1. you update parametric models.
12.2. you revise drawings.

Learning Objectives

12.a. Check work for accuracy.
12.b. Quick print drawings for instructor.
12.c. Study marked up prints.
12.d. Update models.
12.e. Record revisions made.
12.f. Update working drawings.
12.g. Print drawings.

13. Apply techniques needed for mathematical and scientific problem solving.

Assessment Strategies

13.1. In class or lab, home, and workplace.
13.2. With or without a calculator.
13.3. By hand or using parametric software.
13.4. Individually or collaboratively.

Criteria

You will know you are successful when

13.1. you measure components.
13.2. you calculate dimensions required to model parts.
13.3. you use geometry to define model.
13.4. you apply numeric values, equations and dimensions to define model.
13.5. you demonstrate problem solving steps to complete projects.

Learning Objectives

13.a. Use math to calculate dimensions.
13.b. Add and subtract fractions.

13.c. Read measuring devices.
13.d. Add and subtract decimals.
13.e. Add and subtact dimensions to find missing dimensions.
13.f. Use cartesian coordinate system for entering points and distances in software.
13.g. Use trigometry to find missing angles and lengths.
13.h. Calculate tolerances, clearance and interference fits.
13.i. Use problem solving techniques to complete project work.