Passaic County Technical Institute

Wayne, NJ

Architectural Drafting and Design/CAD I

January 2012

Architectural Drafting and Design/CAD I

I.   Course Description

All four marking periods of this course offers a student the basic theory and design techniques necessary to work in drafting, design, engineering, and technical professions. Emphasis is placed on terminology and procedures used in multiview projection, auxiliary and sectional views, dimensioning, and working drawings. 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.

This course will also offer an introduction to basic 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 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 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. Drafting and Its Related Careers - MP1 (9.3.4.A.1,2,3,4,5,6)
- Identify many fields of drafting and design.
- Cite why drafting is called a universal language.
- Explain why drawings are often the best way to describe or show ideas.
- Describe, in a limited way, the technological changes in the ways drawings are made and stored.
- Identify many career possibilities related to the field of drafting and design.
- Cite many of the skills needed to prepare for various fields the use drafting.
- Identify the traits of leadership.
- Summarize the role of leadership in society and how it relates to drafting technology.
- Describe what to expect when entering the world of work.
- Identify sources of information about careers in drafting technology.

II. Sketching - MP1 (9.4.12.B.7, 11, 17, 18, 59)
- Demonstrate sketching skills and techniques.
- Apply the "alphabet of lines" to a drawing.
- Sketch basic geometric shapes.
- Enlarge and reduce the drawn size of an object by the graph method.

III. Drafting Equipment - MP1 (9.4.12.B.59, 75)
- Identify basic drafting equipment.
- Use drafting equipment in a safe and efficient manner.
- Explain the terms CAD and CADD.
- Explain why the principles of drafting are common to both traditional drafting and CAD.

IV. Drafting Techniques - MP1 (9.4.12.B.59, 72, 75)
- Demonstrate basic drafting skills.
- Use basic drafting skills and techniques when solving drawing problems.
- Identify the various drafting scales.
- Make accurate measurements using various drafting scales.

V. Basic Geometric Construction - MP1 (9.4.12.B.18, 59, 75)
- Identify basic geometric shapes.
- Bisect a line, arc and angle.
- Transfer an angle.

- Construct various basic geometric shapes.
- Draw tangent arcs to various lines and arcs given.
- Divide a line into a given number of equal divisions.
- Construct an ellipse using several methods.

VI. Lettering - MP1 (9.4.12.B.59, 75)
- Produce neat lettering.
- Demonstrate the difference between vertical and inclined lettering.
- Identify several lettering aids and devices.

VII. Multiview Drawings – MP1 (9.4.12.B.2, 21, 59, 62, 73, 75)
- Explain what a multiview drawing is.
- Define orthographic projection.
- Use orthographic projection to develop multiview drawings.
- Identify the views necessary to make a multiview drawing.
- Locate multiview drawings on the drawing sheet.
- Transfer points between views when making multiview drawings, by proper use of the mitre line.

VIII. Dimensioning and Notes – MP2 (9.4.12.B.59, 73, 75)
- Explain why dimensions and notes are needed on drawings.
- Describe the difference between unidirectional and aligned dimensioning.
- Apply the general rules for dimensioning inch and/or metric drawings.
- Demonstrate proper dimensioning of circles, holes and arcs.

IX. Sectional Views – MP2 (9.4.12.B.2, 21, 59, 62, 73, 75)
- Describe what a sectional view is and why it is used.
- Explain when a sectional view is needed.
- Draw sectional views when required.
- Apply the multiple types of sectional views to various drawings.

X. Auxiliary Drawings – MP2 (9.4.12.B.2, 21, 59, 62, 73, 75)
- Describe what an auxiliary drawing is and why it is used.
- Explain why an auxiliary view is constructed perpendicular to an angular surface.
- Develop and draw simple auxiliary views.

XI. Working Drawings – MP4 (9.4.12.B.2, 21, 59, 62, 73, 75)
- Explain why working drawings are needed.
- Discuss the differences between detail drawings and assembly drawings.
- Identify the information provided on working drawings.
- Prepare simple detail and assembly drawings.

Computer-Aided Drafting and Design

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

XII.   Introduction to AutoCAD – MP2 (9.4.12.B.24, 59, 73, 75)
- Define computer-aided design and drafting.
- Describe typical AutoCAD applications.
- Explain the value of planning your work and system management.
- Describe the purpose and importance of drawing standards.
- Demonstrate how to start and exit AutoCAD.
- Recognize the AutoCAD interface and access AutoCAD tools.
- Use help resources.

XIII.   Drawings and Templates – MP2 (9.4.12.B.24, 59, 73, 75)
- Begin a new drawing.
- Save drawings.
- Close files.
- Open saved files.
- Work with multiple open documents.
- View and adjust drawing units and limits.
- Create drawing template files.

XIV.   Introduction to drawing and Editing – MP2 (9.4.12.B.24, 59, 73, 75)
- Use appropriate values when responding to prompts.
- Apply basic viewing methods.
- Draw given objects using the LINE tool.
- Describe and use basic drawings aids.
- Use the ERASE, UNDO, U, REDO and OOPS tools appropriately.
- Create selection sets using various selection options.

XV.   Basic Object Tools – MP2 (9.4.12.B.24, 59, 73, 75)
- Draw circles using CIRCLE tool options.
- Draw arcs using the ARC tool options.
- Use the ELLIPSE tool to draw ellipses and elliptical arcs.
- Use the PLINE tool to draw polylines.
- Draw rectangles using the RECTANGLE tool options.
- Draw donuts and filled circles using the DONUT tool.
- Draw true curves using the SPLINE tool.

XVI.   Line Standards and Layers – MP2 (9.4.12.B.24, 59, 73, 75)
- Describe basic line conventions.
- Explain how drawing layers are used in various drafting fields.
- Create and manage layers.

- Draw objects on separate layers.
- Use DesignCenter to copy layers and linetypes between drawings.

XVII. View Tools and Basic Plotting – MP2 (9.4.12.B.24, 59, 73, 75)
- Adjust the display window to view specific portions of a drawing.
- Use display tools transparently.
- Control object display order.
- Isolate or hide selected objects.
- Create named views for instant recall.
- Create multiple viewports in the drawing window.
- Perform general utility tasks such as regenerating and cleaning the screen.
- Print and plot drawings.

XVIII. Object Snap and AutoTrack – MP2 (9.4.12.B.24, 59, 73, 75)
- Set running object snap modes for continuous use.
- Use object snap overrides for single point selections.
- Select appropriate object snaps for various drawing tasks.
- Use AutoSnap features to speed up point specifications.
- Use AutoTrack to locate points relative to other points in a drawing.

XIX. Construction Tools and Multiview Drawings – MP2 (9.4.12.B.24, 59, 73, 75)
- Use the OFFSET tool to draw parallel and concentric objects.
- Place construction points.
- Mark points on objects at equal lengths using the DIVIDE tool.
- Mark points on objects at designated increments using the MEASURE tool.
- Create construction lines using the XPLINE and RAY tools.
- Create multiview drawings.

XX. Text Styles and Multiline Text – MP2 (9.4.12.B.24, 59, 73, 75)
- Describe and use proper text standards.
- Calculate drawing scale and text height.
- Develop and use text styles.
- Use the MTEXT tool to create multiline text objects.

XXI. Single-Line Text and Additional Text Tools – MP2 (9.4.12.B.24, 59, 73, 75)
- Use the TEXT tool to create single-line text.
- Insert and use fields.
- Check spelling.
- Edit existing text.
- Search for and replace text automatically.

XXII.   Modifying Objects – MP2 (9.4.12.B.24, 59, 73, 75)
- Use the FILLET tool to draw fillets, rounds and other radius corners.
- Place chamfers and angled corners with the CHAMFER tool.
- Separate objects using the BREAK tool and combine objects using the JOIN tool.
- Use the TRIM and EXTEND tools to edit objects.
- Change objects using the STRETCH and LENGTHEN tools.
- Edit the size of objects using the SCALE tool.
- Use the EXPLODE tool.

XXIII.   Arranging and Patterning Objects – MP2 (9.4.12.B.24, 59, 73, 75)
- Relocate objects using the MOVE tool.
- Change the angular positions of objects using the ROTATE tool.
- Use the ALIGN tool to move and rotate objects at the same time.
- Make copies of objects using the COPY tool.
- Draw mirror images of objects using the MIRROR tool.
- Use the REVERSE tool.
- Create patterns of objects using the ARRAY tool.

XXIV.   Grips, Properties and Additional Selection Techniques – MP2 (9.4.12.B.24, 59, 73, 75)
- Use grips to stretch, move, rotate, scale, mirror and copy objects.
- Adjust object properties using the Quick Properties panel and the Properties palette.
- Use the MATCHPROP tool to match object properties.
- Edit between drawings.
- Use the ADDSELECTED tool to draw an object based on an existing object.
- Create selection sets using the SELECTSIMILAR and Quick Select tools.
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XXV.   Polyline and Spline Editing Tools – MP3 (9.4.12.B.24, 59, 73, 75)
- Edit polylines with the PEDIT tool.
- Use context-sensitive polyline grip tools.
- Create polyline boundaries.
- Edit splines with the SPLINEEDIT tool.
- Use context-sensitive polyline grip tools.
- Convert polylines and splines.

XXVI.   Obtaining Drawing Information – MP3 (9.4.12.B.24, 59, 73, 75)
- Identify the point location and basic object dimensions.
- Find the distance between points.
- Measure radii, diameters and angles.
- Calculate area.

- List data related to a single point, an object, a group of objects or an entire drawing.
- Determine the drawing status.
- Determine the amount of time spent in a drawing sessions.
- Perform calculations using the QuickCalc calculator.

XXVII. **Dimension Standards and Styles – MP3 (9.4.12.B.24, 59, 73, 75)**
- Describe common dimension standards and practices.
- Create dimension styles.
- Manage dimensions styles.

XXVIII. **Linear and Angular Dimensioning – MP3 (9.4.12.B.24, 59, 73, 75)**
- Add linear dimensions to a drawing.
- Add angular dimensions to a drawing.
- Draw datum and chain dimensions.
- Dimension multiple objects using the QDIM tool

XXIX. **Dimensioning Features and Alternate Practices – MP3 (9.4.12.B.24, 59, 73, 75)**
- Dimension circles and arcs.
- Create and use multileader styles.
- Draw leaders using the MLEADER tool.
- Apply alternate dimensioning practices.
- Dimension using the DIMORDINATE tool.
- Mark up a drawing using REVCLOUD and WIPEOUT tools.

XXX. **Dimensioning and Tolerances – MP3 (9.4.12.B.24, 59, 73, 75)**
- Define and use dimensioning and tolerancing terminology.
- Set the precision for dimensions and tolerances.
- Set up the primary units for use with inch and metric dimensions.
- Create and use specified tolerance dimension styles.
- Explain the purpose of geometric dimensioning and tolerancing (GD&T)

XXXI. **Editing Dimensioning – MP3 (9.4.12.B.24, 59, 73, 75)**
- Describe and control associative dimensions.
- Control the appearance of existing dimensions and dimension text.
- Update dimensions to reflect the current dimension style.
- Override dimension style settings and match dimension properties.
- Change dimension line spacing and alignment.
- Break dimension, extension and leader lines.
- Create inspection dimensions.
- Edit existing multileaders.

XXXII.   Parametric Drafting – MP3 (9.4.12.B.24, 59, 73, 75)
- Explain parametric drafting processes and applications.
- Create and edit parametric drawings.
- Add and manage geometric constraints.
- Add and manage dimensional constraints.
- Adjust the form of dimensional constraints.

XXXIII.   Section Views and Graphic Patterns – MP4
- Identify sectioning techniques.
- Add graphic patterns using the HATCH tool.
- Insert hatch patterns using DesignCenter and tool palettes.
- Edit existing hatch patterns.

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; <u>AutoCAD and Its Applications – Basic</u>, Goodheart-Wilcox Publishing Co., Tinley Park, Illinois, 2011
- Terry T. Wohlers; <u>Applying AutoCAD 2011</u>, Glencoe-McGraw Hill Publishing Co., Peoria Illinois, 2011

II. **Supplemental Instructional Materials**
- Henry Cecil Spencer/John Thomas Dygdon/James E. Novack; <u>Basic Technical Drawing</u>, Glencoe-McGraw Hill Publishing Co., Peoria Illinois, 2004
- Giesecke/Mitchell/Spencer/Hill/Dygdon/Novak; <u>Technical Drawing</u>, Pearson Education Inc. Prentice Hall, Upper Saddle River, NJ, 2003
- John R. Walker/Bernard D. Mathis; <u>Exploring Drafting</u>, 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

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

Architectural Drafting and Design/CAD I

VI.   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			
2. Identify current and emerging careers related to drafting.	IDR			
3. Explain the importance and develop freehand multiview and pictorial sketches.	ID			
4. Use basic drafting tools and equipment properly and efficiently to produce technical drawings.	ID			
5. Demonstrate the ability to create drawings using engineering and architect scales.	ID			
6. Demonstrate the ability to the correct line techniques used in drafting and design.	ID			
7. Solve technical and mathematical problems through geometric constructions using drafting instruments and a CAD system.	ID			
8. Demonstrate the ability to write legibly by using standard lettering used in drafting and design.	ID			
9. Determine the number of views needed to describe fully the shape and size of an object.	ID			
10. Develop a multiview drawing from the initial idea to a finished drawing using drafting instruments and CAD system.	ID			
11. Use board drafting and CAD to add dimensions, notes and symbols to a technical drawing.	ID			
12. Differentiate between size dimensions and location dimensions.	ID			
13. Use ANSI and ISO standards for dimensions and notes.	I			
14. Prepare a drawing with sectional views using both board drafting techniques and CAD.	ID			
15. Prepare a drawing with auxiliary views using both board drafting techniques and CAD.	ID			
16. Produce detail drawings, assembly drawings and assembly working drawings.	ID			
17. Develop a standard bill of materials.	ID			
18. Compute fractions, decimals and basic trigonometry to solve related mathematics.	ID			
19. Knowledge of the components of a computer-aided (CAD) system.	ID			
20. Use computer-aided drafting (CAD) system properly and efficiently to produce technical drawings.	ID			

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Course Description

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This course provides instruction in preparing various types of basic technical 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. Explain the importance of drafting and design the language of industry as well as the various careers in drafting.
3. Explain and demonstrate the importance of freehand sketching in the field of drafting and design.
4. Properly use all types of drafting tools and related equipment commonly used in drafting and design.
5. Utilize various scales used in drafting and design.
6. Explain and demonstrate the correct line technique used in drafting and design.
7. Demonstrate a basic understanding of geometric construction and solve problems related to geometric construction.
8. Explain and demonstrate the correct lettering used in drafting and design.
9. Explain and demonstrate an understanding of orthographic projection techniques.
10. Explain and demonstrate proper layout of orthographic views.
11. Demonstrate correct placement of basic dimensioning.

12. Demonstrate a basic understanding of tolerances.
13. Demonstrate an understanding of sectional views.
14. Demonstrate an understanding of auxiliary views.
15. Demonstrate an understanding of working drawings and it components.
16. Explain and calculate mathematical functions for drafting and design problems.
17. Demonstrate a basic understanding of Computer Aided Drafting using AutoCAD software.
18. Explain and demonstrate the same principles used in manual drafting and design in AutoCAD.
19. Identify and utilize the tool used in AutoCAD in order to create the various two-dimensional drawings used in drafting and design.