

The background is a detailed architectural floor plan of a house, overlaid with a large, semi-transparent drafting triangle and a pencil. The floor plan includes various rooms such as a Foyer, Family Room, Master Bedroom, and several other Bedrooms. Dimensions and technical notes are scattered throughout the drawing. The text is centered over the upper portion of the plan.

Passaic County Technical Institute

Wayne, NJ

**Architectural Drafting and
Design/CAD II**

January 2012

Architectural Drafting and Design/CAD II

I. Course Description

The first marking period of this course offers a student three-dimensional (3D) theory and design techniques necessary to work in drafting, design, engineering, and technical professions. Emphasis is placed on terminology and procedures used in pictorial drawings and pattern developments. Students are encouraged to develop an awareness of proper drafting techniques, the geometry of technical drawing, and new technological advancements in the field of drafting.

During the following marking periods, this course will offer an introduction to 3D computer-aided drafting and design from an interdisciplinary perspective, with a focus on process skills that include critical thinking, ethical reasoning, effective communication and self-directed learning.

The overall aim is to introduce the student to 3D computer-aided drafting and design practices and help them develop the necessary technical skills to communicate ideas in an understandable, efficient, and accurate manner.

This course provides instruction in preparing various types of basic technical drawings and three-dimensional drawings using computer based methods and industrial standard software. It also introduces the student to the many career opportunities available in the computer-aided drafting and design field, and prepares them to enter directly into the work environment or pursue further educational opportunities.

Safety

Shop safety procedures, as well as employment/"job site" safety considerations, will be stressed throughout this course.

Shop Safety Procedures

The location, purpose and use of all safety equipment in the classroom will be explained, demonstrated and periodically reviewed during the course. Students are required to pass a shop safety test and demonstrate safety rules and procedures daily. Safety hazards are to be reported to the instructor immediately. Evacuation and fire drill procedure will be demonstrated and practiced by the students routinely. Students are expected to follow all safety procedures. Failure to do so will result in disciplinary action.

Employment/"Job Site" Safety Considerations

The students will also gain awareness of safety considerations for employment and the job site. Safety clothing and equipment are demonstrated and explained. Students receive instruction in both computer and personal safety and will model safety practices.

II. Course Objectives / VII. Pacing Chart

Basic Manual Drafting and Design

Upon completion of the requirement of this course, students will be able to:

I. Revolutions – MP1 (9.4.12.B.2, 21, 59, 62, 73, 75)

- Explain the relationship between an auxiliary view and a revolution.
- Prepare a revolution about an axis perpendicular to a front plane.
- Prepare a revolution about an axis perpendicular to a top plane.
- Prepare a revolution about an axis perpendicular to a side plane.
- Prepare successive revolutions.
- Find the true length of a line by means of revolution.

II. Pictorial Drawings – MP1 (9.4.12.B.2, 21, 59, 62, 73, 75)

- Describe what a pictorial drawing is and why it is used.
- Sketch an object in isometric.
- Construct angles in isometric.
- Draw circles and arcs in isometric.
- Center isometric and oblique drawings on a drawing sheet.
- Construct from multiview drawings the five types of pictorial views: isometric, cavalier oblique, cabinet oblique, one-point perspective, and two-point perspective.
- Develop and construct simple exploded assembly drawings and cutaway pictorial drawings.

III. Pattern Development – MP1 (9.4.12.B.2, 21, 59, 62, 73, 75)

- Define pattern development.
- Prepare simple patterns using parallel line and radial line development methods.
- Develop patterns for cylinder, rectangular prism, truncated prism, truncated cylinder, pyramid, right rectangular pyramid, and cone.
- Describe what a wired edge, hem, and seam are and why they are used.
- Explain why it is necessary to allow additional material on pattern for hems, edges, and seams.

Computer-Aided Drafting and Design

Upon completion of the requirement of this course, students will be able to:

IV. Standard Blocks – MP2 (9.4.12.B.24, 59, 73, 75)

- Create and save blocks.
- Insert blocks into a drawing.
- Edit a block and update the block in a drawing.
- Create blocks as drawing files.
- Construct and use a symbol library.
- Purge unused content from a drawing.

V. Block Attributes – MP2(9.4.12.B.24, 59, 73, 75)

- Define attributes.
- Create and insert blocks that contain attributes.
- Edit attribute values and definitions in existing blocks.
- Create title blocks, revision blocks, and parts lists with attributes.
- Display attribute values in fields.

VI. Dynamic Blocks – MP2 (9.4.12.B.24, 59, 73, 75)

- Explain the function of dynamic blocks.
- Assign action parameters and actions to blocks.
- Modify parameters and actions.
- Apply visibility and lookup parameters.
- Use parameter sets.
- Constrain block geometry.
- Use a block properties table.

VII. Layouts – MP2(9.4.12.B.24, 59, 73, 75)

- Describe the purpose for and proper use of layouts.
- Begin to prepare layouts for plotting.
- Manage layouts.
- Use the Page Setup Manager to define plot settings.
- Use plot styles and plot style tables.
- Add layout content.
- Use floating viewports.
- Create properly scaled final drawings.
- Preview and plot layouts.

VIII. Annotative Objects – MP2 (9.4.12.B.24, 59, 73, 75)

- Explain the differences between manual and annotative object scaling.
- Specify objects as annotative.
- Create and use annotative objects in model space.
- Display annotative objects in scaled layout viewports.
- Adjust the scale of annotation according to a new drawing scale.
- Use annotative objects to help prepare multiview drawings.

IX. External References – MP2 (9.4.12.B.24, 59, 73, 75)

- Explain the function of external references.
- Attach existing drawings to the current drawing.
- Use DesignCenter and tool palettes to attach external references.
- Bind external references and selected dependent objects to a drawing.
- Edit external references in the current drawing.

X. Sheet Sets – MP2 (9.4.12.B.24, 59, 73, 75)

- Describe the functions of an AutoCAD sheet set.
- Create and manage sheet sets.
- Add subsets and sheets to a sheet set.
- Use sheet views.
- Insert callout and view label blocks.
- Create sheet list tables.
- Manage sheet set fields.
- Publish and archive a sheet set.

XI. Isometric Drawing - MP3 (9.4.12.B.24, 59, 73, 75)

- Set up a drawing file for an isometric drawing.
- Create an isometric drawing.
- Dimension and isometric drawing correctly.

XII. Introduction to Three-Dimensional Modeling – MP3 (9.4.12.B.24, 59, 73, 75)

- Describe how to locate points in 3D space.
- Describe the right-hand rule of 3D visualization.
- Explain the function of the ribbon.
- Display 3D objects from preset isometric viewpoints.
- Display 3D objects from any desired viewpoint.
- Set a visual style current.

XIII. Creating Primitives and Composites – MP3 (9.4.12.B.24, 59, 73, 75)

- Construct 3D solid primitives.
- Explain the dynamic feedback presented when constructing solid primitives.
- Create complex solids using the UNION command.
- Remove portions of a solid using the SUBTRACT command.
- Create a new solid from the interference volume between two solids.
- Create regions.

XIV. Mesh Modeling – MP3 (9.4.12.B.24, 59, 73, 75)

- Explain tessellation division and values.
- Create mesh primitives.
- Create a smoothed mesh object.
- Create a refined mesh object.
- Generate a mesh by converting a solid or surface.
- Generate a solid or surface by converting a mesh.
- Execute editing techniques on mesh objects.
- Create split face on a mesh.
- Produce an extruded mesh face.
- Apply a crease to mesh object gaps.

- Create and close mesh objects gaps.
- Create a new mesh face by collapsing a mesh face or edge.
- Merge mesh faces to form a single mesh face.
- Construct a new mesh face by spinning a triangular mesh face.
- Construct mesh forms.

XV. Viewing and Displaying Three-Dimensional Models – MP3 (9.4.12.B.24, 59, 73, 75)

- Use the navigation bar to perform a variety of display manipulation functions.
- Use the view cube to dynamically rotate the view of the model in 3D space.
- Use the view cube to display orthographic plan views of all sides on the model.
- Use steering wheels to display a 3D model from any angle.
- Render a 3D model.

XVI. Using Show motion to View a Model –MP3 (9.4.12.B.24, 59, 73, 75)

- Explain the show motion tool.
- Create still shots of 3D models.
- Create walk shots of 3D models.
- Create cinematic shots of 3D models.
- Reply single shots and sequence of shots.
- Change the properties of a shot.

XVII. Understanding 3D Coordinates and User Coordinate Systems – MP3 (9.4.12.B.24, 59, 73, 75)

- Describe rectangular, spherical, and cylindrical methods of coordinate entry.
- Draw 3D polylines.
- Describe the function of the world and user coordinate systems.
- Move the user coordinate system to any surface.
- Rotate the user coordinate system to any angle.
- Change the user coordinate system to match the plane of a geometric object.
- Use a dynamic UCS.
- Save and manage user coordinate systems.
- Restore and use named user coordinate systems.
- Control user coordinate system icon visibility in viewports.

XVIII. Using Model Space and Viewports - MP3 (9.4.12.B.24, 59, 73, 75)

- Describe the function of model space viewports.
- Create and save viewport configurations.
- Alter the current viewport configuration.
- Use multiple viewports to construct a drawing.

XIX. Text and Dimensions in 3D – MP3 (9.4.12.B.24, 59, 73, 75)

- Create text with a thickness.
- Draw text that is plan to the current view.
- Dimension a 3D drawing.

XX. Model Extrusions and Revolutions – MP3 (9.4.12.B.24, 59, 73, 75)

- Create solids and surfaces by extruding 2D profiles.
- Extrude planar surfaces.
- Create symmetrical 3D solids and surfaces by revolving 2D profiles.
- Revolve planar surfaces.
- Extrude and revolve objects using mathematical expressions and constraints.
- Use solid extrusions and revolutions and construction tools.

XXI. Sweeps and Lofts - MP3 (9.4.12.B.24, 59, 73, 75)

- Sweep 2D shapes along a 2D or 3D path to create a solid or surface object.
- Create 3D solid or surface objects by lofting a series of cross sections.

XXII. Creating and Working with Solid Model Features – MP3 (9.4.12.B.24, 59, 73, 75)

- Change properties on solids.
- Align objects.
- Rotate and move objects in three dimensions.
- Create 3D arrays.
- Fillet and chamfer solid objects.
- Thicken a surface into a solid.
- Convert planar objects into surfaces.
- Sculpt watertight surfaces into solids.
- Slice a solid using various methods.
- Construct details on solid models.
- Remove features from solid models.

XXIII. Subobject Editing – MP3 (9.4.12.B.24, 59, 73, 75)

- Select subobjects (faces, edges, and vertices).
- Edit solids using grips.
- Edit fillet and chamfer subobjects.
- Edit face, edge, and vertex subobjects.
- Extrude a closed boundary.

XXIV. Solid Model Editing – MP3 (9.4.12.B.24, 59, 73, 75)

- Change the shape and configuration of solid object faces.
- Copy and change the color of solid object edges and faces.
- Break apart a composite solid composed of physically separate entities.
- Extract a wireframe to project edges from a 3D solid.

XXV. Solid Model Display and Analysis – MP3 (9.4.12.B.24, 59, 73, 75)

- Control the display of solid models.
- Construct a 3D section plane through a solid model.
- Adjust the size and location of section planes.
- Create a dynamic section of a 3D solid model.
- Construct 2D and 3D section blocks.
- Create flat, 2D projection of a 3D solid model.
- Create multiview layout of a solid model.
- Construct a profile of a solid.
- Perform an analysis of a solid model.
- Export and import solid model data.

XXVI. Visual Style Settings and Basic Rendering – MP3 (9.4.12.B.24, 59, 73, 75)

- Describe the Visual Style Manager palette.
- Change the settings for visual styles.
- Create custom visual styles.
- Export visual styles to a tool palette.
- Render a scene using sunlight.
- Save a rendered image from the Render window.

XXVII. Materials in AutoCAD – MP4 (9.4.12.B.24, 59, 73, 75)

- Attach materials to the objects in a drawing.
- Change the properties of existing materials.
- Create new materials.

XXVIII. Lighting – MP4 (9.4.12.B.24, 59, 73, 75)

- Describe the types of lighting in AutoCAD.
- List the user-created lights available in AutoCAD.
- Change the properties of lights.
- Generate and modify shadows.
- Add a background to your scene and control its appearance.

XXIX. Advanced Rendering – MP4 (9.4.12.B.24, 59, 73, 75)

- Make advanced rendering settings.
- Set the resolution for a rendering.
- Save a rendering to an image file.
- Add fog/depth cueing to a scene.

XXX. Cameras, Walkthroughs, and Flybys – MP4 (9.4.12.B.24, 59, 73, 75)

- Create a camera to define a static 3D view.
- Activate and adjust front and back clipping planes.
- Record a walkthrough of a 3D model to a movie file.

- Record a flyby of a 3D model to a movie file.
- Create walkthroughs and flybys by following a path.
- Control the viewpoint, speed, and quality of the animation.

XXXI. Using Raster, Vector and Web Graphics –MP4 (9.4.12.B.24, 59, 73, 75)

- Compare raster and vector files.
- Import and export raster and vector files using AutoCAD.
- Set image commands to manipulate inserted raster files.
- Create DWF, DWFx, and PDF files.

III. Methods of Student Evaluation

Teachers Method of Assessment:

- Tests
- Quizzes
- Exercise drawings
- Project Drawings
- Notebook
- Class Participation
- Portfolio

Attendance and discipline are in accordance with Board of Education policy

IV. Textbooks and Instructional Materials and Software

I. Selected Textbooks

- Terence M. Shumaker/David A. Madsen; AutoCAD and Its Applications – Basic, Goodheart-Wilcox Publishing Co., Tinley Park, Illinois, 2011
- Terence M. Shumaker/David A. Madsen; AutoCAD and Its Applications – Advanced, Goodheart-Wilcox Publishing Co., Tinley Park, Illinois, 2011
- Terry T. Wohlers; Applying AutoCAD 2011, Glencoe-McGraw Hill Publishing Co., Peoria Illinois, 2011

II. Supplemental Instructional Materials

- Henry Cecil Spencer/John Thomas Dygdon/James E. Novack; Basic Technical Drawing, Glencoe-McGraw Hill Publishing Co., Peoria Illinois, 2004
- Giesecke/Mitchell/Spencer/Hill/Dygdon/Novak; Technical Drawing, Pearson Education Inc. Prentice Hall, Upper Saddle River, NJ, 2003
- John R. Walker/Bernard D. Mathis; Exploring Drafting, Goodheart-Wilcox Publishing Co., Tinley Park, Illinois, 2003

III. Selected Software

- AutoCAD; Autodesk Inc., Available per the Information Technology Department and according to copyright protection laws.

V. Instructional Strategies and Evaluation System

This curriculum will incorporate a variety of teaching methods to encourage self-motivation, participation and enthusiasm. Students will experience: lecture and demonstration, individual drawings and projects, research projects, work-based learning/professional development activities and portfolio preparation.

Requirements

Students will be responsible to maintain:

- Notebook
- Participation productivity grades
- Projects
- Drawings
- Research projects
- Job sheets
- Time sheets
- Portfolio
- Evaluations
- Exam activities

VII. Scope and Sequence Chart

Key: I – Introduced, D – Developed, R – Reinforced

SKILLS TO BE LEARNED	SUGGESTED GRADE LEVELS			
	9	10	11	12
1. Knowledge of all safety procedures.	IDR	R		
2. Identify current and emerging careers related to drafting.	IDR	R		
3. Explain the importance and develop freehand multiview and pictorial sketches.	ID	R		
4. Use basic drafting tools and equipment properly and efficiently to produce technical drawings.	ID	R		
5. Demonstrate the ability to create drawings using engineering and architect scales.	ID	R		
6. Demonstrate the ability to the correct line techniques used in drafting and design.	ID	R		
7. Solve technical and mathematical problems through geometric constructions using drafting instruments and a CAD system.	ID	R		
8. Demonstrate the ability to write legibly by using standard lettering used in drafting and design.	ID	R		
9. Determine the number of views needed to describe fully the shape and size of an object.	ID	R		
10. Develop a multiview drawing from the initial idea to a finished drawing using drafting instruments and CAD system.	ID	R		
11. Use board drafting and CAD to add dimensions, notes and symbols to a technical drawing.	ID	R		
12. Differentiate between size dimensions and location dimensions.	ID	R		
13. Use ANSI and ISO standards for dimensions and notes.	I	D		
14. Prepare a drawing with sectional views using both board drafting techniques and CAD.	ID	R		
15. Prepare a drawing with auxiliary views using both board drafting techniques and CAD.	ID	R		
16. Produce detail drawings, assembly drawings and assembly working drawings.	ID	R		
17. Develop a standard bill of materials.	ID	R		
18. Compute fractions, decimals and basic trigonometry to solve related mathematics.	ID	R		
19. Knowledge of the components of a computer-aided (CAD) system.	ID	R		
20. Use computer-aided drafting (CAD) system properly and efficiently to produce technical drawings.	ID	R		
21. Prepare a drawing with revolutions using both board drafting techniques and CAD.		IDR		
22. Create isometric, oblique and perspective pictorial drawings using board drafting or CAD techniques.		ID		
23. Create a drawing with pattern developments using both board drafting techniques and CAD.		IDR		
24. Create and utilize block libraries in CAD.		ID		
25. Use CAD properly and efficiently to produce three-dimensional objects.		ID		
26. Apply materials and lighting to CAD drawings.		ID		
27. Create renderings in CAD.		ID		

Architectural Drafting and Design/CAD II

Course Description

The first marking period of this course offers a student three-dimensional (3D) theory and design techniques necessary to work in drafting, design, engineering, and technical professions. Emphasis is placed on terminology and procedures used in pictorial drawings and pattern developments. Students are encouraged to develop an awareness of proper drafting techniques, the geometry of technical drawing, and new technological advancements in the field of drafting.

During the following marking periods, this course will offer an introduction to 3D computer-aided drafting and design from an interdisciplinary perspective, with a focus on process skills that include critical thinking, ethical reasoning, effective communication and self-directed learning.

The overall aim is to introduce the student to 3D computer-aided drafting and design practices and help them develop the necessary technical skills to communicate ideas in an understandable, efficient, and accurate manner.

This course provides instruction in preparing various types of basic technical drawings and three-dimensional drawings using computer based methods and industrial standard software. It also introduces the student to the many career opportunities available in the computer-aided drafting and design field, and prepares them to enter directly into the work environment or pursue further educational opportunities.

Proficiencies

Upon successful completion of the requirements of this course, the students will be able to:

1. Recall and demonstrate proper adherence to shop safety rules with 100% accuracy.
2. Demonstrate an understanding of revolutions.
3. Demonstrate an understanding of the five types of pictorial views: isometric, cavalier oblique, cabinet oblique, one-point perspectives, and two-point perspectives.
4. Demonstrate an understanding of pattern development.
5. Explain and demonstrate an understanding of blocks and block libraries used in AutoCAD.
6. Identify and utilize the tool used in AutoCAD in order to create the various pictorial drawings used in drafting and design.
7. Demonstrate an understanding of the User Coordinate Systems used in AutoCAD.
8. Explain the differences between model space and paper space in AutoCAD.
9. Identify and utilize the tool used to create various three-dimensional objects in AutoCAD.
10. Demonstrate an understanding of text and dimensioning in 3D using AutoCAD.

11. Identify and utilize the tool used to edit three-dimensional objects in AutoCAD.
12. Demonstrate an understanding of the various Visual Styles used in AutoCAD.
13. Demonstrate an understanding of materials used in AutoCAD.
14. Demonstrate an understanding of lighting and rendering used in AutoCAD.
15. Explain and calculate mathematical functions for drafting and design problems.
16. Explain and demonstrate the same principles used in manual drafting and design in AutoCAD.