

Course Title: *Advanced Mechanical Drafting and Design*

8/07

Credit: 1 Unit – 1 Year

Instructor: L. Westphal

Prerequisite: Successful completion of Mechanical Drafting 3

Text: TECHNICAL DRAWING, 12<sup>th</sup> Edition, Giesecke, Mitchell, Spencer, Hill, Dygdon, & Novak,

Course Purpose:

The purpose of this course is to give students who are seriously considering a career in mechanical drafting or related fields an opportunity to expand their knowledge and experience. The scope of this course will cover in greater depth previously learned material and introduce new areas such as geometric tolerancing, threads and fasteners, assembly drawings and solid modeling and design. Students considering careers in Mechanical Drafting and Design, Engineering, Tool & Die, CNC Machining, etc. will benefit from this course.

Course Outcomes:

The student will:

1. Review and apply proper mechanical drafting techniques, rules, standards.
2. Be able to properly use a 2-D Computer-Aided-Drafting program (Auto-CAD LT) to make mechanical drawings: multi-view working drawings, section views, auxiliaries (primary and secondary), and pictorials.
3. Be able to properly use a 3-D Solid Modeling CAD program (Solidworks) to draw solid models and assembly drawings
4. Learn and apply advanced drafting concepts such as geometric tolerancing and threads and fasteners.

Course Goals:

The student will:

1. Be prepared to matriculate smoothly into post-secondary drafting and design courses.
2. Appreciate the value of applying God's gifts of time and technical ability
3. Learn more about himself/herself as to his/her ability to think and see abstractly and problem solve.
4. Value his/her math, science, and English classes as they relate to the field of design and drafting.

Note: College credit (Introduction to AutoCAD - 2 cr. **and** Technical Drafting 1- 3 cr.) is available at Milwaukee Area Technical College for completion of this course with a "B" grade or better.

COURSE OUTLINE:

Unit 1: Geometric Construction

- \* Apply relevant geometric principles to construct various relationships between lines, arc, circles, etc. using instruments

Number of days: 14-16

S.O. – 6

D.O. – 3.4, 5.3, 5.4, 6.1, 6.2,

W.S.S. - A1, B1, B6, B8

## Unit 2: Review of CAD program - AUTOCAD LT

- \* Review all major set-up and drawing commands
- \* Apply reviewed material to basic mechanical drawing problems

Number of days: 14-16

S.O. – 6

D.O. – 3.3, 3.4, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - A1, A7, B1, B2, B3, B5, B6, B7, B8, D4

## Unit 3: Orthographic Projection

- \* Apply orthographic projection principles to one, two, and three view working drawings in the normal plane
- \* Apply proper dimensioning techniques to the above drawings

TEXT: Pg. 197-231

Number of days: 28-30

S.O. – 4, 6

D.O. – 3.3, 3.4, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - B8, C2, C9

## Unit 4: Section Views

- \* Learn proper line and hatching techniques as they apply to sectional views
- \* Learn proper drafting principles as they relate to full, half, revolved, removed, and aligned sections
- \* Demonstrate understanding of the above principles by making related drawings

TEXT: Pg. 285-314

Number of days: 25-30

S.O. – 6

D.O. – 3.3, 3.4, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - A1, B8, C2, C9

## Unit 5: Auxiliary Views

- \* Learn proper drafting principles as they relate to primary and secondary auxiliary views
- \* Demonstrate understanding of the above principles by making related drawings

TEXT: Pg. 315-327

Number of days: 13-16

S.O. – 2, 4, 6

D.O. – 3.3, 3.4, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - A1, B8, C2, C9

## Unit 6: Tolerancing

- \* Define the basic terms related to tolerancing
- \* Learn and apply the basic “fit” definitions
- \* Learn and apply the basic forms of size tolerancing
- \* Demonstrate understanding of the above principles by making related drawings

TEXT: Pg. 433-442

Number of days: 7-9

S.O. – 2, 4, 6

D.O. – 3.3, 3.4, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - A1, B1, B2, B5, B7, B8, C5

## Unit 7: Threads and Fasteners

- \* Given a diagram, identify the parts of a screw thread
- \* Identify the following thread symbols on a drawing; schematic, simplified, and detailed
- \* Demonstrate understanding of the above terms and concepts by making related drawings

TEXT: Pg. 467-478

Number of days: 8-10

S.O. – 4, 6

D.O. – 3.3, 3.4, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - A1, B8, C2, C9

## Unit 8: Pictorials

- \* Review types and purpose of pictorials

TEXT: None

Number of days: 4-5

S.O. – 6

D.O. – 3.3, 3.4, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - B8, C2, C9

## Unit 9: 3-D Solid Modeling

- \* Learn the basic drawing commands related to a 3-D Solid Modeling software program
- \* Define solid modeling
- \* Using the above software program, demonstrate the ability to make a 3-D drawings

TEXT: Solidworks Tutorial

Number of days: 23-25

S.O. – 2, 4, 6

D.O. – 3.1, 3.2, 3.3, 3.4, 3.5, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - A1, A3, A7, B1, B2, B5, B6, B7, C9

Unit Ten: Culminating Activity:

- \* Draw a complete set of drawings for an assigned part to include:
  - a solid model of each part of the assembly using the 3-D CAD program and CAM/CNC machining
  - an assembly drawing
  - an assembly drawing in section
  - working drawings of major parts

TEXT: Solidworks Reference Manual

Number of days: 20-25

S.O. – 2, 4, 6

D.O. – 1, 3.1, 3.2, 3.3, 3.4, 3.5, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3

W.S.S. - B2, B8

INSTRUCTIONAL STRATEGIES:

Lecture and demonstration: 5%

Individual classroom work: 95%

GRADING:

Quarter 1 grade:

Drawings: 80%

Tests: 20%

Quarter 2 grade:

Drawings 80%

Culminating project: 20%

FINAL GRADE:

Quarter 1: 40%

Quarter 2: 40%

Final Exam: 20%

Quarter 3 grade:

Drawings: 80%

Tests: 20%

Quarter 4 grade:

Drawings 75%

Culminating project: 25%

FINAL GRADE:

Quarter 1: 40%

Quarter 2: 40%

Final Exam: 20%

## **APPENDIX:**

COURSE: ADVANCED MECHANICAL DRAFTING  
INSTRUCTOR: LEE WESTPHAL

### Unit One: Geometric Construction

- 3.4 Develop their gifts
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely

### Unit Two: Review of CAD program

- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

### Unit Two: Orthographic Projection

- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

### Unit Three: Electrical Schematics

- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

#### Unit Four: Section Views

- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

#### Unit Five: Auxiliary Views

- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

#### Unit Six: Tolerancing

- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

#### Unit Seven: Threads and Fasteners

- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

#### Unit Eight: Pictorials

- 3.3 Identify their own personal abilities and interests

- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

#### Unit Nine: 3-D Solid Modeling

- 3.1 Recognize the need to be a life-longer learner
- 3.2 Identify and evaluate trends in the work place
- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 3.5 Use abilities and interests for God-pleasing recreation
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

#### Unit Ten: Culminating Activity

- 1.1 Apply the problem-solving process to challenging situations
- 3.1 Recognize the need to be a life-longer learner
- 3.2 Identify and evaluate trends in the work place
- 3.3 Identify their own personal abilities and interests
- 3.4 Develop their gifts
- 5.1 Apply mathematical and scientific principles to industrial applications
- 5.2 Explore technologies
- 5.3 Produce products by using current technology
- 5.4 Produce products with high quality standards
- 6.1 Follow verbal and written direction
- 6.2 Communicate clearly and precisely
- 6.3 Read technical literature and/or drawings effectively

### **WISCONSIN STATE STANDARDS**

#### Unit 1: Geometric Construction

- A1 Contrast the increasing complexities of technology with its ease of use
- B1 Identify and explain the ways technological systems have evolved and will continue to evolve to satisfy human needs and desires
- B6 Show how new knowledge is usually, by design or otherwise, an outcome of technological activity that contributes to the exponential growth of technological knowledge
- B8 Select and apply appropriate processes to transform information into its most useful format

#### Unit 2: Review of CAD program - AUTOCAD LT

- A1 Contrast the increasing complexities of technology with its ease of use
- A7 Explain how scientific and technological research can contribute to improved quality of life and a better standard of living
- B1 Identify and explain the ways technological systems have evolved and will continue to evolve to satisfy human needs and desires
- B2 Demonstrate how systems are planned, organized, designed, built, and controlled
- B3 Explain how enterprises apply technological systems for generating wealth by providing goods and services
- B5 Assess the impact new and improved products and services have had on the quality of life; explain how the development of new tools, materials and processes is necessary to maintain and improve high productivity and quality
- B6 Show how new knowledge is usually, by design or otherwise, an outcome of technological activity that contributes to the exponential growth of technological knowledge
- B7 Explain how new and higher quality products require new and higher quality materials and processing techniques
- B8 Select and apply appropriate processes to transform information into its most useful format
- D4 Evaluate the relative appropriateness of a given technology by comparing the risks with the benefits or the advantages with the disadvantages

#### Unit 3: Orthographic Projection

- B8 Select and apply appropriate processes to transform information into its most useful format
- C2 Measure, collect, and analyze data in order to solve a technological problem
- C9 Apply basic engineering concepts in the design and creation of solutions to various problems or opportunities

#### Unit 3: Electrical Schematics

- B3 Explain how enterprises apply technological systems for generating wealth by providing goods and services
- B5 Assess the impact new and improved products and services have had on the quality of life; explain how the development of new tools, materials and processes is necessary to maintain and improve high productivity and quality
- B7 Explain how new and higher quality products require new and higher quality materials and processing techniques
- B8 Select and apply appropriate processes to transform information into its most useful format

#### Unit 4: Section Views

- A1 Contrast the increasing complexities of technology with its ease of use
- B8 Select and apply appropriate processes to transform information into its most useful format
- C2 Measure, collect, and analyze data in order to solve a technological problem
- C9 Apply basic engineering concepts in the design and creation of solutions to various problems or opportunities

#### Unit 5: Auxiliary Views

- A1 Contrast the increasing complexities of technology with its ease of use
- B8 Select and apply appropriate processes to transform information into its most useful format
- C2 Measure, collect, and analyze data in order to solve a technological problem

C9 Apply basic engineering concepts in the design and creation of solutions to various problems or opportunities

#### Unit 6: Tolerancing

- A1 Contrast the increasing complexities of technology with its ease of use
- B1 Identify and explain the ways technological systems have evolved and will continue to evolve to satisfy human needs and desires
- B2 Demonstrate how systems are planned, organized, designed, built, and controlled
- B5 Asses the impact new and improved products and services have had on the quality of life; explain how the development of new tools, materials and processes is necessary to maintain and improve high productivity and quality
- B7 Explain how new and higher quality products require new and higher quality materials and processing techniques
- C5 Identify constraints present in a given technological processes

#### Unit 7: Threads and Fasteners

- A1 Contrast the increasing complexities of technology with its ease of use
- B8 Select and apply appropriate processes to transform information into its most useful format
- C2 Measure, collect, and analyze data in order to solve a technological problem
- C9 Apply basic engineering concepts in the design and creation of solutions to various problems or opportunities

#### Unit 8: Pictorials

- B8 Select and apply appropriate processes to transform information into its most useful format
- C2 Measure, collect, and analyze data in order to solve a technological problem
- C9 Apply basic engineering concepts in the design and creation of solutions to various problems or opportunities

#### Unit 9: 3-D Solid Modeling

- A1 Contrast the increasing complexities of technology with its ease of use
- A3 Explain why decisions regarding the use of technology are dependent on the situation, application, or perception of the group using it
- A7 Explain how scientific and technological research can contribute to improved quality of life and a better standard of living
- B1 Identify and explain the ways technological systems have evolved and will continue to evolve to satisfy human needs and desires
- B2 Demonstrate how systems are planned, organized, designed, built, and controlled
- B5 Asses the impact new and improved products and services have had on the quality of life; explain how the development of new tools, materials and processes is necessary to maintain and improve high productivity and quality
- B6 Show how new knowledge is usually, by design or otherwise, an outcome of technological activity that contributes to the exponential growth of technological knowledge
- B7 Explain how new and higher quality products require new and higher quality materials and processing techniques
- C9 Apply basic engineering concepts in the design and creation of solutions to various problems or opportunities

#### Unit Ten: Culminating Activity

- B2 Demonstrate how systems are planned, organized, designed, built, and controlled

B8 Select and apply appropriate processes to transform information into its most useful form