Western Technical College

10606133 Parametric Design 2

Course Outcome Summary

Course Information

Description	Students will learn how to select and model drive systems including gears, chain drives, belt drives, and cams. Advanced software topics such as presentation files, using parameters to creating I-parts; derived parts and adaptivity will also be covered. We will also cover manufacturing requirements for castings, machined parts, sheet metal and welding. Correct drawing layout and annotation will be emphasized for detail and assembly drawings.
Career Cluster	Science, Technology, Engineering and Mathematics
Instructional Level	Associate Degree Courses
Total Credits	4
Total Hours	144

Pre/Corequisites

Pre/Corequisite 10606115 Parametric Design

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

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

Creo-Parametric E-Learning Software - $50. **Vendor:** Campus Shop. Required.

Success Abilities

1. Cultivate Passion: Enhance Personal Connections
2. Cultivate Passion: Expand a Growth-Mindset
3. Cultivate Passion: Increase Self-Awareness
4. Live Responsibly: Develop Resilience
5. Live Responsibly: Embrace Sustainability
6. Live Responsibly: Foster Accountability
7. Refine Professionalism: Act Ethically
8. Refine Professionalism: Improve Critical Thinking
9. Refine Professionalism: Participate Collaboratively
10. Refine Professionalism: Practice Effective Communication

High Impact Practices

1. Community Based Learning Project: a key learning outcome of this course is to connect academic learning and civic development while simultaneously addressing a community partner's needs, interests, or problems.

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. Select purchase parts
6. Produce and revise supporting engineering documentation
7. Evaluate manufacturing processes and materials for product development
8. Demonstrate awareness of product liability and industry standards
9. Meet design and production deadlines
10. Interpret and communicate technical concepts, designs, and documentation

Course Competencies

1. Create multiple parts using top-down approach

Assessment Strategies

1.1. By presenting ideas to others in group.
1.2. By completing assigned tasks within group.
1.3. By completion of group project for instructor.

Learning Objectives

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

2. Create a new part using the Split command.

Assessment Strategies

2.1. Attending lecture, demos and lab with no unexcused absences.
2.2. Obtain missed information and assignments from other students and/or instructor.
2.3. Read missed technical information.
2.4. Practice missed demonstrations.
2.5. Make up excused lab time.

Learning Objectives

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

3. Model component parts and mechanical system assemblies.

Assessment Strategies

3.1. In class or lab, home, and workplace.
3.2. With or without a calculator.
3.3. By hand or using parametric software.
3.4. Individually or collaboratively.

Criteria

You will know you are successful when

3.1. you calculate dimensions required to model parts.
3.2. you use geometry to define model.
3.3. you use numeric values, equations and dimensions to define model.
3.4. you demonstrate problem solving steps to complete projects.

Learning Objectives

3.a. Use math to calculate dimensions.
3.b. Add and subtract fractions.
3.c. Read measuring devices.
3.d. Add and subtract decimals.
3.e. Add and subtract dimensions to find missing dimensions.
3.f. Use trig to find missing angles and len
3.g. Calculate tolerances, clearance and interference fits.
3.h. Use problem solving techniques to complete project work.

4. Create advanced features on model.

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 create basic model using Extrude, Loft and Sweep.
4.2. you add features to models using Extrude, Loft and Sweep.
4.3. you add fillets and chamfers to model.
4.4. you add holes to model.
4.5. you control feature visibility.
4.6. you copy sketches, edges and features of model to create a new model.
4.7. you use workplanes, work axis and work points.

Learning Objectives

4.a. Differentiate between options of each command.
4.b. Use sketch planes to draw profiles on basic model.
4.c. Use construction lines and circles
4.d. Use work planes, axes and points
4.e. Establish work planes using work axis.
4.f. Use loft command to create base part
4.g. Use loft command to add/subtract from existing 3D part.

4.h. Control work feature visibility.

5. Create and use design parameters

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

Criteria

You will know you are successful when

5.1. you reorder features.
5.2. you replay steps in the creation of a part.
5.3. you determine the mass properties of a model.
5.4. you list parts.
5.5. you join, cut, and intersect using the Combine command.
5.6. you create a shelled part.
5.7. you add draft to faces.
5.8. you array features.
5.9. you create new parts using the Split command.
5.10. you create a table driven part.
5.11. you create a new part using the Mirror command.
5.12. you create and use design variables.

Learning Objectives

5.a. Create multiple parts or toolbodys in same drawing file.
5.b. Use Visibility command to hide and unhide objects and work features.
5.c. Find information about the part using Mass properties command.
5.d. List Parts or Features using List Part command.
5.e. Create Table-Driven Parts.
5.f. Use Variables between drawings.
5.g. Create and use Design Variables.
5.h. Join, cut, Intersect parts using the Combine command.
5.i. Create arrays of features.
5.j. Create a new part by Mirroring.
5.k. Split a face.
5.l. Create a new part using the Split command.
5.m. Create new parts from Split using Extrude, Revolve and Sweep.
5.n. Add draft to individual faces.
5.o. Create a shelled part.
5.p. Use surfaces to shape solids.
5.q. Review part creation using the Replay command.
5.r. Reorder features.
5.s. Suppress features.
5.t. Array features.
5.u. Copy features.
5.v. Scale a part.
5.w. Mirror a part.
5.x. Compress a part.

6. Select drive systems.

Assessment Strategies

6.1. After attending lecture.
6.2. Upon completion of guided practice in lab.
6.3. Upon completion of homework and reading assignments.

Learning Objectives

6.a. Define major, minor and pitch diameter of a thread.
6.b. Define the following terms related to fasteners: Tap drill size, clearance drill size, counterbored hole,

countersunk hole, and spotface.

6.c. Draw the following types of fasteners and the correct hole size for each: Machine screws, cap screws, bolts, studs.

6.d. Define and draw the specific types of head styles: hex, square, pan, oval, flat, fillister.

6.e. Define and draw the following types of point styles: cup, flat, cone, oval and half dog.

6.f. Describe the function of washer, nuts, miscellaneous fasteners and be able to draw each given the type and a Machinery's Handbook.

6.g. Describe a Metric fastener designation. Differentiate between metric and english.

6.h. Describe a Pipe Thread designation. Differentiate from screw thread designation.

6.i. Differentiate straight (NPS) from taper (NPT) and dryseal (NPSF or NPTF).

7. Develop models of castings.

Assessment Strategies

7.1. After attending lecture.

7.2. Given a CAD station and a dimensioned machining drawing of part or actual part.

7.3. Upon completion of homework and reading assignments.

7.4. Upon completion of guided practice.

Criteria

You will know you are successful when

7.1. you process drawings and documentation required to design and manufacture cast parts.

Learning Objectives

7.a. Provide a general definition for the casting process.

7.b. Describe how forming processes differ from other manufacturing processes.

7.c. Describe the factors that affect the selection of a specific casting process.

7.d. Define the terms: draft, gates, feeders, flash, parting lines, cores, patterns, and shrinkage.

7.e. Differentiate between the casting processes: Sand , shell, plaster permanent and investment mold, centrifugal, continuous and die casting.

7.f. Describe general design rules for cast parts, including wall thickness, use of rounds and fillets, minimum number of adjoining sections, design of ribs and spokes, selection of parting line.

7.g. Describe the special drafting practices applicable to casting drawings, including draft angles, parting lines, casting tolerance, machining allowances, limits on cast surfaces that must controlled, locating points, and surface texture.

7.h. Describe why cast parts must be designed to include rounds and fillets in part geometry.

8. Develop models of machined components.

Assessment Strategies

8.1. After attending lecture.

8.2. Given a CAD station and dimensioned sketch of casted part, and/or part itself.

8.3. Upon completion of guided practice in lab.

8.4. Upon completion of homework and reading assignments.

Criteria

You will know you are successful when

8.1. you work drawings of castings to be machined complete with all dimensions, symbology and information required to machine the part to final specifications.

Learning Objectives

8.a. Differentiate when a hole would be drilled rather than cored.

8.b. Describe the use of machining allowance.

8.c. Apply surface texture and material removal symbols.

8.d. Differentiate machining and casting operations on part.

8.e. Call out specifications, material and tolerancing on drawing.

8.f. Use datum or baseline dimensioning.

9. Develop formed part models.

Assessment Strategies

9.1. After attending lecture.

9.2. Upon completion of guided practice in lab.

9.3. Upon completion of homework and reading assignments.

Criteria

You will know you are successful when

9.1. you model and develop drawings of sheet metal formed parts.

Learning Objectives

9.a. Define the term development.
9.b. Translate gage thickness into inch or millimeter sizes.
9.c. Indicate how fold lines are represented on a drawing.
9.d. Differentiate between formed up and formed down.
9.e. Calculate bend and setback allowance.
9.f. Differentiate when to use bend or setback allowance.
9.g. Use correct dimensioning practices for various operations: Chain for fold dimensions, baseline for holes, slots, overall dimensions.
9.h. Use sheet metal software to develop models.

10. Introduce automatic assembly imates

Assessment Strategies

10.1. After attending lecture.
10.2. Upon completion of guided practice in lab.
10.3. Upon completion of homework and reading assignments.

Criteria

You will know you are successful when

10.1. you create models of plastic components.

Learning Objectives

10.a. Describe what properties plastics have that make them superior to metals when used as an engineering material.
10.b. Differentiate between thermoset and thermoform plastics.
10.c. Describe how plastic components can be fabricated.
10.d. Describe different methods of forming plastics.
10.e. Describe the special drafting practices applicable to plastics, including draft angles, parting lines, tolerances, shrinkage, and surface texture.

11. Prepare welded assemblies.

Assessment Strategies

11.1. After attending lecture.
11.2. Upon completion of guided practice in lab.
11.3. Upon completion of homework and reading assignments.

Criteria

You will know you are successful when

11.1. <Product> Individual component models and assembled model.

Learning Objectives

11.a. Identify and define components of a weld symbols.
11.b. List the basic types of welding joints.
11.c. Describe the welding process.
11.d. Describe the significance of the locations of arrow for welds.
11.e. Differentiate between arrow, other, and both sides.
11.f. Associate a welding process with correct symbology.
11.g. Associate a weld finish process with correct symbology and designation.
11.h. Apply field weld symbols.
11.i. Show how multiple operations are indicated by a weld symbol.
11.j. Use software t apply weld symbols to drawing layout.

12. Develop techniques for dimensioning, tolerancing, and fits.

Assessment Strategies

12.1. After attending lecture.
12.2. Upon completion of homework and reading assignments.
12.3. Upon completion of guided practice.

Criteria

You will know you are successful when

12.1. you produce drawings from which a part can be produced.
12.2. you include views necessary to explain the shape, the dimensions needed for manufacture, required specifications such as material and quantity, and tolerancing and fits.

Learning Objectives

12.a. Discuss why limits or tolerances on dimensions are required for interchangeable manufactured parts.
12.b. Define the following list of terms: actual size, basic size, design size, limits of size, nominal size, tolerance, bilateral tolerance, unilateral tolerance.
12.c. Specify the two ways in which tolerances are applied to dimensions.
12.d. Specify how tolerances may be indicated by local or general notes.
12.e. Define and calculate the following fits: running and sliding, locational clearance, locational transition, locational interference, and force or shrink.
12.f. Describe the function and use of tolerance grades from metric limits and fits.
12.g. Calculate fits and tolerances for metric-based designs.
12.h. Properly annotate fits of both inch and metric dimensioned parts.
12.i. Create dimension styles and use styles to dimension tolerances.

13. Conceptualize and model components of a given assembly.

Assessment Strategies

13.1. After attending all lectures, demos and labs.
13.2. After measuring existing assembly.
13.3. Upon successful completion of sketches.
13.4. After determining correct modeling procedure for each part.

Criteria

You will know you are successful when

13.1. you complete accurate models of each component.

Learning Objectives

13.a. Disassemble an existing assembly.
13.b. Measure each part.
13.c. Sketch each part.
13.d. Decide on best method to create 3D part: Extrude, Revolve, Sweep, Loft
13.e. Create 3D parts of Assembly.

14. Assemble parts using parametric assembly concepts.

Assessment Strategies

14.1. Upon completion of homework and reading assignments.
14.2. Upon completion of guided practice in lab.
14.3. After attending all lectures, demos and labs.

Criteria

You will know you are successful when

14.1. 3D Models of each components of an assembly.
14.2. Assembly of models.

Learning Objectives

14.a. Constrain using mate, flush, angle and insert.
14.b. Compare types of constraints.
14.c. Control the visibility of a part.
14.d. Display or hide work features of the current part, work objects and parts of the assembly.
14.e. Control the visibility of the Degrees of Freedom symbol.
14.f. Analyze relationships between parts.
14.g. Differentiate between six degrees of freedom: translational and rotational.

14.h. Differentiate between local (bottom-up) and external (top-down) assemblies.
14.i. Create multiple local parts in the assembly file (bottom-up).
14.j. Create a new part based on existing parts.
14.k. Create multiple instances in the same file.
14.l. Create parts in individual files and External Reference component files to assembly file (top-down).
14.m. Edit external parts.
14.n. Check for interference.
14.o. Edit constraints.
14.p. Browse, Add and Release directories and component parts using Assembly catalog.
14.q. Differentiate between local and external parts using the Assembly Catalog.
14.r. Use browser to list and control parts and assemblies.
14.s. Generate a Bill of Material for an assembly.

15. Create views of assemblies.

Assessment Strategies

15.1. Upon completion of homework and reading assignments.
15.2. Upon completion of guided practice in lab.
15.3. After attending all lectures, demos and labs.

Criteria

You will know you are successful when

15.1. Drawing layouts of assembled components.

Learning Objectives

15.a. Create scenes.
15.b. Change the explosion factor and update scenes.
15.c. Add trails between parts.
15.d. Edit scenes.
15.e. Edit trails.
15.f. Tweak the view.
15.g. Hide parts.
15.h. Copy a scene.
15.i. Create views of scenes.

16. Use Creo-Parametric to create models.

Assessment Strategies

16.1. Performance

Learning Objectives

16.a. Familiarize self to softwares' user interface, command entry and sequence, file preferences and options.

16.b. Sketch 2D geometry using 3D parametric software.

16.c. Constrain 2D geometry using dimensions and geometric constraints.
16.d. Create a basic parametric model.
16.e. Create features on model.

17. Use Creo-Parametric to create assemblies

Learning Objectives

17.a. Assemble parts using parametric assembly concepts.
17.b. Conceptualize and model components of a given assembly.

18. Use Creo Parametric to create drawings.

Learning Objectives

18.a. Complete working drawings and views of parametric models using acceptable industry standards.
18.b. Revise and update working drawings.
18.c. Create documentation of assemblies including Bill of Material, Balloons, other required documentation