WEST ISLIP HIGH SCHOOL
ENGINEERING TECHNOLOGY

COMPUTER AIDED DESIGN

COURSE SYLLABUS

2024-2025

INSTRUCTOR: MR. POPE / MR. BUONOMO

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A. DESCRIPTION

COMPUTER AIDED DESIGN (1220)

Year – Credit 1

Prerequisite: Design and Drawing for Production

Students will use design software to produce mechanical drawings with an emphasis placed on the continuation of the competencies established in Design and Drawing for Production. An introduction to Computer Aided Machining (CAM) and rapid prototyping using a 3D Printer will also be covered. This method of 3D design prepares students for how industry uses CAD in real world design projects.

B. ORGANIZATION

This is a lecture-lab course in which topics are presented by the instructor, practice drawings are explained, and assigned drawings are completed by students during class periods. This CAD course assumes minimal if any previous CAD experience or training.

C. COURSE OBJECTIVES

1. Introduce the use of 2D computer aided design software, to drafting procedures, and to acceptable standards of work in the industry.
2. Introduce 3D feature based parametric modeling software, various forms of graphical representation and to selection of visual representations appropriate to specific needs.
3. Orient students into developing well documented digital drawings and prepare them for plotting on a large format printer.
4. Introduce 3D printing technologies and design 3D models for fused deposition modeling on a Stratasys F170 FDM Printer and Prusa FDM Printers.
5. Introduce computer aided manufacturing, tool path design and related parametric modeling design to completed machined parts. CNC Plasma, CNC Lathe, CNC Mill

D. COURSE TOPICS - The course will cover the following topics:

1. Using an engineering notebook to keep detailed notes and record project ideas.
2. Basic math skills including: reading a ruler, reducing fractions, precision measurement and measuring with a dial caliper.
3. Introduction to Autodesk AutoCAD interface, file naming conventions, and saving files for class assignments.
4. Screen layout and drawing primitive objects (Snap, Grid, Line, Circle, Arc, Erase, Zoom, coordinate system)
5. Commands include: Object Snaps, Trim, Extend, Polygon, Tangent, Fillet and creating parallel geometries
6. Drawing floor plans with complex object layers
7. Using projection lines and creating orthographic drawings
8. Modify and update feature dimensions
9. Perform History based part modifications
10. Apply geometric constraints and create projected geometry
11. Using the BORN technique, parent/child relations in features
12. Suppressing Features and resolving undesired feature interactions
13. Create drawing layouts from solid models and apply proper dimensions
14. Create revolved features, mirror features and circular patterns.
15. Create and modify linear dimensions, and identify symmetrical features in designs.
16. Create swept, lofted and shell features.
17. Create parts in sheet metal modeler mode

18. Create parts in assembly modeler mode and create exploded assemblies.
19. Use the assemble command and drive constraint tool to create basic motion analysis and output associated simulation video file.
20. Introduction to 3D Printing using Stratasys F170 and Prusa MK4 printers. Creating 3D printed models from Inventor drawings.
21. Create an online profile at printables.com and post a 3D model, associated drawings and photos of completed classroom projects.
22. Introduction to Inventor CAM and tool path creation for CNC machining of parts.

E. TEXT AND SUPPLIES

1. Parametric Modeling with Autodesk Inventor 2024, by Randy H. Shih

2. Bound graph paper "Engineering Notebook"

F. GRADING PLAN

Coursework will be weighted as follows:

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1. Drawings / Projects / Unit Exams	70%
2. Engineering Notebook / Classroom Assignments	30%
Total	100%

1. DRAWINGS:

A drawing will be assigned for every class period. Each drawing will be graded unless there are major errors or omissions in which case it is returned for correction or completion. Drawings with minor detail or other non-conceptual errors will be graded as submitted and numerical grades will be given.

Drawing due dates will be given for each assignment. Drawings will be due at the end of class on the due date (unless specifically stated otherwise). If you are absent from class when a drawing is due, it will be accepted late -- but only if submitted immediately upon your return and

only if an acceptable "excuse" is presented. Due dates will not be changed because of earlier absences.

2. PARTICIPATION:

Students are expected to participate each day and should be ready to work as soon as the class period begins. Students working diligently and cooperatively on the assigned work will receive full participation credit. Students not fully utilizing the class period for CAD work will lose credit for classroom participation.

3. ENGINEERING NOTEBOOK:

All students are required to keep daily engineering notebook entries as outlined in the engineering notebook packet. Notebooks will be graded according to the rubric provided by the teacher. All thoughts, dimensions, mathematical computations and notes must be recorded in the engineering notebook, dated and indexed. Engineering notebook pages should never be torn out. The engineering notebook should be treated as a legal document and a representation of all work completed in class.

4. QUIZZES:

There will be weekly drawing-type and conceptual based quizzes. Quizzes will relate to current and previous topics. A quiz may be given at any time during any class period -- immediately after a lecture, at the beginning or end of a class, etc.

5. DRAWINGS AND DIGITAL PORTFOLIO:

Your recorded grades will be available for your review at any convenient time. Remember to keep all drawings and quizzes returned to you so that any discrepancies can be easily adjusted. In each chapter a practice drawing will be created and submitted for grading. Adobe PDF files will be created for each printed drawing and submitted for grading. A digital copy of the PDF file will be created and submitted for grading as a DIGITAL PORTFOLIO at the end of each QUARTER.

G. YOUR IDEAS, EVALUATIONS, ETC.

In general, your ideas, comments, suggestions, questions, grade challenges, etc. are welcome. Your discretion in these matters is expected, however. No part of your grade will be based on anything other than your coursework.

H. SUGGESTIONS FOR SUCCESS

For most students this will not be a "difficult" course. However, there will probably be some students who did well in academic courses where information was most important and who will be surprised at the relative difficulty of this course where drawing skills and visualization are most important. You are encouraged to take advantage of instructor extra help sessions.

Unit #	Length (weeks)	Topic Sequence	Scope
1	1	Introduction	● Course Introduction ● Engineering Lab Tour ● Introduction to Engineering Notebook
2	1	Ruler Review and Fraction Review	● Orthographic view ● Isometric views ● Section Drawings ● Fractional Math ● Reading a ruler
3	0	Chapter 1 – Introduction to Autodesk Inventor and Parametric modeling	● Development of Computer Geometric Modeling ● Feature-Based Parametric Modeling ● Startup Options and Units Setup ● Autodesk Inventor Screen Layout ● User Interface & Mouse Buttons
4	2	Chapter 2 - Parametric Modeling Fundamentals	● Create Simple Extruded Solid Models ● Understand the Basic Parametric ● Modeling Procedure ● Create 2D Sketches ● Understand the “Shape before Size” Design Approach ● Use the Dynamic Viewing Commands ● Create and Edit Parametric Dimensions
5	2	Chapter 3 - Constructive Solid Geometry Concepts	● Understand Constructive Solid Geometry Concepts ● Create a Binary Tree ● Understand the Basic Boolean Operations ● Set up GRID and SNAP Intervals ● Understand the Importance of Order of Features ● Create Placed Features

			• Use the Different Extrusion Options •
6	2	Chapter 4 - Model History Tree	• Understand Feature Interactions • Use the Part Browser • Modify and Update Feature Dimensions • Perform History-Based Part Modifications • Change the Names of Created Features • Implement Basic Design Changes
7	2	Chapter 5 - Parametric Constraints Fundamentals	• Create Parametric Relations • Use Dimensional Variables • Display, Add, and Delete Geometric Constraints • Understand and Apply Different Geometric Constraints • Display and Modify Parametric Relations • Create Fully Constrained Sketches
8	2	Chapter 6 - Geometric Construction Tools	• Apply Geometry Constraints • Use the Trim/Extend Command • Use the Offset Command • Understand the Profile Sketch Approach • Create Projected Geometry • Understand and Use Reference Geometry • Edit with Click and Drag • Use the Auto Dimension Command
9	2	Chapter 7 - Parent/Child Relationships	• Understand the Concept and Usage of the BORN Technique • Understand the Importance of Parent/Child Relations in Features • Use the Suppress Feature Option • Resolve Undesired Feature Interactions
10	3	Precision Measurement	• Precision Measurement • Using a dial caliper • Reverse Engineering the Lego Block • Introduction to 3D Printing • Slicing for 3D printing • Introduction to Inventor Assembly Modeling
11	3	Introduction to CNC Machining	• Various CNC Machine Overview • CNC Plasma cut logo design • G-Code programming and reading • Using CAM to create cutting profile • CNC plasma operation
12	2	Chapter 8 - Part Drawings and 3D Annotations	• Create Drawing Layouts from Solid Models • Understand Associative Functionality • Use the Default Borders and Title Block in the Layout Mode • Arrange and Manage 2D Views in Drawing Mode • Display and Hide Feature Dimensions • Create Reference Dimensions

			• Create 3D Model-Based Definition on Solid Models
13	2	Chapter 9 - Datum Features and Auxiliary Views	• Understand the Concepts and the Use of Work Features • Use the Different Options to Create Work Features • Create Auxiliary Views in 2D Drawing Mode • Create and Adjust Centerlines • Create Shaded Images in 2D Drawing Mode
14	5	Engineering Design Process	• Flat Pack Catapult Engineering Design • Laser Cutting • Kerf Compensation • Design Optimization • Assembly Instructions • Engineering Design Process • Advanced Inventor Assembly Modeling
15	2	Chapter 11 - Symmetrical Features in Designs	• Create Revolved Features • Use the Mirror Feature Command • Create New Borders and Title Blocks • Create Circular Patterns • Create and Modify Linear Dimensions • Use Autodesk Inventor's Associative Functionality • Identify Symmetrical Features in Designs
16	3	CNC Lathe Introduction	• CNC Chess Pawn Project • CNC Lathe capabilities • Chess Piece Design • Generating G-Code for the lathe • CNC Lathe operation
17	2	Chapter 12 - Advanced 3D Construction Tools	• Understand the Concepts Behind the Different 3D Construction Tools • Set up Multiple Work Planes • Create Swept Features • Create Lofted Features • Use the Shell Command • Create 3D Rounds & Fillets
18	2	Chapter 14 - Assembly Modeling – Putting It All Together	• Understand the Assembly Modeling Methodology • Create Parts in the Assembly Modeler Mode • Understand and Utilize Assembly Constraints • Understand the Autodesk Inventor DOF Display • Utilize the Autodesk Inventor Adaptive Design Approach • Create Exploded Assemblies
Total	**38**		