Title 7: Education K-12

Part 86: Trades Industrial

2005 Mississippi Curriculum Framework

Secondary General Drafting

(Program CIP: 15.1301 – Drafting and Design Technology/Technician, General)

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Standards in this document are based on information from the following organizations:

Standards and Guidelines for Drafting Programs	American Design Drafting Association
Academic Standards	Mississippi Department of Education Subject Area Testing Program
Workplace Skills for the 21st Century	Secretary's Commission on Achieving Necessary Skills
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Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
  - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
  - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards - This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the general workplace skills as identified in the Secretary's Commission on Achieving Necessary Skills (SCANS) report as being critical for all workers in the 21st Century. In addition, national technology standards and occupational skills standards associated with the competencies and suggested objectives for the unit are also identified.
- References - A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Table of Contents

Program Description

General Drafting is an instructional program designed to teach students to produce workable drawings on the drawing board and with the computer. Upon successful completion of the program, the student will be qualified for an entry level drafting or related position or may pursue postsecondary education.

General Drafting I is the entry level course of the secondary General Drafting program. Students will gain foundation competencies related to orientation, safety, leadership and personal development, and drafting and CAD skills. Students receive 2-2½ Carnegie units, depending upon time spent in the course.

General Drafting II is the exit level course of the secondary General Drafting program. Students will gain foundation competencies related to orientation, safety, advanced leadership and personal development, architectural drafting, and CAD skills. The architectural drafting section includes floor plans, elevations, foundations, and sections. Students receive 2-2½ Carnegie units, depending upon time spent in the course.

The content of this curriculum framework is based on national standards as developed by the American Design Drafting Association.

Course Outline

General Drafting I

Course CIP Code: 48.0101

Unit	Title	Hours
Unit 1:	Orientation and Safety	14.0
Unit 2:	Introduction to Drafting	15.0
Unit 3:	Lettering	7.0
Unit 4:	Geometric Construction	25.0
Unit 5:	Computer Aided Drafting (CAD)	20.0
Unit 6:	Orthographic Projection	30.0
Unit 7:	Dimensioning	8.0
Unit 8:	Sectional Views	14.0
Unit 9:	Auxiliary Views	10.0
Unit 10:	Pictorial Drawings	15.0
Unit 11:	Machine Drafting	40.0

General Drafting II

Course CIP Code: 48.0190

Unit	Title	Hours
Unit 1:	Orientation and Safety Review and Reinforcement	14.0
Unit 2:	Architectural Drafting Math	25.0
Unit 3:	Residential Architectural Drafting	146.0
Unit 4:	Field Applications of Architectural Drafting	25.0

General Drafting I
Unit 1: Orientation and Safety **(14 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Discuss program and vocational center policies and procedures.	**Teaching:** • Present local program and vocational center policies and procedures. • Have students read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. • Pair students (a student with a higher reading ability may team up with a student with a lower reading ability), and have them type or write a report about what is expected in relation to school and program policies and procedures.[E2, E3, E8] • Have students prepare posters to identify the name and functions of equipment in the school lab. **Assessment:** • Evaluate the written report on rules and regulations for content as well as grammar and organization. • Evaluate posters to identify names and functions of equipment in the school lab for content, neatness, and creativity. • Assess student orientation knowledge on applicable policies and procedures through teacher observations and written unit test. File completed test to document student mastery of the school and program policies and procedures.
2. Examine drafting occupation job titles with qualifications and responsibilities, and identify areas of specialization in the drafting profession.	**Teaching:** • Identify professional titles within the drafting occupation. Have the students match the titles with qualifications and responsibilities. • Have students use career software, such as Choices, to measure their aptitudes and abilities for particular careers.[E3, E8] • Have students use the Internet to research a list of careers for which they will be

	qualified upon program completion.[E2, E3, E4, E5, E10] • Have students use available resources (college catalogs and college websites) to research information about postsecondary educational opportunities.[E2, E3, E4, E5, E10] • Have students select a career in the field and outline educational and skill requirements, expected job growth, and entry-level salaries and present the material to the class.[E1, E3, E8, E9] • Discuss the parts of a resume, cover letter, and/or job application and provide each student a written sample. • Have each student use the Internet or newspapers to choose a job for which they are qualified and prepare a resume and cover letter that can be used to apply for the selected job.[E1, E2, E4, E10] **Assessment:** • Evaluate the professional title matching activity for correctness using an answer key. • Review career software printout to assess student aptitudes and abilities. • Evaluate the presentation for content and delivery. • Use a checklist to evaluate the resume and cover letter for completeness and neatness.
3. Develop leadership in a vocational student organization (VSO). a. State procedures of leadership. b. Describe the leadership purposes of a VSO.	**Teaching:** • Discuss the role of a team member and leader. • Assign the students roles within a team and have them role-play a situation in which there is a conflict which must be resolved. • Utilize the lessons from SkillsUSA, or other resources to provide additional training.[E3, E8] • Discuss appropriate work ethics standards. Have the students list what they believe to be the most common problems among the drafting profession. **Assessment:** • Assess role-play using a checklist for

	participation, presentation, and content. • Assess lessons from other resources according to the recommended resource guide. • Evaluate lists of work ethics for content.
3. Discuss office safety. a. Explain ergonomics and computer safety. b. Demonstrate the proper use of equipment.	**Teaching:** • Discuss information related to the drafting environment. This could include terms, procedures, rules, hazards, Occupational Safety and Health Administration (OSHA) regulations, and Material Safety Data Sheet (MSDS) procedures. • Give a required written test for safety rules and procedures.[E2, E3, E7, E8, E10] **Assessment:** • Evaluate the required written test for accuracy.

STANDARDS

American Design Drafting Association Skill Standards

DDS1 General Drafting Terminology

Academic Standards

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Choices [Computer Software]. (n.d.). Ogdensburg, NY: Careerware, IMS Information Systems Management Corporation.

Davies, D. (1997). *Grammar? No problem!* Mission, KS. SkillPath.

Gould, M. C. (2002). *Developing literacy & workplace skills*. Bloomington, IN: National Education Service.

Local District Policy Handbook

SkillsUSA. (2002). *Leadership and competition curricula.* Tinley Park, IL: Goodheart-Willcox.

General Drafting I
Unit 2: Introduction to Drafting **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain the purpose of technical drawing and freehand technical sketches.	**Teaching:** • Differentiate between technical drawing and freehand technical sketches. • Have students participate in a class discussion relating to the differences between the two and where each would be more effectively used and applied in industry.[E3, E7, E8, E10] **Assessment:** • Assess this activity for class participation by teacher observation.
2. Create freehand technical sketches. a. Identify appropriate techniques for freehand sketches. b. Construct a freehand technical sketch. c. Recognize the alphabet of lines.	**Teaching:** • Discuss and demonstrate the appropriate techniques used in freehand sketches. • Give students technique exercises to construct the freehand sketches.[A3, E2, E7, E8, E10] • Identify and discuss the alphabet of lines. • Have students sketch various lines. **Assessment:** • Assess the technique exercise for accuracy using a checklist. • Assess the sketching exercise for accuracy using a checklist.
3. Identify and demonstrate drafting tools and media. a. Identify drafting tools. b. Examine media and various sheet sizes. c. Interpret architect, engineering, and metric scale units.	**Teaching:** • Identify the various tools used in drafting. Relate the tools with their uses. • Have the students participate in a tool matching activity.[E3, E7, E8, E10] • Provide examples of different types of media and sheet sizes. • Have the student distinguish between the various media and sheet sizes.[A1, A2, E2, E7, E10] • Demonstrate various linear techniques for measuring. • Have students measure lines using various scales, and have students perform various measuring exercises.[A1, A2, E2, E7, E10]

	Assessment: • Assess the matching activity for accuracy using a matching key. • Assess the media and sheet size activity for accuracy by teacher observation. • Assess the measuring activities for accuracy using a key.
THIS COMPETENCY WILL BE ONGOING THROUGHOUT THE YEAR 4. Demonstrate skills in mathematical concepts related to drafting technology.	**Teaching:** • Explain basic fraction operations, reading fractional scales and measuring tools, conversions of fractional/decimal units of measurements, and conversions of English/metric measurements. • Have students complete mathematic exercises. A1, A2, A3, A5, A6, E2, E7, E10 **Assessment:** • The exercises will be assessed using mathematical keys.

STANDARDS

American Design Drafting Association Skill Standards

DDS1 General Drafting Terminology
DDS6 General Drafting Standards

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications. All
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables. CAD
A5 Utilize various formulas in problem-solving situations.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

Instructional Materials Laboratory, University of Missouri-Columbia. (n.d.). *Drafting curriculum guide.* Columbia, MO: Author.

Instructional Materials Laboratory, University of Missouri-Columbia. (1997). *Basic drafting.* Columbia, MO: Author.

Multistate Academic and Vocational Curriculum Consortium. (1997). *Basic drafting.* Stillwater, OK: Author.

Phagan, R. J. (1997). *Applied mathematics.* Tinley Park, IL: Goodheart-Willcox.

Walker, J. R., & Mathis, B. D. (2003). *Exploring drafting.* Tinley Park, IL: Goodheart-Willcox.

General Drafting I
Unit 3: Lettering **(7 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Demonstrate the techniques of lettering, and construct uppercase gothic letters and numerals.	**Teaching:** • Discuss and demonstrate the techniques of lettering. • Provide students with handouts to practice these techniques and complete a lettering exercise. E3, E7, E8, E10 **Assessment:** • The exercise will be assessed for accuracy and neatness using a checklist.

STANDARDS

American Design Drafting Association Skill Standards

DDS1 General Drafting Terminology

Academic Standards

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

Instructional Materials Laboratory, University of Missouri-Columbia. (n.d.). *Drafting curriculum guide.* Columbia, MO: Author.

Instructional Materials Laboratory, University of Missouri-Columbia. (1997). *Basic Drafting.* Columbia, MO: Author.

Multistate Academic and Vocational Curriculum Consortium. (1997). *Basic drafting.* Stillwater, OK: Author.

Phagan, R. J. (1997). *Applied mathematics.* Tinley Park, IL: Goodheart-Willcox.

Walker, J. R., & Mathis, B. D. (2003). *Exploring drafting.* Tinley Park, IL: Goodheart-Willcox.

General Drafting I
Unit 4: Geometric Construction **(25 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Define basic geometric shapes and terms.	**Teaching:** • Provide the basic geometric shapes and terms using a handout, the textbook, and/or PowerPoint. • Have students match shapes and terms with definitions.[A2, A5, E3, E7, E8, E10] **Assessment:** • The activity will be assessed for accuracy using an answer key.
2. Construct various geometric shapes using constructional techniques on a drawing table. a. Bisect a line and arc. b. Bisect an angle. c. Construct a perpendicular line from a point to a line. d. Divide a line into equal parts. e. Draw an arc tangent to a straight line and an arc. f. Draw an arc tangent to two arcs. g. Construct an octagon. h. Construct a hexagon. i. Construct a line parallel to a given line.	**Teaching:** • Demonstrate various geometric construction techniques using a drawing table. • Have students practice using the techniques and complete a test to demonstrate all of the geometric constructions.[A2, A5, E2, E7, E10] **Assessment:** • The test will be assessed for accuracy using an answer key.

STANDARDS

American Design Drafting Association Skill Standards

DDS1 General Drafting Terminology

Academic Standards

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

Instructional Materials Laboratory, University of Missouri-Columbia. (1997). *Basic Drafting.* Columbia, MO: Author.

Instructional Materials Laboratory, University of Missouri-Columbia. (n.d.). *Drafting curriculum guide.* Columbia, MO: Author.

Multistate Academic and Vocational Curriculum Consortium. (1997). *Basic drafting.* Stillwater, OK: Author.

Phagan, R. J. (1997). *Applied mathematics.* Tinley Park, IL: Goodheart-Willcox.

Walker, J. R., & Mathis, B. D. (2003). *Exploring drafting.* Tinley Park, IL: Goodheart-Willcox.

General Drafting I
Unit 5: Computer Aided Drafting (CAD) (20 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Use CAD hardware and software. a. Define CAD hardware/software terms. b. Demonstrate care and maintenance of computer software/hardware. c. Start up/shut down CAD system. d. Operate plotter/printer.	**Teaching:** • Provide terms and definitions of a CAD workstation. • Have students identify the components of the computer and match the terms with their definitions using a matching activity.[E2, E3, E7, E8, E10] • Discuss and demonstrate the proper use of a CAD system to include care and maintenance, start-up/shut-down, and operation of peripherals.[E2, E3, E7, E8, E10] **Assessment:** • Assess the matching activity using an answer key. • Assess the discussion for class participation by teacher observation.
2. Create text using appropriate style and size on a CAD system. a. Select text style. b. Create various text sizes. c. Utilize CAD text edit commands. d. Create borders and title blocks for various sheet sizes.	**Teaching:** • Demonstrate various text styles and sizes. Discuss the text edit commands. • Have students practice assigned text styles and sizes. Provide the students with text exercises which need to be edited and have them edit the exercises.[A6, E2, E3, E7, E8, E10] • Demonstrate creating borders and title blocks to specific sheet sizes. • Have students complete exercises from assigned specifications.[A6, E2, EE3, E7, E8, E10] **Assessment:** • Assess the exercises using teacher observation and an editing key. • Assess the exercises for accuracy using a key.
3. Create a basic CAD drawing. a. Identify basic commands for CAD drawing. b. Construct a CAD drawing.	**Teaching:** • Discuss and demonstrate CAD draw commands. • Provide students with activities to practice the commands, and have them match CAD icons with their functions.[A1, A2, A3, E2, E3, E7, E8, E10] • Demonstrate the development of a CAD

	drawing and have the students practice the drawing techniques. • Provide the students with a specific test exercise, and have them produce the basic CAD drawing. A1, A2, A3, E2, E3, E7, E8, E10 **Assessment:** • Assess the matching exercise for accuracy with a matching key. • Assess the test exercise for accuracy with a key.

STANDARDS

American Design Drafting Association Skill Standards

DDS10 Computer / CADD Terminology

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Instructional Materials Laboratory, University of Missouri-Columbia. (1993). *CAD survival kit.* Columbia, MO: Author.

Kallameja, J., & Wilson, J. (2004). *AUTOCAD 2004.* Clifton Park, NY: Glencoe McGraw-Hill.

Manning, D. J. (2004). *Project-based AUTOCAD.* Peoria, IL: Glencoe McGraw-Hill.

Tickoo, S. (2004). *AUTOCAD 2004: A problem-solving approach.* Clifton Park, NY: Delmar.

General Drafting I
Unit 6: Orthographic Projection **(30 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe terms, views, line types, and the spacing of views used in orthographic projections.	**Teaching:** • Present the terms and definitions of orthographic projections. Discuss the possible views in a multi-view drawing. Identify line types and weights used in orthographic projections. Calculate the spacing for the views on various sized paper.[A1, A2, A5, E2, E3, E7, E8, E10] **Assessment:** • Assess participating in the discussion using teacher observation.
2. Construct principal views in orthographic projections.	**Teaching:** • Discuss and demonstrate the projection of views. • Have students practice and construct a third view from two given views, from a pictorial drawing, and/or from an object.[A1, A2, A5, E2, E3, E7, E8, E10] **Assessment:** • Assess drawings using teacher observation and a drawing key.
3. Construct orthographic views using a CAD station. a. Identify CAD commands used to create a multi-view drawing.	**Teaching:** • Provide the student with a drawing exercise to incorporate CAD commands used in creating orthographic projections.[A1, A2, A3, A5, E2, E3, E7, E8, E10] **Assessment:** • Assess the exercise using teacher observation and a drawing key.

STANDARDS

American Design Drafting Association Skill Standards

DDS2 View Identification
DDS5 Orthographic Projections Standards & Terminology

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

French, T. E., & Helsel, J. D. (2003). *Mechanical drawing.* New York: Glencoe McGraw-Hill.

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General Drafting I
Unit 7: Dimensioning **(8 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Apply general rules, line types, and notes for dimensioning per ANSI standards.	**Teaching:** • Discuss dimensioning rules and demonstrate the use of line types, notations, and symbols used in dimensioning. • Have students dimension various objects. A1, A2, A3, A5, E2, E3, E7, E8, E10 **Assessment:** • Assess the assignment using a drawing key.

STANDARDS

American Design Drafting Association Skill Standards

DDS3 Dimensioning Standards & Terminology

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

French, T. E., & Helsel, J. D. (2003). *Mechanical drawing.* New York: Glencoe McGraw-Hill.

Giesecke, F., Mitchell, A., Spencer, H., & Hill, I. (1991). *Technical drawing*. New York: Collier: MacMillian.

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General Drafting I
Unit 8: Sectional Views **(14 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and identify the types of sectional views.	**Teaching:** • Demonstrate the techniques for developing sectional views. • Provide students with modeling clay to create objects for sectioning exercises. Each student will describe the type of section cut in an oral presentation. • Have students identify the sectional views from a written test. E1, E2, E5, E7, E9, E10 **Assessment:** • Assess the presentation for content and clarity using a checklist. • Assess the test using an answer key.
2. Construct full and half section views.	**Teaching:** • Provide students with drawing plates and have them construct a full and half section view. A1, A2, E2, E7, E10 **Assessment:** • Assess the drawings using a drawing key.
3. Construct a full and half section view using CAD. a. Identify CAD commands used to create sectional drawings.	**Teaching:** • Demonstrate and incorporate the commands associated with producing a sectional view. • Have students use the commands to create CAD sectional drawings. A1, A2, A3, E2, E7, E10 **Assessment:** • Assess the drawings using a drawing key.

STANDARDS

American Design Drafting Association Skill Standards

DDS4 Sections View Standards & Terminology

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

French, T. E., & Helsel, J. D. (2003). *Mechanical drawing.* New York: Glencoe McGraw-Hill.

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General Drafting I
Unit 9: Auxiliary Views **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe and construct primary auxiliary views.	**Teaching:** • Discuss the purpose and demonstrate the procedure to develop a primary auxiliary view. • Have students construct a primary auxiliary drawing from a multi-view drawing.[A1, A2, E2, E7, E10] **Assessment:** • Assess the drawings using a drawing key.
2. Construct a primary auxiliary view using CAD. a. Identify CAD commands used to create a primary auxiliary view.	**Teaching:** • Demonstrate and incorporate the commands associated with producing a primary auxiliary view. • Have students use the commands to create primary auxiliary drawings using CAD.[A1, A2, A3, E2, E7, E10] **Assessment:** • Assess the drawings using a drawing key.

STANDARDS

American Design Drafting Association Skill Standards

DDS9 Auxiliary View Standards, Definitions & Terminology

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

French, T. E., & Helsel, J. D. (2003). *Mechanical drawing.* New York: Glencoe McGraw-Hill.

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General Drafting I
Unit 10: Pictorial Drawings **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify the different types of pictorial drawings.	**Teaching:** • Discuss the various types of pictorial drawings such as oblique, isometric and perspective. • Have students identify types of pictorials from provided illustrations. E2, E3, E7, E8, E10 **Assessment:** • Assess the activity with an answer key.
2. Construct pictorial drawings. a. Construct an isometric drawing.	**Teaching:** • Discuss and demonstrate the techniques for creating an isometric drawing. • Have students produce an isometric drawing from 2-D or 3-D drawings provided. A1, A2, A3, E2, E7, E10 **Assessment:** • Assess the drawing using a drawing key.
3. Construct an isometric drawing on the CAD system. a. Identify CAD commands used to create an isometric drawing.	**Teaching:** • Demonstrate and incorporate the commands associated with producing an isometric drawing. • Have students use the commands to create an isometric drawing using CAD. A1, A2, A3, E2, E7, E10 **Assessment:** • Assess the drawing using a drawing key.

STANDARDS

American Design Drafting Association Skill Standards

DDS8 Pictorial View Standards & Terminology

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.

A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

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General Drafting I
Unit 11: Machine Drafting **(40 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify terms and symbols associated with machining and manufacturing processes.	**Teaching:** • Discuss and describe terms related to machine drafting such as finish marks, tolerancing, forging, casting, and machine operations (drilling, reaming, countersinking, counterboring, spotfacing knurling, chamfering, etc.). • Provide students with the symbols associated with machine drafting, and have them match terms and symbols with descriptions. E2, E3, E7, E8, E10 **Assessment:** • Assess the activity using a matching key.
2. Identify thread forms and representations of threads and fasteners. a. Describe uses of threads. b. Identify types of thread forms. c. Interpret thread notes. d. Describe methods of thread representation. e. Draw an internal and external thread form.	**Teaching:** • Discuss the uses of threads and distinguish the various types. • Provide an illustration to explain the thread note and thread representations, and have students identify the information from a written test. • Demonstrate internal and external thread form on a drawing, and have students draw these thread forms. A1, A2, A3, A5, A6, E2, E3, E7, E8, E10 **Assessment:** • Assess the test using a key. • Assess the drawing using a drawing key.
3. Produce an assembly drawing.	**Teaching:** • As a culminating project, provide students a reference drawing and have them produce a detailed assembly drawing using board and/or CAD. A1, A2, A3, A5, A6, E2, E3, E7, E8, E10 **Assessment:** • Assess the drawing using a drawing key.

STANDARDS

American Design Drafting Association Skill Standards

DDS7 Manufacturing Processes & Welding

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools

Secondary General Drafting

T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

French, T. E., & Helsel, J. D. (2003). *Mechanical drawing.* New York: Glencoe McGraw-Hill.

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General Drafting II
Unit 1: Orientation and Safety Review and Reinforcement (14 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Review program and vocational center policies and procedures.	**Teaching:** • Present local program and vocational center policies and procedures. • Have students read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. • Pair students (a student with a higher reading ability may team up with a student with a lower reading ability), and have them type or write a report about what is expected in relation to school and program policies and procedures.[E2, E3, E8] • Have students prepare posters to identify the name and functions of equipment in the school lab. **Assessment:** • Evaluate the written report on rules and regulations for content as well as grammar and organization. • Evaluate posters to identify names and functions of equipment in the school lab for content, neatness, and creativity. • Assess student orientation knowledge on applicable policies and procedures through teacher observations and written unit test. File completed test to document student mastery of the school and program policies and procedures.
2. Examine drafting occupation job titles with qualifications and responsibilities, and identify areas of specialization in the drafting profession.	**Teaching:** • Identify professional titles within the drafting occupation. Have the students match the titles with qualifications and responsibilities. • Have students use career software, such as Choices, to measure their aptitudes and abilities for particular careers.[E3, E8] • Have students use the Internet to research a list of careers for which they will be

	qualified upon program completion.[E2, E3, E4, E5, E10] • Have students use available resources (college catalogs and college websites) to research information about postsecondary educational opportunities.[E2, E3, E4, E5, E10] • Have students select a career in the field and outline educational and skill requirements, expected job growth, and entry-level salaries and present the material to the class.[E1, E3, E8, E9] • Discuss the parts of a resume, cover letter, and/or job application and provide each student a written sample. • Have each student use the Internet or newspapers to choose a job for which they are qualified and prepare a resume and cover letter that can be used to apply for the selected job.[E1, E2, E4, E10] **Assessment:** • Evaluate the professional title matching activity for correctness using an answer key. • Review career software printout to assess student aptitudes and abilities. • Evaluate the presentation for content and delivery. • Use a checklist to evaluate the resume and cover letter for completeness and neatness.
3. Develop leadership in a vocational student organization (VSO). a. State procedures of leadership. b. Describe the leadership purposes of a VSO.	**Teaching:** • Discuss the role of a team member and leader. • Assign the students roles within a team and have them role-play a situation in which there is a conflict which must be resolved. • Utilize the lessons from SkillsUSA, or other resources to provide additional training.[E3, E8] • Discuss appropriate work ethics standards. Have the students list what they believe to be the most common problems within the drafting profession. **Assessment:** • Assess role-play using a checklist for

	participation, presentation, and content. • Assess lessons from other resources according to the recommended resource guide. • Evaluate lists of work ethics for content.
4. Discuss office safety. a. Explain ergonomics and computer safety. b. Demonstrate the proper use of equipment.	**Teaching:** • Discuss information related to the drafting environment. This could include terms, procedures, rules, hazards, Occupational Safety and Health Administration (OSHA) regulations, and Material Safety Data Sheet (MSDS) procedures. • Give a required written test for safety rules and procedures.[E2, E3, E7, E8, E10] **Assessment:** • Evaluate the required written test for accuracy.

STANDARDS

American Design Drafting Association Skill Standards

DDS1 General Drafting Terminology

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Choices [Computer Software]. (n.d.). Ogdensburg, NY: Careerware, IMS Information Systems Management Corporation.

Davies, D. (1997). *Grammar? No problem!* Mission, KS. SkillPath.

Gould, M. C. (2002). *Developing literacy & workplace skills*. Bloomington, IN: National Education Service.

Local District Policy Handbook

SkillsUSA. (2002). *Leadership and competition curricula.* Tinley Park, IL: Goodheart-Willcox.

General Drafting II
Unit 2: Architectural Drafting Math (Ongoing throughout the year) (25 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Calculate linear measurements.	**Teaching:** • Explain how to add, subtract, multiply, and divide feet and inches. • Have students complete mathematic exercises.[A1, A2, E2, E7, E10] **Assessment:** • Assess the exercises using mathematical keys.
2. Read and interpret the architect and engineering scale.	**Teaching:** • Explain basic fraction operations, reading fractional scales and measuring tools, conversions of fractional/decimal units of measurements, and conversions of English/metric measurements. • Have students complete mathematic exercises.[A1, A2, E2, E7, E10] **Assessment:** • Assess the exercises using mathematical keys.
3. Calculate residential square footage.	**Teaching:** • Explain the process of calculating residential square footage. • Have students complete area exercises.[A1, A2, A5, E2, E7, E10] **Assessment:** • Assess the exercises using mathematical keys.
4. Employ the adjustable triangle to lay out angles. a. Utilize the adjustable triangle and/or protractor to indicate length and bearing of property lines using the Polar Coordinate System. b. Plot the X and Y values of the Cartesian Coordinate System.	**Teaching:** • Demonstrate the use of the adjustable triangle to lay out angles. Explain the Cartesian and Polar Coordinate Systems. • Have students complete exercises to locate bearings and distances using the Polar Coordinate System and property corners using the Cartesian Coordinate System.[A1, A2, A5, A6, E2, E7, E10] **Assessment:** • Assess the exercises using a key.

5. Calculate and apply spacial requirements for residential design.	**Teaching:** • Provide and explain handouts with the required size and space requirements for residential design. Students will participate in a class discussion concerning the future applications. Students will apply these handouts throughout the year. A1, A2, E2, E7, E10 **Assessment:** • Assess the discussion for class participation using teacher observation.

STANDARDS

American Design Drafting Association Skill Standards

DDS1 General Drafting Terminology
DDS6 General Drafting Standards

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.

WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Boyce, J., Margolis, L., & Slade, S. (2000). *Mathematics for technical and vocational students*. Upper Saddle River: NJ: Prentice Hall.

Carman, R., & Saunders, H. (2005). *Mathematics for the trades: A guided approach*. Upper Saddle River, NJ: Pearson Prentice Hall.

Cook, N. (2004). *Mathematics for technical trades.* Upper Saddle River, NJ: Pearson Prentice Hall.

Cook, N. (2004). *Introductory mathematics.* Upper Saddle River, NJ: Pearson Prentice Hall.

Phagan, R. J. (1997). *Applied mathematics.* Tinley Park, IL: Goodheart-Willcox.

General Drafting II
Unit 3: Residential Architectural Drafting (146 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Produce sketches in planning the three main residential areas.	**Teaching:** • Discuss and describe requirements for the three main residential areas. • Have students sketch rooms included in the service, living, and sleeping areas. A1, A2, E2, E5, E7, E10 **Assessment:** • Assess the sketch for content using a checklist.
2. Produce an architecturally correct floor plan. a. Identify architectural terms and symbols related to floor plans. b. Construct architectural letters. c. Draw and dimension a floor plan.	**Teaching:** • Provide and discuss the terms, symbols, and requirements related to floor plans. • Have students match terms and symbols in a written exercise/test. A1, A2, A5, E2, E5, E7, E10 • Provide various styles of architectural lettering, and have students practice techniques to develop their own style. A1, A2, E2, E5, E7, E10 • Have students produce a floor plan. A1, A2, E2, E5, E7, E10 **Assessment:** • Assess the terms, symbols, and requirements using a key. • Assess the practice exercises by teacher observation. • Assess the floor plan for content using a checklist.
3. Produce an architecturally correct foundation plan. a. Describe terms, symbols, and requirements related to foundation plans. b. Draw and dimension a foundation plan. c. Draw footing details.	**Teaching:** • Provide and discuss the terms, symbols, and requirements related to a foundation plan. • Have students match terms and symbols in a written exercise/test. A1, A2, A5, E2, E5, E7, E10 • Have students produce a foundation plan. A1, A2, A5, E2, E5, E7, E10 **Assessment:** • Assess the terms, symbols, and requirements using a key. • Assess the foundation plan for content

	using a checklist.
4. Draw, dimension, and label an exterior wall section. a. Identify building material terms, symbols, and requirements. b. Draw, dimension, and label a typical exterior wall section.	**Teaching:** • Provide and discuss the terms, symbols, and requirements related to an exterior wall section. • Have students match terms and symbols in a written exercise/test. A1, A2, A3, A5, A6, A7, E2, E5, E7, E10 • Have students produce a typical wall section. A1, A2, A3, A5, A6, A7, E2, E5, E7, E10 **Assessment:** • Assess the terms, symbols, and requirements using a key. • Assess the typical wall section using a key.
5. Draw and note exterior elevations. a. Identify architectural terms, symbols, and requirements related to elevations.	**Teaching:** • Discuss the various elevation terms, symbols, and requirements including architectural styles, roof types, and calculations of roof slope. • Have students match terms and symbols in a written exercise/test. A1, A2, A3, A5, A6, A7, E2, E5, E7, E10 • Have students draw and note exterior elevations. A1, A2, A3, A5, A6, A7, E2, E5, E7, E10 **Assessment:** • Assess the terms, symbols, and requirements using a key. • Assess the elevations using a checklist.
6. Produce an electrical plan. a. Describe terms, symbols, and requirements related to an electrical plan. b. Draw an electrical plan.	**Teaching:** • Provide and discuss the terms, symbols, and requirements related to an electrical plan. • Have students match terms and symbols in a written exercise/test. A1, E2, E5, E7, E10 • Have students produce an electrical plan. A1, E2, E5, E7, E10 **Assessment:** • Assess the terms, symbols, and requirements using a key. • Assess the electrical plan with a checklist.

7. Develop a residential plot/site plan. a. Describe terms, symbols, and requirements related to a plot/site plan. b. Draw a plot/site plan.	**Teaching:** • Provide and discuss the terms, symbols, and requirements related to a plot/site plan. • Have students match terms and symbols in a written exercise/test. A1, A2, A3, A5, A6, E2, E5, E7, E10 • Have students produce a plot/site plan. A1, A2, A3, A5, A6, E2, E5, E7, E10 **Assessment:** • Assess the terms, symbols, and requirements using a key. • Assess the plot/site plan with a checklist.

STANDARDS

American Design Drafting Association Skill Standards

DDS1 General Drafting Terminology
DDS2 View Identification
DDS3 Dimensioning Standards & Terminology
DDS4 Sections View Standards & Terminology
DDS5 Orthographic Projections Standards & Terminology
DDS6 General Drafting Standards
DDS7 Manufacturing Processes & Welding
DDS8 Pictorial View Standards & Terminology
DDS9 Auxiliary View Standards, Definitions & Terminology
DDS10 Computer / CADD Terminology

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.
A7 Interpret and apply slope as a rate of change.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.

E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T3 Technology productivity tools
T4 Technology communications tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

French, T. E., & Helsel, J. D. (2003). *Mechanical drawing.* New York: Glencoe McGraw-Hill.

Giesecke, F., Mitchell, A., Spencer, H., Hill, I., Dygdon, J., & Novak, J. (1997). *Engineering drawing problem series I.* Upper Saddle River, NJ: Prentice Hall.

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Instructional Materials Laboratory, University of Missouri-Columbia. (n.d.). *Drafting curriculum guide.* Columbia, MO: Author.

Instructional Materials Laboratory, University of Missouri-Columbia. (n.d.). *Mechanical drafting with CAD.* Columbia, MO: Author.

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Instructional Materials Laboratory, University of Missouri-Columbia. (1997). *Basic drafting.* Columbia, MO: Author.

Kallameja, J., & Wilson, J. (2004). *AUTOCAD 2004.* Clifton Park, NY: Glencoe McGraw-Hill.

Kicklighter, C. E. (2004). *Architectural residential drafting and design*. Tinley Park, IL: Goodheart-Willcox.

Manning, D. J. (2004). *Project-based AUTOCAD.* Peoria, IL: Glencoe McGraw-Hill.

Multistate Academic and Vocational Curriculum Consortium. (1993). *Drafting.* Stillwater, OK: Author.

Multistate Academic and Vocational Curriculum Consortium. (1993). *Mechanical drafting with CAD.* Stillwater, OK: Author.

Multistate Academic and Vocational Curriculum Consortium. (1997). *Basic drafting.* Stillwater, OK: Author.

Phagan, R. J. (1997). *Applied mathematics.* Tinley Park, IL: Goodheart-Willcox.

Spencer, H, & Dygdon, J. (2004). *Basic technical drawing*. New York: Glencoe McGraw-Hill.

Tickoo, S. (2004). *AUTOCAD 2004: A problem-solving approach.* Clifton Park, NY: Delmar.

Walker, J. R., & Mathis, B. D. (2003). *Exploring drafting.* Tinley Park, IL: Goodheart-Willcox.

General Drafting II
Unit 4: Field Applications of Architectural Drafting (25 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Integrate business/industry experiences with the drafting program.	**Teaching:** • Lead students to participate in field trips, field exercises, and/or listening to guest speakers. • Have students prepare an oral and/or written summary of the experience. A1, A2, A5, A6, A7, E1, E2, E3, E4, E5, E7, E8, E9, E10 **Assessment:** • Assess for class participation by teacher observation. • Assess the summary for content using a checklist.
2. Investigate career opportunities related to general drafting.	**Teaching:** • Have students explore career opportunities in the drafting field. Students may research using the Internet, interviews, job shadowing/mentoring experiences, and other resources. • Have students complete a career-related project such as a paper, oral presentation, or model building. A1, A2, A5, A6, A7, E1, E2, E3, E4, E5, E7, E8, E9, E10 **Assessment:** • Assess student exploration of career opportunities using teacher observation. • Assess the project for content and completeness using a checklist.

STANDARDS

American Design Drafting Association Skill Standards

DDS1 General Drafting Terminology
DDS2 View Identification
DDS3 Dimensioning Standards & Terminology
DDS4 Sections View Standards & Terminology
DDS5 Orthographic Projections Standards & Terminology
DDS6 General Drafting Standards
DDS7 Manufacturing Processes & Welding
DDS8 Pictorial View Standards & Terminology

DDS9 Auxiliary View Standards, Definitions & Terminology
DDS10 Computer / CADD Terminology

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.
A7 Interpret and apply slope as a rate of change.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
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T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Brown, W. C., & Kicklighter, C. E. (1995). *Drafting for industry.* Tinley Park, IL: Goodheart-Willcox.

French, T. E., & Helsel, J. D. (2003). *Mechanical drawing.* New York: Glencoe McGraw-Hill.

Giesecke, F., Mitchell, A., Spencer, H., Hill, I., Dygdon, J., & Novak, J. (1997). *Engineering drawing problem series I.* Upper Saddle River, NJ: Prentice Hall.

Giesecke, F., Mitchell, A., Spencer, H., & Hill, I. (1991). *Technical drawing*. New York: Collier: MacMillian.

Instructional Materials Laboratory, University of Missouri-Columbia. (n.d.). *Drafting curriculum guide.* Columbia, MO: Author.

Instructional Materials Laboratory, University of Missouri-Columbia. (n.d.). *Mechanical drafting with CAD.* Columbia, MO: Author.

Instructional Materials Laboratory, University of Missouri-Columbia. (1993). *CAD survival kit.* Columbia, MO: Author.

Instructional Materials Laboratory, University of Missouri-Columbia. (1997). *Basic drafting.* Columbia, MO: Author.

Kallameja, J., & Wilson, J. (2004). *AUTOCAD 2004.* Clifton Park, NY: Glencoe McGraw-Hill.

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Phagan, R. J. (1997). *Applied mathematics.* Tinley Park, IL: Goodheart-Willcox.

Spencer, H, & Dygdon, J. (2004). *Basic technical drawing*. New York: Glencoe McGraw-Hill.

Tickoo, S. (2004). *AUTOCAD 2004: A problem-solving approach.* Clifton Park, NY: Delmar.

Walker, J. R., & Mathis, B. D. (2003). *Exploring drafting.* Tinley Park, IL: Goodheart-Willcox.

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Computer file server with network software (1)
2. Student computer with operating software with multimedia kit and CAD software (10 minimum)
3. Teacher computer for CAD instruction
4. Internet access
5. Networkable laser printer (1)
6. Networkable plotter (1)
7. Drafting tables (20 per program)
8. Light table (1 per program)
9. Blueprint machine (1 per program)
10. Flat paper file cabinet with 30 drawers (1 per program)

NON-CAPITALIZED ITEMS

1. 30/60x6" triangle (1 per student)
2. Circle template (1 per student)
3. Isometric ellipse template (1 per student)
4. Adjustable triangle (6 per program)
5. 30/60x18" triangle (1 per student)
6. 45/90x18" triangle (1 per student)
7. Large circle template (1 per student)
8. Parallel bars and/or V-track machines (50/50 split) (20 per program)
9. Stools (20 per program)
10. 45/90x6" triangle (1 per student)
11. Paper cutter (1 per program)
12. Scale, engineer (1 per student)
13. Architectural scale (1 per student)
14. 1/8" architectural floor plan templates (1 per student)
15. 6-inch bow compass/dividers set (1 per student)
16. Metric scale (1 per student)
17. Erasing shield (1 per student)
18. Brush (1 per student)
19. French curve (1 per student)
20. Architectural floor plan 3" template (1 per student)
21. Lettering guides (1 per student)

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Construction calculator (1)
2. VCR-DVD player (1)

3. Data projector (1)
4. Laptop computer (1)
5. Digital camera
6. Digital scanner with optical character recognition (OCR)

Student Competency Profile for General Drafting I

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation and Safety

_____1. Discuss program and vocational center policies and procedures.
_____2. Examine drafting occupation job titles with qualifications and responsibilities, and identify areas of specialization in the drafting profession.
_____3. Develop leadership in a vocational student organization (VSO).
_____4. Discuss office safety.

Unit 2: Introduction to Drafting

_____1. Explain the purpose of technical drawing and freehand technical sketches.
_____2. Create freehand technical sketches.
_____3. Identify and demonstrate drafting tools and media.
_____4. Demonstrate skills in mathematical concepts related to drafting technology.

Unit 3: Lettering

_____1. Demonstrate the techniques of lettering, and construct uppercase gothic letters and numerals.

Unit 4: Geometric Constructions

_____1. Define basic geometric shapes and terms.
_____2. Construct various geometric shapes using constructional techniques on a drawing table.

Unit 5: Computer Aided Drafting (CAD)

_____1. Use CAD hardware and software.
_____2. Create text using appropriate style and size on a CAD system.
_____3. Create a basic CAD drawing.

Unit 6: Orthographic Projections

_____1. Describe terms, views, line types, and the spacing of views used in orthographic projections.
_____2. Construct principal views in orthographic projections.
_____3. Construct orthographic views using a CAD station.

Unit 7: Dimensioning

_____1. Apply general rules, line types, and notes for dimensioning per ANSI standards.

Unit 8: Sectional Views

_____1. Describe and identify the types of sectional views.
_____2. Construct full and half section views.
_____3. Construct a full and half section view using CAD.

Unit 9: Auxiliary Views

_____1. Describe and construct primary auxiliary views.
_____2. Construct a primary auxiliary view using CAD.

Unit 10: Pictorial Drawings

_____1. Identify the different types of pictorial drawings.
_____2. Construct pictorial drawings.
_____3. Construct an isometric drawing on the CAD system.

Unit 11: Machine Drafting

_____1. Identify terms and symbols associated with machining and manufacturing processes.
_____2. Identify thread forms and representations of threads and fasteners.
_____3. Produce an assembly drawing.

Student Competency Profile for General Drafting II

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation and Safety Review and Reinforcement

_____1. Review program and vocational center policies and procedures.
_____2. Examine drafting occupation job titles with qualifications and responsibilities and identify areas of specialization in the drafting profession.
_____3. Develop leadership in a vocational student organization (VSO).
_____4. Discuss office safety.

Unit 2: Architectural Drafting Math

_____1. Calculate linear measurements.
_____2. Read and interpret the architect and engineering scale.
_____3. Calculate residential square footage.
_____4. Employ the adjustable triangle to lay out angles.
_____5. Calculate and apply spacial requirements for residential design.

Unit 3: Residential Architectural Drafting

_____1. Produce sketches in planning the three main residential areas.
_____2. Produce an architecturally correct floor plan.
_____3. Produce an architecturally correct foundation plan.
_____4. Draw, dimension, and label an exterior wall section.
_____5. Draw and note exterior elevations.
_____6. Produce an electrical plan.
_____7. Develop a residential plot/site plan.

Unit 4: Field Applications of Architectural Drafting

_____1. Integrate business/industry experiences with the drafting program.
_____2. Investigate career opportunities related to general drafting.

Appendix A: American Design Drafting Association Skill Standards[1]

DDS1	General Drafting Terminology
DDS2	View Identification
DDS3	Dimensioning Standards & Terminology
DDS4	Sections View Standards & Terminology
DDS5	Orthographic Projections Standards & Terminology
DDS6	General Drafting Standards
DDS7	Manufacturing Processes & Welding
DDS8	Pictorial View Standards & Terminology
DDS9	Auxiliary View Standards, Definitions & Terminology
DDS10	Computer / CADD Terminology

[1] American Design Drafting Association. (2004). *Drafter certification examination as a competency program.* Newbern, TN: Author.

Appendix B: Academic Standards

Algebra I[2]

Competencies and Suggested Objective(s)

A1 Recognize, classify, and use real numbers and their properties.
- a. Describe the real number system using a diagram to show the relationships of component sets of numbers that compose the set of real numbers.
- b. Model properties and equivalence relationships of real numbers.
- c. Demonstrate and apply properties of real numbers to algebraic expressions.
- d. Perform basic operations on square roots excluding rationalizing denominators.

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- a. Analyze relationships between two variables, identify domain and range, and determine whether a relation is a function.
- b. Explain and illustrate how change in one variable may result in a change in another variable.
- c. Determine the rule that describes a pattern and determine the pattern given the rule.
- d. Apply patterns to graphs and use appropriate technology.

A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- a. Solve, check, and graph linear equations and inequalities in one variable, including rational coefficients.
- b. Graph and check linear equations and inequalities in two variables.
- c. Solve and graph absolute value equations and inequalities in one variable.
- d. Use algebraic and graphical methods to solve systems of linear equations and inequalities.
- e. Translate problem-solving situations into algebraic sentences and determine solutions.

A4 Explore and communicate the characteristics and operations of polynomials.
- a. Classify polynomials and determine the degree.
- b. Add, subtract, multiply, and divide polynomial expressions.
- c. Factor polynomials using algebraic methods and geometric models.
- d. Investigate and apply real-number solutions to quadratic equations algebraically and graphically.
- e. Use convincing arguments to justify unfactorable polynomials.
- f. Apply polynomial operations to problems involving perimeter and area.

A5 Utilize various formulas in problem-solving situations.
- a. Evaluate and apply formulas (e.g., circumference, perimeter, area, volume, Pythagorean Theorem, interest, distance, rate, and time).
- b. Reinforce formulas experimentally to verify solutions.
- c. Given a literal equation, solve for any variable of degree one.

[2] *Mississippi mathematics framework—Algebra I.* (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/mathematics/ma_algebra_i.html

d. Using the appropriate formula, determine the length, midpoint, and slope of a segment in a coordinate plane.
e. Use formulas (e.g., point-slope and slope-intercept) to write equations of lines.

A6 Communicate using the language of algebra.
a. Recognize and demonstrate the appropriate use of terms, symbols, and notations.
b. Distinguish between linear and non-linear equations.
c. Translate between verbal expressions and algebraic expressions.
d. Apply the operations of addition, subtraction, and scalar multiplication to matrices.
e. Use scientific notation to solve problems.
f. Use appropriate algebraic language to justify solutions and processes used in solving problems.

A7 Interpret and apply slope as a rate of change.
a. Define slope as a rate of change using algebraic and geometric representations.
b. Interpret and apply slope as a rate of change in problem-solving situations.
c. Use ratio and proportion to solve problems including direct variation (y=kx).
d. Apply the concept of slope to parallel and perpendicular lines.

A8 Analyze data and apply concepts of probability.
a. Collect, organize, graph, and interpret data sets, draw conclusions, and make predictions from the analysis of data.
b. Define event and sample spaces and apply to simple probability problems.
c. Use counting techniques, permutations, and combinations to solve probability problems.

Biology I[3]

Competencies and Suggested Objective(s)

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
a. Demonstrate the proper use and care for scientific equipment used in biology.
b. Observe and practice safe procedures in the classroom and laboratory.
c. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
d. Communicate results of scientific investigations in oral, written, and graphic form.

B2 Investigate the biochemical basis of life.
a. Identify the characteristics of living things.
b. Describe and differentiate between covalent and ionic bonds using examples of each.
c. Describe the unique bonding and characteristics of water that makes it an essential component of living systems.
d. Classify solutions using the pH scale and relate the importance of pH to organism survival.

[3] *Mississippi science framework—Biology I*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/science/sci_biology_I.html

e. Compare the structure, properties and functions of carbohydrates, lipids, proteins and nucleic acids in living organisms.
f. Explain how enzymes work and identify factors that can affect enzyme action.

B3 Investigate cell structures, functions, and methods of reproduction.
a. Differentiate between prokaryotic and eukaryotic cells.
b. Distinguish between plant and animal (eukaryotic) cell structures.
c. Identify and describe the structure and basic functions of the major eukaryotic organelles.
d. Describe the way in which cells are organized in multicellular organisms.
e. Relate cell membrane structure to its function in passive and active transport.
f. Describe the main events in the cell cycle and cell mitosis including differences in plant and animal cell divisions.
g. Relate the importance of meiosis to sexual reproduction and the maintenance of chromosome number.
h. Identify and distinguish among forms of asexual and sexual reproduction.

B4 Investigate the transfer of energy from the sun to living systems.
a. Describe the structure of ATP and its importance in life processes.
b. Examine, compare, and contrast the basic processes of photosynthesis and cellular respiration.
c. Compare and contrast aerobic and anaerobic respiration.

B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
a. Compare and contrast the molecular structures of DNA and RNA as they relate to replication, transcription, and translation.
b. Identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
c. Analyze the applications of DNA technology (forensics, medicine, agriculture).
d. Discuss the significant contributions of well-known scientists to the historical progression of classical and molecular genetics.
e. Apply genetic principles to solve simple inheritance problems including monohybrid crosses, sex linkage, multiple alleles, incomplete dominance, and codominance.
f. Examine inheritance patterns using current technology (gel electrophoresis, pedigrees, karyotypes).

B6 Investigate concepts of natural selection as they relate to diversity of life.
a. Analyze how organisms are classified into a hierarchy of groups and subgroups based on similarities and differences.
b. Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.
c. Differentiate among major divisions of the plant and animal kingdoms (vascular/non-vascular; vertebrate/invertebrate).
d. Compare the structures and functions of viruses and bacteria relating their impact on other living organisms.
e. Identify evidence of change in species using fossils, DNA sequences, anatomical and physiological similarities, and embryology.

f. Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.

B7 Investigate the interdependence and interactions that occur within an ecosystem.

a. Analyze the flow of energy and matter through various cycles including carbon, oxygen, nitrogen and water cycles.
b. Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships).
c. Compare variations, tolerances, and adaptations of plants and animals in major biomes.
d. Investigate and explain the transfer of energy in an ecosystem including food chains, food webs, and food pyramids.
e. Examine long and short-term changes to the environment as a result of natural events and human actions.

English II[4]

Competencies and Suggested Objective(s)

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

a. Produce individual and/or group compositions and/or projects to persuade, tell a story, describe, create an effect, explain or justify an action or event, inform, entertain, etc.
b. Produce writing typically used in the workplace such as social, business, and technical correspondence; explanation of procedures; status reports; research findings; narratives for graphs; justification of decisions, actions, or expenses; etc.
c. Write a response, reaction, interpretation, analysis, summary, etc., of literature, other reading matter, or orally presented material.
d. Revise to ensure effective introductions, details, wording, topic sentences, and conclusions.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.

a. Listen to determine the main idea and supporting details, to distinguish fact from opinion, and to determine a speaker's purpose or bias.
b. Speak with appropriate intonation, articulation, gestures, and facial expression.
c. Speak effectively to explain and justify ideas to peers, to inform, to summarize, to persuade, to entertain, to describe, etc.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

a. Read, view, and listen to distinguish fact from opinions and to recognize persuasive and manipulative techniques.
b. Access both print and non-print sources to produce an I-Search paper, research paper, or project.

[4] *Mississippi language arts framework—English II*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/language_arts/la_10.html

c. Use computers and audio-visual technology to access and organize information for purposes such as resumes, career search projects, and analytical writings, etc.
d. Use reference sources, indices, electronic card catalog, and appropriate research procedures to gather and synthesize information.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
a. Interact with peers to examine real world and literary issues and ideas.
b. Show growth in critical thinking, leadership skills, consensus building, and self-confidence by assuming a role in a group, negotiating compromise, and reflecting on individual or group work.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
a. Share, critique, and evaluate works in progress and completed works through a process approach.
b. Communicate effectively in a group to present completed projects and/or compositions.
c. Edit oral and written presentations to reflect correct grammar, usage, and mechanics.

E6 Explore cultural contributions to the history of the English language and its literature.
a. Explore a variety of works from various historical periods, geographical locations, and cultures, recognizing their influence on language and literature.
b. Identify instances of dialectal differences which create stereotypes, perceptions, and identities.
c. Recognize root words, prefixes, suffixes, and cognates.
d. Relate how vocabulary and spelling have changed over time.

E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
a. Listen to and read aloud selected works to recognize and respond to the rhythm and power of language to convey a message.
b. Read aloud with fluency and expression.
c. Analyze the stylistic devices, such as alliteration, assonance, word order, rhyme, onomatopoeia, etc., that make a passage achieve a certain effect.
d. Demonstrate how the use of language can confuse or inform, repel or persuade, or inspire or enrage.
e. Analyze how grammatical structure or style helps to create a certain effect.

E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
a. Read and explore increasingly complete works, both classic and contemporary, for oral discussion and written analysis.
b. Read, discuss, and interpret literature to make connections to life.
c. Read from a variety of genres to understand how the literary elements contribute to the overall quality of the work.
d. Identify qualities in increasingly complex literature that have produced a lasting impact on society.

e. Read for enjoyment, appreciation, and comprehension of plot, style, vocabulary, etc.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.

a. Infuse the study of grammar and vocabulary into written and oral communication.
b. Demonstrate, in the context of their own writing, proficient use of the conventions of standard English, including, but not limited to, the following: complete sentences, subject-verb agreement, plurals, spellings, homophones, possessives, verb forms, punctuation, capitalization, pronouns, pronoun-antecedent agreement, parallel structure, and dangling and misplaced modifiers.
c. Give oral presentations to reinforce the use of standard English.
d. Employ increasingly proficient editing skills to identify and solve problems in grammar, usage, and structure.

E10 Use language and critical thinking strategies to serve as tools for learning.

a. Use language to facilitate continuous learning, to record observations, to clarify thought, to synthesize information, and to analyze and evaluate language.
b. Interpret visual material orally and in writing.

U. S. History from 1877[5]

Competencies and Suggested Objective(s)

H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.

a. Apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues (e.g., gold standard, free coinage of silver, tariff issue, laissez faire, deficit spending, etc.).
b. Explain the emergence of modern America from a domestic perspective (e.g., frontier experience, Industrial Revolution and organized labor, reform movements of Populism and Progressivism, Women's Movement, Civil Rights Movement, the New Deal, etc.).
c. Explain the changing role of the United States in world affairs since 1877 through wars, conflicts, and foreign policy (e.g., Spanish-American War, Korean conflict, containment policy, etc.).
d. Trace the expansion of the United States and its acquisition of territory from 1877 (e.g., expansionism and imperialism).

H2 Describe the impact of science and technology on the historical development of the United States in the global community.

a. Analyze the impact of inventions on the United States (e.g., telephone, light bulb, etc.).
b. Examine the continuing impact of the Industrial Revolution on the development of our nation (e.g., mass production, computer operations, etc.).
c. Describe the effects of transportation and communication advances since 1877.

[5] *Mississippi social studies framework—U.S. History from 1877*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/social_studies/ss_us_history.html

H3 Describe the relationship of people, places, and environments through time.
- a. Analyze human migration patterns since 1877 (e.g., rural to urban, the Great Migration, etc.).
- b. Analyze how changing human, physical, geographic characteristics can alter a regional landscape (e.g., urbanization, Dust Bowl, etc.).

H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
- a. Interpret special purpose maps, primary/secondary sources, and political cartoons.
- b. Analyze technological information on graphs, charts, and timelines.
- c. Locate areas of international conflict (e.g., Caribbean, Southeast Asia, Europe, etc.).

H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.
- a. Examine various reform movements (e.g., Civil Rights, Women's Movement, etc.).
- b. Examine the government's role in various movements (e.g., arbitration, 26th Amendment, etc.).
- c. Examine the role of government in the preservation of citizens' rights (e.g., 19th Amendment, Civil Rights Act of 1964).
- d. Examine individuals' duties and responsibilities in a democratic society (e.g., voting, volunteerism, etc.).

Appendix C: Workplace Skills for the 21st Century[6]

WP1 Allocates resources (time, money, materials and facilities, and human resources).

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

WP5 Selects, applies, and maintains/troubleshoots technology.

WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.

WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

[6] *Secretary's commission on achieving necessary skills*. Retrieved July 13, 2004, from http://wdr.doleta.gov/SCANS/

Appendix D: National Educational Technology Standards for Students[7]

T1 Basic operations and concepts
- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.

T2 Social, ethical, and human issues
- Students understand the ethical, cultural, and societal issues related to technology.
- Students practice responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

T3 Technology productivity tools
- Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

T4 Technology communications tools
- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

T5 Technology research tools
- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

T6 Technology problem-solving and decision-making tools
- Students use technology resources for solving problems and making informed decisions.
- Students employ technology in the development of strategies for solving problems in the real world.

[7] *ISTE: National educational technology standards (NETS).* Retrieved July 13, 2004, from http://cnets.iste.org/