

2011 Mississippi Curriculum Framework

Postsecondary Commercial/Residential Maintenance

(Program CIP: 46.0401 – Building/Property Maintenance and Management)

Direct inquiries to

LaNell Kellum, PhD
Director for Career and Technical Education
Mississippi Community College Board
3825 Ridgewood Road
Jackson, MS 39211
601.432.6518
lkellum@mccb.edu

Jason Crittenden, PhD
Instructional Design Specialist
Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
(662) 325-2510
jason.crittenden@rcu.msstate.edu

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Acknowledgments

Writing Team

Buddy Naramore, Mississippi Gulf Coast Community College, Perkinston Campus, Perkinston, MS

RCU Staff

Jason Crittenden, Instructional Design Specialist
Terry Thomas, Editor
Theresa Wheeler, Curriculum Research Specialist

Professional Curriculum Advisory Team

Mississippi Construction Education Foundation, Ridgeland, MS

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Preface

Commercial Residential Maintenance Research Synopsis

The Commercial Residential Maintenance program is designed to prepare individuals for employment opportunities in commercial and residential building general maintenance and repairs. Content of the program includes federal, state, and local codes and basic maintenance of heating and cooling systems, ice machines, refrigerators, electrical, plumbing, welding, irrigation, pools, spas, and building components.

Needs of the Future Workforce

Residential Maintenance occupations will grow about as fast as average in the United States, 10%, and in Mississippi, 17%, between 2010 and 2020 (EMSI, 2010). Job prospects will be best for those with combined knowledge and experience. Jobs are expected to increase with reconstruction projects as well as new construction projects, highlighting the viability of such a program in Mississippi's community and junior colleges.

Commercial/Residential Maintenance Employment Projections and Earnings

Region	2010 Jobs	2020 Jobs	Change	% Change	Openings	2010 Median Hourly Earnings
Regional Total	36,067	42,210	6,143	17%	11,096	\$12.08
National Total	3,612,538	3,960,970	348,432	10%	882,535	\$16.80

Articles, books, Web sites, and other materials listed at the end of each course were considered during the revision process. Specific journals and magazines were especially useful in providing insight into trends and issues in the field. These references are suggested for use by instructors and students during the study of the topics outlined. Industry advisory team members at colleges throughout the state were asked to give input related to changes to be made to the curriculum framework. Specific comments related to soft skills needed in this program include "People skills are a must. You have to be able to talk to the contractors you are working with." Course names should be updated to reflect current industry terminology, and more technical electives should be added so colleges will have the flexibility to cater to industry and student needs.

Curriculum

The following national standards were referenced in each course of the curriculum:

- CTB/McGraw-Hill LLC *Tests of Adult Basic Education, forms 9 and 10* Academic Standards
- *21st Century Skills*
- *Contren Learning Series Best Practices*

Industry and instructor comments, along with current research, were considered by the curriculum revision team during the revision process; and changes were made as needed and appropriate. Many of the skills and topics noted in the research were already included in the curriculum framework. Specific changes made to the curriculum at the **November 2010** curriculum revision meeting included the following:

- A 2-year certificate (61 sch) for Commercial Residential Maintenance was developed.

- A 2-year associate's degree program (63 sch) for Commercial Residential Maintenance was developed.
- Fundamentals of Maintenance Services (CRM 1113) was changed from 2 to 3 scheduled credit hours.
- Maintenance Regulations (CRM 1122) was changed from 1 to 2 scheduled credit hours.
- Mathematics and Blueprint Interpretation (CRM 1134) was changed from 3 to 4 scheduled credit hours.
- Heating, Ventilating, and Air Conditioning (CRM 1616) was changed from 5 to 6 scheduled credit hours.
 - Two competencies pertaining to the EPA Clean Air Act, Section 608, and basic wiring of HVAC units were added to CRM 1616.
- The equipment list was amended to include a combination wrench set (1/4 in. to 2 in., QTY: 2), a sheet metal brake (QTY: 1), and a socket and ratchet set (1/4 in. to 1 ½ in., QTY: 2).

Assessment

Students will be assessed using the Commercial Residential Maintenance MS-CPAS2 test. The MS-CPAS2 blueprint can be found at <http://www.rcu.msstate.edu/>. All students will test after year one of their program. A second test covering the second year material will be administered to AAS track students upon completion of their program. If there are questions regarding assessment of this program, please contact the Architecture and Construction Instructional Design Specialist at the Research and Curriculum Unit at 662.325.2510.

No Alternate assessments are available at this time.

Professional Learning

It is suggested that instructors participate in professional learning related to the following concepts:

- New topics in curriculum and new standards
- Topics where instructors need help
- How to use the program Blackboard site
- Differentiated instruction – To learn more about differentiated instruction, please go to http://www.paec.org/teacher2teacher/additional_subjects.html, and click on Differentiated Instruction. Work through this online course, and review the additional resources.

Program Exceptions

No program exceptions exist at this time.

Articulation

Articulation credit from Secondary Construction: Carpentry to Postsecondary Commercial Residential Maintenance will be awarded upon implementation of this curriculum by the college. The course to be articulated is Carpentry (CRM 1214) with the stipulation of passing the MS-CPAS2 according to State Board for Community and Junior Colleges (MCCB) guidelines.

Articulated Secondary Course	Articulated Postsecondary Course
[S] Construction: Carpentry (CIP: 46.000)	CRM 1214 – Carpentry

Statewide Guidelines on Articulated Credit

Eligibility

- To be eligible for articulated credit, a student must do the following:
 - Complete the articulated Secondary Career Program.
 - Score 80% or higher on the Mississippi Career Planning and Assessment System (MS CPAS) in his or her secondary program of study.
- To be awarded articulated credit, a student must do the following:
 - Complete application for articulated credit at the community or junior college.
 - Enroll in the community or junior college within 18 months of graduation.
 - Successfully complete 12 non-developmental career/technical or academic credit hours in the corresponding articulated postsecondary career-technical program of study.

How MS CPAS will be documented

- The Research and Curriculum Unit of Mississippi State University will provide the SBCJC a list of all secondary CTE students scoring at or above the 80 percentile for the articulated programs.
- The SBCJC will forward the list of students eligible for articulated credit to the colleges.

Transcripting of Articulated Credit

- Students must complete 12 non-developmental career/technical or academic credit hours in the articulated postsecondary career-technical program of study before the articulated credit is transcripted.
- No grade will be given on the transcript for articulated courses; only hours granted will be transcripted (thus resulting in no change in quality points).

Time Limit

- MS CPAS scores will be accepted to demonstrate competencies for up to 18 months after high school graduation.

Cost

- No costs will be assessed on hours earned through articulated credit.

Foreword

As the world economy continues to evolve, businesses and industries must adopt new practices and processes in order to survive. Quality and cost control, work teams and participatory management, and an infusion of technology are transforming the way people work and do business. Employees are now expected to read, write, and communicate effectively; think creatively, solve problems, and make decisions; and interact with each other and the technologies in the workplace. Career–technical programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact local career–technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and career skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide career and technical educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Referenced throughout the courses of the curriculum are the 21st Century Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. Another important aspect of learning and working in the 21st century involves technology skills. The International Society for Technology in Education, developer of the National Educational Technology Standards (NETS), was a strategic partner in the Partnership for 21st Century Skills. Each postsecondary program of instruction consists of a program description and a suggested sequence of courses that focus on the development of occupational competencies. The MS-CPAS2 blueprints are based upon the suggested course sequences to allow for year 1 and year 2 assessments for all exit options. Please refer to the blueprint online. Each career–technical course in this sequence has been written using a common format, which includes the following components:

- Course Name – A common name that will be used by all community and junior colleges in reporting students
- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students
- Classification – Courses may be classified as the following:
 - Career–technical core – A required career–technical course for all students
 - Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs
 - Career–technical elective – An elective career–technical course
 - Related academic course – An academic course that provides academic skills and knowledge directly related to the program area

- Academic core – An academic course that is required as part of the requirements for an associate’s degree
- Description – A short narrative that includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester
- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course
- Corequisites – A listing of courses that may be taken while enrolled in the course
- Competencies and Suggested Objectives – A listing of the competencies (major concepts and performances) and the suggested student objectives that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
 - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
 - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
 - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
 - Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs
 - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas
- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.
- Programs that offer an Associate of Applied Science degree must include a minimum 15-semester-credit-hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:
 - 3 semester credit hours (sch) Math/Science Elective
 - 3 semester credit hours Written Communications Elective
 - 3 semester credit hours Oral Communications Elective
 - 3 semester credit hours Humanities/Fine Arts Elective

○ 3 semester credit hours

Social/Behavioral Science Elective

It is recommended that courses in the academic core be spaced out over the entire length of the program, so that students complete some academic and career–technical courses each semester. Each community or junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- Career–technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their area.

In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:

- Adding new competencies and suggested objectives
- Revising or extending the suggested objectives for individual competencies
- Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)

In addition, the curriculum framework as a whole may be customized by doing the following:

- Resequencing courses within the suggested course sequence reflecting the new assessment format
- Developing and adding a new course that meets specific needs of industries and other clients in the community or junior college district (with MCCB approval)
- Utilizing the career technical elective options in many of the curricula to customize programs

Table of Contents

Acknowledgments.....	2
Preface.....	3
Foreword.....	6
Program Description.....	10
Suggested Course Sequence	11
Commercial/Residential Maintenance Technology Courses	16
Fundamentals of Maintenance Services.....	16
Maintenance Regulations.....	20
Mathematics and Blueprint Interpretation	23
Carpentry.....	26
Surface Finishes	30
Masonry	33
Plumbing.....	36
Pool and Spa Maintenance.....	39
Landscape Irrigation	41
Electrical	43
Heating, Ventilating, and Air Conditioning (HVAC).....	46
Welding.....	50
Special Project in Commercial/Residential Maintenance.....	53
Supervised Work Experience in Commercial/Residential Maintenance	54
Work-Based Learning I, II, III, IV, V, and VI.....	55
Recommended Tools and Equipment	56
Appendix A: Contren Learning Series Best Practices	61
Appendix B: Related Academic Standards.....	72
Appendix C: 21 st Century Skills	73

Program Description

The Commercial/Residential Maintenance program is designed to prepare individuals for employment opportunities in commercial and residential building general maintenance and repairs. Content of the program includes federal, state, and local codes; and basic maintenance of heating and cooling systems, ice machines, refrigerators, electrical, plumbing, welding, irrigation, pools, spas, and building components.

Industry standards referenced are from the *Best Practices for Content Learning Series*, National Center for Construction Education and Research.

PROGRAM REQUIREMENTS

The curriculum for Commercial/Residential Maintenance is based upon data as collected from curricula guides, various codes, input from the business and industry, and a writing team. The listing of tasks within these documents served as baseline data for the development of this curriculum. The task list used in this curriculum is based upon the following assumptions:

1. In all areas, appropriate theory, safety, and support instruction will be provided for each task. It is essential that all instruction include use of the appropriate equipment needed to accomplish certain tasks. It is also assumed that each student has received instruction to locate and use current reference materials from publications which present manufacturers' recommended or required specifications and procedures for doing the various tasks.
2. The individual program should have written and detailed evaluation standards for each task covered in the curriculum. Learning progress of students should be monitored and evaluated against these stated standards. A system should be in place that informs all students of their progress throughout the program.
3. It is recognized that individual courses will differ across the technical programs. The development of appropriate learning activities and tests will be the responsibility of the individual program.
4. These standards require that tasks contained in the list be included in the program to validate that the program is meeting the needs of the business.

Suggested Course Sequence*
Commercial/Residential Maintenance Technology
Career Certificate

3 sch Fundamentals of Maintenance Services (CRM 1113) 2 sch Maintenance Regulations (CRM 1122) 4 sch Mathematics and Blueprint Interpretation (CRM 1134) 4 sch Carpentry (CRM 1214) 3 sch Masonry (CRM 1313) 2-3 sch Career–Technical Elective**	4 sch Plumbing (CRM 1414) 4 sch Electrical (CRM 1514) 6 sch Heating, Ventilating, and Air Conditioning (HVAC) (CRM 1616) 4 sch Career–Technical Electives**
18-19 sch	18 sch

CAREER–TECHNICAL ELECTIVES**

2 sch Surface Finishes (CRM 1222)	
2 sch Pool and Spa Maintenance (CRM 1422)	
2 sch Landscape Irrigation (CRM 1432)	
3 sch Welding (CRM 1713)	
1-3 sch Special Project in Commercial/Residential Maintenance [CRM 291(1-3)]	
1-6 sch Supervised Work Experience in Commercial/Residential Maintenance [CRM 292(1-6)]	
1-3 sch Work-Based Learning I, II, III, IV, V and VI [WBL 191(1-3), WBL 192(1-3), WBL 193(1-3), WBL 291(1-3), WBL 292(1-3), and WBL 293(1-3)]	

* Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

Note: Any other technical or academic course as approved by the instructor

Suggested Course Sequence*
Commercial Residential Maintenance
Technical Certificate

FIRST YEAR

3 sch Fundamentals of Maintenance Services (CRM 1113) 2 sch Maintenance Regulations (CRM 1122) 4 sch Mathematics and Blueprint Interpretation (CRM 1134) 4 sch Carpentry (CRM 1214) 3 sch Masonry (CRM 1313) 2 sch Career–Technical Elective [†]	4 sch Plumbing (CRM 1414) 4 sch Electrical (CRM 1514) 6 sch Heating, Ventilating, and Air Conditioning (HVAC) (CRM 1616) 4 sch Career–Technical Electives [†]
18 sch	18 sch

SECOND YEAR

3 sch Construction Materials (DDT 1213) 4 sch Fundamentals of Drafting (DDT 1114) 6 sch Career–Technical Electives [†]	3 sch Principles of Multi-family & Light Commercial Construction (CAV 2113) 3 sch Cost Estimating (DDT 2243) 6 sch Career–Technical Electives [†]
13 sch	12 sch

* Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

** Baseline competencies are taken from the secondary Construction: Carpentry program. Students who can document mastery of these competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

[†]CAREER–TECHNICAL ELECTIVES

3 sch	Science and Technology (ATE 1113)
3 sch	Fundamentals of Microcomputer Applications (CPT 1113) (or any other suitable computer science course approved by the instructor)
3 sch	Forming Applications (CAV 1123)
3 sch	Advanced Cabinet Making (CAV 2133)

- 3 sch Advanced Interior Finishing (CAV 2313)
- 1-3 sch Special Problem in Residential Carpentry Technology [CAV 291(1-3)]
- 1-6 sch Supervised Work Experience in Residential Carpentry Technology [CAV 292(1-6)]
- 1-3 sch Work Based Learning [WBL 191(1-3), WBL 192(1-3), WBL 193(1-3), WBL 291(1-3), WBL 292(1-3), and WBL 293(1-3)]

Note: Any other technical or academic course as approved by the instructor

Suggested Course Sequence*
Commercial Residential Maintenance
Associate of Applied Science Degree

FIRST YEAR

3 sch Fundamentals of Maintenance Services (CRM 1113) 2 sch Maintenance Regulations (CRM 1122) 4 sch Mathematics and Blueprint Interpretation (CRM 1134) 4 sch Carpentry (CRM 1214) 3 sch Math/Science Elective <hr style="width: 100%;"/> 16 sch	3 sch Masonry (CRM 1313) 4 sch Plumbing (CRM 1414) 4 sch Electrical (CRM 1514) 6 sch Heating, Ventilating, and Air Conditioning (HVAC) (CRM 1616) <hr style="width: 100%;"/> 17 sch
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SECOND YEAR

3 sch Written Communications Elective 3 sch Oral Communications Elective 3 sch Construction Materials (DDT 1213) 4 sch Fundamentals of Drafting (DDT 1114) 3 sch Career–Technical Electives [†] <hr style="width: 100%;"/> 16 sch	3 sch Humanities/Fine Arts Elective 3 sch Social/Behavioral Science Elective 3 sch Computer Elective ^{††} 3 sch Cost Estimating (DDT 2243) 2-3 sch Career–Technical Electives [†] <hr style="width: 100%;"/> 14-15 sch
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* Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

** Baseline competencies are taken from the secondary Construction: Carpentry program. Students who can document mastery of these competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

[†]CAREER–TECHNICAL ELECTIVES

3 sch Science and Technology (ATE 1113)
3 sch Fundamentals of Microcomputer Applications (CPT 1113) (or any other suitable computer science course approved by the instructor)
3 sch Forming Applications (CAV 1123)
3 sch Advanced Cabinet Making (CAV 2133)
3 sch Advanced Interior Finishing (CAV 2313)
1-3 sch Special Problem in Residential Carpentry Technology [CAV 291(1-3)]

- 1-6 sch Supervised Work Experience in Residential Carpentry Technology [CAV 292(1-6)]
 1-3 sch Work Based Learning [WBL 191(1-3), WBL 192(1-3), WBL 193(1-3), WBL 291(1-3), WBL 292(1-3), and WBL 293(1-3)]

Note: Any other technical or academic course as approved by the instructor.

††COMPUTER ELECTIVES
 (As approved by the instructor)

- 3 sch Fundamentals of Microcomputer Applications (CPT 1113) (or any other suitable computer science course approved by the instructor)
 3 sch Electronic Spreadsheet (BOT 1813)
 3 sch Records Management (BOT 1413)
 3 sch Document Formatting and Production (BOT 1113)
 3 sch Business Accounting (BOT 1433)
 OR Principles of Accounting I (ACC 1213)
 3 sch Keyboard Skillbuilding (BOT 1123)

Note: Any other technical or academic course as approved by the instructor

Commercial/Residential Maintenance Technology Courses

Course Name: Fundamentals of Maintenance Services

Course Abbreviation: CRM 1113

Classification: Career–Technical Core

Description: Emphasis on basic concepts and practices in the maintenance programs for commercial and residential facilities including scheduling, work order systems, workforce management, inventory control, safety, and right-to-know programs. (3 sch: 2-hr lecture, 2- hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1.	Describe general safety rules for working in a shop/lab and industry. ^(DOK1, C1, C3, C7) a. Describe how to avoid on-site accidents. ^(DOK1) b. Explain the relationship between housekeeping and safety. ^(DOK1) c. Explain the importance of following all safety rules and company safety policies. ^(DOK1) d. Explain the importance of reporting all on-the-job injuries, accidents, and near misses. ^(DOK1) e. Explain the need for evacuation policies and the importance of following them. ^(DOK1) f. Explain the employer’s substances abuse policy and how it relates to safety. ^(DOK1) g. Demonstrate the safety procedures when working near pressurized or high temperature systems. ^(DOK2)
2.	Identify and explain the use of various barriers and confinements. ^(DOK1, C1, C3, C7) a. Explain the safety requirements for working in confined areas. ^(DOK1) b. Demonstrate and practice lockout/tagout procedures. ^(DOK2) c. Explain the different barriers and barricades and how they are used. ^(DOK1) d. Recognize and utilize personal protective equipment. ^(DOK1) e. Inspect and care for personal protective equipment. ^(DOK1)
3.	Explain lifting and the use of ladders and scaffolds. ^(DOK1, C1, C3, C4, C7) a. Identify and demonstrate the procedures for lifting heavy objects. ^(DOK1) b. Inspect and safely work with various ladders and scaffolds. ^(DOK1)
4.	Evaluate the function of the Material Safety Data Sheets (MSDSs). ^(DOK1, C1, C3, C7)
5.	Explain fires. ^(DOK1, C1, C3, C7) a. Discuss the process by which fires start. ^(DOK1) b. Apply fire prevention procedures for various flammable liquids. ^(DOK2) c. Identify the classes of fire and the types of extinguishers. ^(DOK1)
6.	Demonstrate safety procedures in and around electrical situations. ^(DOK2, C1, C3, C7) a. Describe injuries from electrical contact. ^(DOK1) b. Demonstrate safety around electrical hazards. ^(DOK2) c. Explain action to take when an electrical shock occurs. ^(DOK1)
7.	Perform basic maintenance scheduling. ^(DOK2, C1, C3, C7)

a. Illustrate the importance of scheduling. ^(DOK2)
b. Develop a maintenance schedule. ^(DOK2)
8. Prepare work orders for various tasks. ^(DOK2, C1, C3, C7)
a. Identify terms associated with work orders. ^(DOK1)
b. Describe various work orders. ^(DOK1)
c. Explain the importance of work orders. ^(DOK1)
9. Utilize an inventory control system. ^(DOK2, C1, C3, C7)
a. Describe the importance of an inventory system and its controls. ^(DOK1)
b. Define terms associated with an inventory system and its controls. ^(DOK1)

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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Course Name: Maintenance Regulations

Course Abbreviation: CRM 1122

Classification: Career–Technical Core

Description: Basic information on the various federal, state, and local regulations agencies that govern maintenance operations and practices, including Occupational and Safety Health Act (OSHA), Environmental Protection Agency (EPA), and American with Disabilities Act (ADA). (2 sch: 2-hr lecture)

Prerequisite: None

Competencies and Suggested Objectives	
1.	Handle, store, and dispose of hazardous materials. ^(DOK1, C1) <ol style="list-style-type: none"> Recognize signal words and symbols that indicate severity of a hazard. ^(DOK1) Describe methods for reducing hazardous waste. ^(DOK1) Describe procedures for storing hazardous waste. ^(DOK1) Interpret data found on a hazardous Material Safety Data Sheet. ^(DOK2) Describe general safety procedures for first aid and cleanup to follow in case of an accident involving hazardous materials. ^(DOK1)
2.	Describe hiring policies. ^(DOK1, C6) <ol style="list-style-type: none"> Discuss American Disabilities Act. ^(DOK1) Explore general hiring procedures. ^(DOK1) Simulate the steps in the hiring process. ^(DOK2)
3.	Explain federal, state, and local building codes. ^(DOK1, C9) <ol style="list-style-type: none"> Identify which code books are needed. ^(DOK1) Discuss the differences among federal, state, and local codes. ^(DOK1) Locate various topics in the code books. ^(DOK1) Explain the procedures to follow when a code violation is found. ^(DOK1)

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)

- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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- Naderi, H., & Thornburg, D. (2006). *Significant changes to the international residential code*. Albany, NY: Delmar.

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Occupational Safety and Health Administration. Retrieved March 21, 2011 <http://www.osha.gov/>

Course Name: Mathematics and Blueprint Interpretation

Course Abbreviation: CRM 1134

Classification: Career–Technical Core

Description: Basic instruction in mathematics and the methods of interpreting information and the relationship of details and sections to an overall blueprint utilizing scale drawings, symbols, abbreviations, floor plans, elevations, and specifications tables. (4 sch: 2-hr lecture, 4-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1. Apply the basic principles of mathematics. ^(DOK2, C2)	
a. Solve problems using fractions. ^(DOK2)	
b. Solve problems using decimals. ^(DOK2)	
c. Identify measuring tools. ^(DOK1)	
d. Read measuring tools. ^(DOK1)	
e. Apply basic mathematics. ^(DOK2)	
2. Interpret symbols, abbreviations, alphabet of lines, types of views, and title blocks. ^{DOK2, C3}	
a. Identify the common blueprint symbols. ^(DOK1)	
b. Interpret information found in the title block of a blueprint. ^(DOK2)	
c. Interpret the meaning of various parts of a blueprint. ^(DOK2)	
d. Prepare a building layout. ^(DOK2)	

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)

- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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Shea, J. (2004). *Working with numbers*. Orlando, FL: Steck Vaughn.

Course Name: Carpentry

Course Abbreviation: CRM 1214

Classification: Career–Technical Core

Description: Basic course in carpentry skills required to perform building maintenance activities. Covers the installation methods and materials available to make repairs to building structures using accepted trade practices. (4 sch: 1-hr lecture, 6-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1. Demonstrate safety terms and practices. (DOK2, C1)	<ul style="list-style-type: none"> a. Identify safety terms. (DOK1) b. Demonstrate safety practices. (DOK2) c. Safely use the different ladders. (DOK1) d. Recognize and safely use aerial work platforms and scissor lifts. (DOK1)
2. Explain and apply basic building codes. (DOK1, C1)	
3. Identify and demonstrate the safe use of hand tools, power tools, and stationary equipment. (DOK1, C11)	<ul style="list-style-type: none"> a. Identify hand tools, power tools, and stationary equipment. (DOK1) b. Demonstrate the maintenance of hand tools, power tools, and stationary equipment. (DOK2) c. Demonstrate the safe use of hand tools, power tools, and stationary equipment. (DOK2)
4. Construct a project. (DOK3, C12, C13, C15)	<ul style="list-style-type: none"> a. Select tools and materials for a specific building task. (DOK1) b. Demonstrate procedures to use in storing materials. (DOK2) c. Lay out, cut, and assemble a specific building task. (DOK3)
5. Install and/or repair building components. (DOK2, C12, C13, C15)	<ul style="list-style-type: none"> a. Install and/or repair underlayment and asphalt shingles. (DOK2) b. Install and/or repair a window unit. (DOK2) c. Install and/or repair an exterior and interior door unit. (DOK2) d. Install and/or repair interior wall covering. (DOK2) e. Install and/or repair blanket insulation in walls. (DOK2) f. Install and/or repair ceiling tile. (DOK2) g. Install and/or repair various hardware. (DOK2)

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)

Postsecondary Commercial/Residential Maintenance

- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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Fine Home Building. Retrieved March 21, 2011, from
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Hometime. Retrieved March 21, 2011, from <http://www.hometime.com/>

Course Name: Surface Finishes

Course Abbreviation: CRM 1222

Classification: Career–Technical Elective

Description: Various techniques and processes of surface cleaning, preparation, and repair.
(2 sch: 1-hr lecture, 2-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1. Discuss and apply general safety rules.	(DOK1, C1)
2. Prepare a surface.	(DOK2, C14, C15)
a. Identify terms associated with surface preparations.	
b. Identify and discuss the various tools used in surface preparations.	
c. Prepare a surface for refinishing.	
3. Identify various surface/substrate materials and conditions.	(DOK1, C14, C15)
a. Identify various substrates hardware for a specific job.	
b. Identify the surface condition of substrates and coatings.	
c. Identify the basic surface preparation methods and coatings required for various substrates.	
4. Finish a surface.	(DOK2, C14, C15)
a. Identify the necessary tools to finish various surfaces.	
b. Lay out and discuss the procedures for finishing various surfaces.	
5. Describe the procedures for protecting adjacent surfaces.	(DOK1, C14, C15)
a. Describe the tools.	
b. Describe the methods of applying interior and exterior masking and coverings for various surfaces.	
c. Describe the procedures for complete cleanup of the area.	

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
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- M6 Fractions (addition, subtraction, multiplication, division)

- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Surface Finishes

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Fine Home Building. Retrieved March 21, 2011, from <http://www.taunton.com/finehomebuilding/index.asp>

Hometime. Retrieved March 21, 2011, from <http://www.hometime.com/>

Course Name: Masonry

Course Abbreviation: CRM 1313

Classification: Career–Technical Core

Description: Techniques of brick, block, and ceramic tile laying and repairing processes to include safety practices. (3 sch: 1-hr lecture, 4-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1. Define terms and rules for safety. ^(DOK1, C1, C17)	
a. Define terms used in the masonry trade. ^(DOK1)	
b. Explain and demonstrate rules of safety. ^(DOK1)	
c. Perform safety checks on tools and equipment. ^(DOK1)	
2. Apply procedures for laying blocks and bricks. ^(DOK2, C16, C17, C18)	
a. Identify characteristics of good brick and block laying performance. ^(DOK1)	
b. Select tools and materials for a specific task. ^(DOK1)	
c. Demonstrate the steps in mechanical and manual mixing of mortar. ^(DOK1)	
d. Perform trowel spreading and buttering. ^(DOK2)	
e. Lay a 4-in. brick lead. ^(DOK2)	
f. Lay a 4-in. return corner lead. ^(DOK2)	
g. Lay a block wall out. ^(DOK2)	
3. Perform repair procedures. ^(DOK2, C18)	
a. Measure, mark, and cut brick and block to specifications. ^(DOK1)	
b. Perform repairs on a brick and block wall. ^(DOK2)	
4. Perform procedures for laying and repairing ceramic tile. ^(DOK2, C17, C18)	
a. Select tools and materials. ^(DOK1)	
b. Explain the steps in mixing thin set. ^(DOK2)	
c. Perform trowel spreading. ^(DOK2)	
d. Lay and/or repair ceramic tile. ^(DOK2)	
e. Apply grout and finish. ^(DOK2)	

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
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- M9 Algebraic Operations
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- A2 Number Theory (ratio, proportion)
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- A5 Measurement (money, time, temperature, length, area, volume)
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- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
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21st Century Skills

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- CS2 Financial, Economic, and Business Literacy
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- CS6 Interpersonal and Self-Directional Skills

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Course Name: Plumbing

Course Abbreviation: CRM 1414

Classification: Career–Technical Core

Description: Basic design, function, maintenance, repair, and replacement of all types of light commercial and residential plumbing fixtures. (4 sch: 1-hr lecture, 6-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1.	Discuss and apply general safety rules. (DOK1, C1, C19)
2.	Discuss terms, materials, and components. (DOK1, C20)
	a. Define terms associated with plumbing. (DOK1)
	b. Identify basic materials and components used in the plumbing trade. (DOK1)
	c. Identify basic fixtures used in light commercial and residential structures. (DOK1)
3.	Identify and apply basic regional and local plumbing codes. (DOK1, C19)
	a. Describe the procedure for modifying the plumbing codes. (DOK1)
	b. Explain the model code and local code used in the local area. (DOK1)
	c. Write a proposed code change. (DOK2)
4.	Apply basic procedures used in copper tubing. (DOK1, C22)
	a. Select tools, materials, and equipment necessary to cut and join copper tubing by the compression, flare, and sweat methods. (DOK1)
	b. Cut and join copper tubing by the compression, flare, and sweat methods. (DOK1)
5.	Apply basic procedures used in polyvinyl chloride (PVC) pipe. (DOK1, C21)
	a. Select tools and materials used to join PVC pipe. (DOK1)
	b. Join PVC pipe and fittings. (DOK2)
6.	Apply basic procedures used in steel pipe. (DOK1, C23)
	a. Identify sizes of steel pipe. (DOK1)
	b. Identify the tools and materials used to join steel pipe. (DOK1)
	c. Identify basic plumbing fittings, bends, valves, and branches. (DOK1)
	d. Measure, cut, ream, thread, and assemble steel pipe and fitting. (DOK2)
7.	Troubleshoot, repair, and/or install basic water and drainage systems and fixtures. (DOK2, C25)
	a. Troubleshoot water systems according to local codes. (DOK2)
	b. Troubleshoot PVC-DWV (Drain-Waste-Vent) system according to local codes. (DOK2)
	c. Troubleshoot, repair, and/or install various plumbing fixtures. (DOK2)

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)

Postsecondary Commercial/Residential Maintenance

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- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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Plumbing

Blankenbaker, E. (2005). *Modern plumbing*. Tinley Park, IL: Goodheart-Willcox.

- Joyce, M. (2005). *Residential construction academy plumbing*. Albany, NY: Delmar.
- Naderi, H., & Thornburg, D. (2006). *Significant changes to the international residential code*. Albany, NY: Delmar.
- National Center for Construction Education and Research. (2005). *Plumbing level I*. Upper Saddle River, NJ: Pearson Prentice Hall.
- Ripka, L. (2002). *Plumbing design and installation*. Homewood, IL: American Technical.

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Video

- Hometime Video Publishing. (1993). *Plumbing* [Videotape]. (Available from Hometime, ATTN: Orders, 4355 Peavey Rd, Chaska, MN 55318)

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- B4UBUILD*. Retrieved March 21, 2011, from <http://www.b4ubuild.com/>
- Do It Yourself Network*. Retrieved March 21, 2011, from <http://www.diynetwork.com/>
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Course Name: Pool and Spa Maintenance

Course Abbreviation: CRM 1422

Classification: Career–Technical Elective

Description: Basic skills and techniques for the safe and proper maintenance of pools and spas.
(2 sch: 1 hr. lecture, 2-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1. Identify terms, materials, and components of spas and pools. ^(DOK1, C26)	
a. Explain the primary differences in the development, maintenance, and repair of spas and pools. ^(DOK1)	
2. Explain the basic procedures for the installation of a spa and pool. ^(DOK1, C26)	
a. Identify the various codes which affect the installation of a spa and pool. ^(DOK1)	
3. Inspect and provide basic maintenance and repair to a spa and pool. ^(DOK1, C26)	
a. Identify procedures for inspection and maintenance of a spa and pool. ^(DOK1)	
b. Provide basic maintenance and repair to a spa and pool. ^(DOK2)	

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
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- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)

- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
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- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Pool and Spa Maintenance

National Center for Construction Education and Research. (2005). *Plumbing level I*. Upper Saddle River, NJ: Pearson Prentice Hall.

Web Sites

Association of Pool and Spa Professionals. Retrieved March 21, 2011, from <http://www.nspi.org/Home/>

Course Name: Landscape Irrigation

Course Abbreviation: CRM 1432

Classification: Career–Technical Elective

Description: Basic use of irrigation in residential and light commercial applications. Sprinkler designs and plans, practices, equipment, and maintenance for single-family dwellings, light commercial buildings, and apartment/townhouse complexes. (2 sch: 1-hr lecture, 2-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1. Identify and explain the terms and basic parts of an irrigation system.	(DOK1, C27)
2. Determine the layout of an irrigation system.	(DOK1, C27)
a. Determine location and type of sprinkler heads needed.	(DOK1)
b. Determine amount of flow of water in a system.	(DOK1)
c. Determine size and amount of pipe for an irrigation system.	(DOK1)
3. Perform maintenance on an irrigation system.	(DOK2, C27)
a. Explain the necessary procedures in the maintenance of an irrigation system.	(DOK1)
b. Determine a maintenance schedule for an irrigation system.	(DOK1)
c. Troubleshoot and repair an irrigation system.	(DOK2)

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
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- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
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- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)

- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
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21st Century Skills

- CS1 Global Awareness
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- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Landscape Irrigation

- Keesan, L. (1995). *The complete irrigation workbook*. New York: John Wiley & Sons.
- Melby, P. (1995). *Simplified irrigation design*. New York: John Wiley & Sons.
- National Center for Construction Education and Research. (2002). *Sprinkler fitting level III*. Upper Saddle River, NJ: Pearson Prentice Hall.

Video

- Hometime Video Publishing. (1994). *Basic landscaping* [Videotape]. (Available from Hometime, ATTN: Orders, 4355 Peavey Rd, Chaska, MN 55318)

Course Name: Electrical

Course Abbreviation: CRM 1514

Classification: Career–Technical Core

Description: Basic electrical diagnosis and repair techniques including basic circuit theory, safety and grounding essentials, wiring systems, circuitry, and electrical troubleshooting.
(4 sch: 1-hr lecture, 6-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1.	Describe basic electrical safety practices. (DOK1, C8) <ol style="list-style-type: none"> Describe hazards of electrical shock. (DOK1) Describe accident procedures. (DOK1) Describe basic electrical circuit safety methods. (DOK1) Describe the operation of current overload devices. (DOK1)
2.	Explain and apply basic regional and local electrical codes. (DOK1, C9) <ol style="list-style-type: none"> Explain the purpose of the National Electrical Code (NEC). (DOK1) Explain how to navigate the NEC. (DOK1) Explain Article 90 of the NEC. (DOK1)
3.	Install electrical wiring. (DOK2, C10) <ol style="list-style-type: none"> Select tools and materials for a specific task. (DOK1) Install wiring for various circuits. (DOK2) Install boxes, cables, receptacles, and switches. (DOK2) Install simulated wiring circuits of various voltages from the service entrance panel to the receptacles, switches, and load centers. (DOK2)
4.	Install and troubleshoot electrical wiring components. (DOK2, C10) <ol style="list-style-type: none"> Install a simulated residential electrical system from the weather head to the service entrance panel. (DOK2)

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
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- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
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21st Century Skills

- CS1 Global Awareness
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- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Electrical

- Callanan, M., & Wusinich, B. (2005). *Electrical systems based on the 2005 NEC*. Homewood, IL: American Technical.
- Fletcher, G. (2004). *Residential construction academy house wiring*. Albany, NY: Delmar.
- Herman, S. (2003). *Residential construction academy electrical principles*. Albany, NY: Delmar.
- Holzman, H. (2005). *Modern residential wiring*. Tinley Park, IL: Goodheart-Willcox.

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Fine Home Building. Retrieved March 21, 2011, from <http://www.taunton.com/finehomebuilding/index.asp>

Hometime. Retrieved March 21, 2011, from <http://www.hometime.com/>

Course Name: Heating, Ventilating, and Air Conditioning (HVAC)

Course Abbreviation: CRM 1616

Classification: Career–Technical Core

Description: Basic principles, operation, maintenance, and repair of heating, ventilation, air conditioning, ice machines, and refrigerators in residential and light commercial buildings (6 sch: 2-hr lecture, 8-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1.	Safely use hand tools commonly found in the heating and air-conditioning industry. ^(DOK1, C28) a. Define terms associated with hand tools. b. Describe the various types of hand tools.
2.	Explain and apply basic heating and air-conditioning codes. ^(DOK1, C30, C31) a. Explain the purpose and use of heating and air-conditioning codes. b. Explain how to navigate the heating and air-conditioning codes. ^(DOK1) c. Apply basic codes when performing maintenance to heating and air-conditioning systems. ^(DOK2)
3.	Explain/apply the basic principles in the use of gauges. ^(DOK1, C30, C31) a. Explain the safety precautions when working with charging cylinders. ^(DOK1) b. Explain the purposes of refrigeration gauges. ^(DOK1) c. Connect a set of refrigeration gauges to a system. ^(DOK2)
4.	Charge a refrigeration system. ^(DOK2, C30) a. Identify the methods of charging a refrigeration system. ^(DOK1) b. Charge the refrigeration system from the low side and/or high side. ^(DOK2)
5.	Provide basic recovery system service operations. ^(DOK1, C30) a. Describe the effect of refrigerant and fluorocarbons on the atmosphere. ^(DOK1) b. Identify special access fittings needed for the removal of a refrigerant from the system. ^(DOK1) c. Use a refrigerant recovery system to reclaim refrigerant. ^(DOK2)
6.	Locate leaks in a refrigerant system. ^(DOK2, C32) a. Locate leaks using soap bubbles. ^(DOK2) b. Locate leaks using an electronic detector. ^(DOK2) c. Locate leaks using a halide detector. ^(DOK2)
7.	Identify and perform basic maintenance repairs on a heating system. ^(DOK1, C31) a. Explain the functions of an electric heating system and gas furnace. ^(DOK1) b. Troubleshoot and provide maintenance to heating systems. ^(DOK2)
8.	Explain and discuss the EPA Clean Air Act, Section 608. ^(DOK1, C28)
9.	Explain basic wiring of HVAC units. ^(DOK1, C29) a. Demonstrate basic wiring in electric heat, gas heat, heat pump, and condenser units. ^(DOK2) b. Demonstrate basic wiring of control voltage. ^(DOK2)

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
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- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
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- S1 Vowel (short, long)
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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills

Postsecondary Commercial/Residential Maintenance

CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

HVAC

Althouse, A., Turnquist, C., & Bracciano, A. (2000). *Modern refrigeration and air conditioning*. Tinley Park, IL: Goodheart-Willcox.

Jeffus, L., & Air Conditioning and Refrigeration Institute. (2004). *Refrigeration and air conditioning*. Upper Saddle River, NJ: Pearson Prentice Hall.

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Commercial Building Products. Commercial Building Products ConSource LLC. Retrieved March 21, 2011, from <http://www.cbpmagazine.com/>

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RSES Journal: Heating, Ventilation, Air Conditioning, and Refrigeration. RSES. Retrieved March 21, 2011, from www.rsesjournal.com

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The Educational Standards Corporation. Retrieved March 21, 2011, from <http://www.escoinst.com>

Insider Newspapers. Retrieved March 21, 2011, from <http://www.insidernewspapers.com>

Refrigerating Engineers & Technicians Association. Retrieved March 21, 2011, from <http://www.reta.com>

Wrightsoft. Retrieved March 21, 2011, from <http://www.wrightsoft.com/>

Course Name: Welding

Course Abbreviation: CRM 1713

Classification: Career–Technical Elective

Description: Basic course in the development of welding skills in the safe use of the oxyfuel and arc welding techniques. (3 sch: 1-hr lecture, 4-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1. Identify and describe the basic equipment, setup, and safety rules for proper use of oxyfuel equipment. (DOK1, C33, C35)	
a. Explain oxyfuel cutting safety. (DOK1)	
b. Identify and explain oxyfuel cutting equipment. (DOK1)	
c. Identify and explain oxyfuel flames. (DOK1)	
d. Identify and explain backfire and flashbacks. (DOK1)	
e. Set up oxyfuel equipment. (DOK1)	
f. Light and adjust an oxyfuel torch. (DOK1)	
g. Shut down oxyfuel cutting equipment. (DOK1)	
h. Disassemble oxyfuel equipment. (DOK1)	
2. Perform various operations with oxyfuel equipment. (DOK2, C34)	
a. Explain and demonstrate how to cut straight lines and square shapes. (DOK1)	
b. Explain and demonstrate how to do piercing and slot cutting. (DOK1)	
c. Explain and demonstrate how to lay out and cut bevels. (DOK1)	
3. Identify and explain arc welding safety and equipment. (DOK1, C35)	
a. Identify and explain safety. (DOK1)	
b. Identify and explain welding electrical current. (DOK1)	
c. Identify and explain arc welding machines. (DOK1)	
d. Explain setting up arc welding equipment. (DOK1)	
4. Construct various basic welds. (DOK2, C35, C36)	
a. Weld beads on plate. (DOK2)	
b. Make fillet welds. (DOK2)	
c. Tack various metals together. (DOK2)	

STANDARDS

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
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- A6 Geometry (angles, Pythagorean theory)
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- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
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21st Century Skills

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- CS3 Civic Literacy
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- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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Welding

Althouse, A., Turnquist, C., Bowditch, W., Bowditch, K., & Bowditch, M. (2003). *Modern welding*. Tinley Park, IL: Goodheart-Willcox.

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Videos

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Web Sites

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Hobart Welding Institute. Retrieved March 21, 2011, from <http://www.welding.org/>

Kobelco Welding of America Inc. Retrieved March 21, 2011, from <http://www.kobelcowelding.com/>

Lincoln Electric. Retrieved March 21, 2011, from <http://www.lincolnelectric.com/>

Miller Electric Manufacturing Company. Retrieved March 21, 2011, from <http://www.millerwelds.com/>

Thermadyne Holdings Corporation. Retrieved March 21, 2011, from <http://www.thermadyne.com/>

Course Name: Special Project in Commercial/Residential Maintenance

Course Abbreviation: CRM 291(1-3)

Classification: Career–Technical Elective

Description: Practical application of skills and knowledge gained in other building maintenance courses. The instructor works closely with the student to insure that the selection of a project will enhance the student’s learning experience. (1-3 sch: 2-6-hr lab)

Prerequisite: None

Competencies and Suggested Objectives	
1.	Develop a written plan and blueprints that detail the activities and projects to be completed. <ol style="list-style-type: none"> a. Utilize a written plan that details the activities and projects to be completed. b. Perform written occupational objectives in the special project.
2.	Assess accomplishment of objectives. <ol style="list-style-type: none"> a. Prepare daily written assessment of accomplishment of objectives. b. Present weekly written reports to instructor in activities performed and objectives accomplished.
3.	Utilize a set of written guidelines for the special project. <ol style="list-style-type: none"> a. Develop and follow a set of written guidelines for the special project.

STANDARDS

Specific standards and best practices for this course will depend upon the nature of the problem under investigation.

SUGGESTED REFERENCES

Specific references for this course will depend upon the nature of the problem under investigation.

Course Name: Supervised Work Experience in Commercial/Residential Maintenance

Course Abbreviation: CRM 292(1-6)

Classification: Career–Technical Elective

Description: A cooperative program between industry and education designed to integrate the student’s technical studies with work experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours. (1-6 sch: 3-18-hr externship)

Prerequisite: None

Competencies and Suggested Objectives
1. Apply technical skills needed to be a viable member of the workforce. <ol style="list-style-type: none"> a. Prepare a description of technical skills to be developed in the supervised work experience. b. Develop technical skills needed to be a viable member of the workforce.
2. Apply skills developed in other program area courses. <ol style="list-style-type: none"> a. Perform skills developed in other program area courses.
3. Apply human relationship skills. <ol style="list-style-type: none"> a. Use proactive human relationship skills in the supervised work experience.
4. Apply and practice positive work habits and responsibilities. <ol style="list-style-type: none"> a. Perform assignments to develop work habits and responsibilities.
5. Work with instructor and employer to develop written occupational objectives to be accomplished. <ol style="list-style-type: none"> a. Perform written occupational objectives in the supervised work experience.
6. Assess accomplishment of objectives. <ol style="list-style-type: none"> a. Prepare daily written assessment of accomplishment of objectives. b. Present weekly written reports to instructor in activities performed and objectives accomplished.
7. Utilize a set of written guidelines for the supervised work experience. <ol style="list-style-type: none"> a. Develop a set of written guidelines for the supervised work experience. b. Follow a set of written guidelines for the supervised work experience.

STANDARDS

Specific standards and best practices for this course will depend upon the nature of the problem under investigation.

SUGGESTED REFERENCES

Specific references for this course will depend upon the nature of the problem under investigation.

Course Name: Work-Based Learning I, II, III, IV, V, and VI

Course Abbreviation: WBL 191(1-3), WBL 192(1-3), WBL 193(1-3), WBL 291(1-3), WBL 292(1-3), and WBL 293(1-3)

Classification: Free Elective

Description: A structured work site learning experience in which the student, program area teacher, Work-Based Learning Coordinator, and work site supervisor/mentor develop and implement an educational training agreement. Designed to integrate the student's academic and technical skills into a work environment. May include regular meetings and seminars with school personnel and employers for supplemental instruction and progress reviews.
(1-3 sch: 3-9-hr externship)

Prerequisite: Concurrent enrollment in Career–Technical program area courses

Competencies and Suggested Objectives	
1.	Apply technical skills and related academic knowledge needed to be a viable member of the workforce. <ol style="list-style-type: none"> a. Demonstrate technical skills necessary to complete job requirements. b. Demonstrate academic skills necessary to complete job requirements. c. Perform tasks detailed in an educational training agreement at the work setting.
2.	Apply general workplace skills to include positive work habits necessary for successful employment. <ol style="list-style-type: none"> a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service. b. Utilize time, materials, and resource management skills. c. Use critical thinking skills such as problem solving, decision making, and reasoning. d. Acquire, evaluate, organize, maintain, interpret, and communicate information.

STANDARDS

Specific standards for this course will depend upon the nature of the problem under investigation.

SUGGESTED REFERENCES

Specific references for this course will depend upon the nature of the problem under investigation.

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Cabinet, flammable materials (1)
2. Computer with operating software with multimedia kit (4 per program)
3. Mixer, cement, gas or electric powered (1)
4. Saw, masonry (14 in. with blade) (1)
5. Saw, radial arm (1)
6. Saw, table (1)
7. Saw, band (14 in.) (1)
8. Welder, shielded metal arc (SMAW) or metal inert gas (MIG) (1)
9. Oxyfuel burning table with dross pan and replaceable slats (4 ft x 8 ft x 31 in.) (1)
10. A/C split (gas) (1)
11. A/C split system (410A) (1)
12. A/C window unit (1)
13. Residential package heating (Dual purpose - for heating and cooling instruction) (1)
14. Air-to-air heat pump (with electrical backup heat) (1)
15. Residential refrigerator (1)
16. Recovery/recycling equipment (2)
17. Velometer (Dual purpose – for heating and cooling instruction) (1)
18. Woodwork joiner 6 in. (1)

NON-CAPITALIZED ITEMS

1. Air compressor (1)
2. Awl, scratch (2)
3. Bar, ripping (2)
4. Bender, copper tubing (1)
5. Bender, conduit (1/2 in. to 3/4in.) (1)
6. Bin, revolving (1)
7. Bit set, auger (1/4 in. to 1 in.) (2)
8. Bit, expansion (2)
9. Box, mortar (15 cu. ft.) (1)
10. Brace, wood hand (4)
11. Brush, masonry (6)
12. C-clamp, vise grip (4)
13. C-clamp, assorted sizes (4)
14. Chalkline (2)
15. Chisel, ripping (1)
16. Chisel set, wood (1/4 in. to 1 1/2 in.) (2)
17. Chisel set, cold (1/4 in. to 1 in.) (1)
18. Clamp, bar (4)
19. Combination Wrench Set (1/4 in. to 2 in.) (2)
20. Cutter, bolt (1)
21. Cutter, PVC pipe (2)

22. Cutter, cable (2 ft) (1)
23. Cutter, pipe (1)
24. Cutter, copper tubing (2)
25. Darby (1)
26. Die set, threader ratchet type (3/8 in. to 2 in.) (1)
27. Dividers, wing (1)
28. Drill, portable (1/2 in.) (1)
29. Drill press, (14 in. with vise) (1)
30. Drill set, spade (1/4 in. to 1 1/2 in.) (1)
31. Drill set, twist (1/16 in. to 1/2 in.) (1)
32. Drill, portable (1/2 in., right angle) (1)
33. Drill, portable (3/8 in.) (1)
34. Dust collection system for shop (1)
35. Edger, cement (2)
36. Extension cord (25 ft 12/3 conductor) (6)
37. Extinguisher, fire (ABC) (2)
38. Eye protection and sterilization chest (with 20 pairs safety glasses) (1)
39. File, metal double-cut (3)
40. File, wood (flat, assorted sizes) (6)
41. File, wood rasp (half-round) (1)
42. Flaring tool, copper tubing (2)
43. Float, rubber (2)
44. Grinder, pedestal (1)
45. Groover, cement (2)
46. Hacksaw (5)
47. Half hatchet (1)
48. Hammer, straight claw (6)
49. Hammer, sledge (3)
50. Hammer, ball peen (2)
51. Hammer, brick (4)
52. Hammer, curved claw (16 oz) (6)
53. Handsaw, rip (4)
54. Handsaw, crosscut (8)
55. Hawk, plastering (2)
56. Hoe, mortar (2)
57. Hose, water (50 ft) (2)
58. Hose, air (50 ft) (2)
59. Jointer, sled block (6)
60. Jointer, rake bricklaying (6)
61. Jointer, concave bricklaying (6)
62. Knife, putty (4 in.) (2)
63. Knife, putty (6 in.) (2)
64. Knife, putty (2 in.) (2)
65. Knife, utility (2)
66. Ladder, extension (32 ft) (1)
67. Ladder, step (4 ft) (1)

68. Ladder, step (6 ft) (1)
69. Ladder, step (8 ft) (1)
70. Level, transit with tripod and leveling rod (1)
71. Level, carpenter's aluminum (48 in.) (2)
72. Level, carpenter's aluminum (24 in.) (2)
73. Level, masonry (48 in.) (8)
74. Light, electrical circuit tester (120 V and 240 V) (6)
75. Mallet, wood (2)
76. Mallet, rubber (1)
77. Nailer, pneumatic (1)
78. Plane, jack (2)
79. Plane, block (2)
80. Pliers, channel lock (12 in.) (2)
81. Pliers, diagonal (6)
82. Pliers, lineman's (side cutters) (8)
83. Pliers, needlenose (8)
84. Pliers, joint (6)
85. Pliers, vise grip (2)
86. Plumb bob (2)
87. Pouch, electrician's tool (6)
88. Printer, laser (4 per program)
89. Reamer, pipe (1)
90. Ripper, cable (6)
91. Router, with bits (1)
92. Rule, folding (6 ft) (6)
93. Rule, folding (6 ft modular) (6)
94. Safety kit (OSHA approved) (1)
95. Sander, belt (1)
96. Sander, finish (1)
97. Sander, portable finishing (1)
98. Saw, back (2)
99. Saw, circular (7½ in. portable) (3)
100. Saw, coping (2)
101. Saw, motorized miter (1)
102. Saw, keyhole (2)
103. Saw, saber (1)
104. Saw, reciprocating (1)
105. Scaffold kit (1)
106. Screwdriver set (Phillips, assorted sizes) (10)
107. Screwdriver set (spiral w/bits) (2)
108. Screwdriver set (flat blade, assorted sizes) (10)
109. Set, nail (6)
110. Set, brick (2)
111. Sheet metal brake (1)
112. Shield, safety (5)
113. Shovel, round point (2)

114. Shovel, square point (2)
115. Snips, aviation (2)
116. Snips, tin (2)
117. Socket and ratchet set (1/4 in. - 1 1/2 in.) (2)
118. Solder gun (2)
119. Square, framing with rafter chart (6)
120. Square, combination (6)
121. Square, tri (6)
122. Stripper, wire (8)
123. T-bevel (2)
124. Table, workbench (4)
125. Table, metal shop (1)
126. Tamper, hand (1)
127. Tape, steel (100 ft) (2)
128. Tape, steel (16 ft) (8)
129. Tester, voltage (multimeter) (1)
130. Tong, brick (2)
131. Torch, propane (2)
132. Torch, striker (2)
133. Trowel, bricklaying (20)
134. Trowel, tuck point (1)
135. Trowel, cement finishing (2)
136. Vise, pipe stand with yoke (1)
137. Vise, pipe stand with chain (1)
138. Vise, woodworking (5 in.) (8)
139. Wheelbarrow (6 cu ft) (3)
140. Wheelbarrow, brick (1)
141. Wrench, basin (1)
142. Wrench, pipe (8 in.) (2)
143. Wrench, pipe (10 in.) (2)
144. Wrench, pipe (12 in.) (2)
145. Wrench set, combination (SAE) (1)
146. Wrench, adjustable (12 in.) (1)
147. Wrench, adjustable (10 in.) (1)
148. Wrench, pipe (14 in.) (1)
149. Wrench, adjustable (8 in.) (1)
150. Wrench, pipe (16 in.) (1)
151. Wrench, seat (1)
152. Wrench set combination (metric) (1)
153. Wrench set, sockets with ratchets and pull handles (SAE 1/4 in., 3/8 in., and 1/2 in. drives) (2)
154. Wrench set, sockets with ratchets and pull handles (metric) (2)
155. Helmet, welding (2)
156. Jacket, cape, sleeve, or apron (leather) (2)
157. Gloves, welding (2 pair)
158. Hammer, chipping (2)

159. Hammer, rotary with bits (1)
160. Grinder, pedestal with grinder wheels (1)
161. Oxyfuel gas cutting equipment with regulators, hoses, torch, tips, cart, and accessories (1 set)
162. Safety glasses with side shields and a sanitizing cabinet (2 sets)
163. Burning goggles or face shields (2)
164. #5 filter plate/lens (2)
165. Clear cover plate/lens (2)
166. Clamp-on ammeters (4)
167. Hermetic analyzer (1)
168. Capacitor analyzer (1)
169. Set of recording ammeter and voltmeter (1)
170. Electronic thermometer (1)
171. Electronic charging scale (1)
172. Micron vacuum gauge (1)
173. Manifold gauge sets (2)
174. Bimetal (digital) thermometers (2)
175. Temperature recorder (1)
176. Psychrometer (dry and wet bulb) (1)
177. Vacuum pumps (2)
178. Refrigerant identifier (1)
179. Storage tanks (3)
180. Hand oil pump (1)
181. Combustion test kit (1)
182. U-tube manometer (1)
183. Carbon monoxide tester (1)
184. Planer, 12 in. (1)

RECOMMENDED INSTRUCTIONAL AIDS

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

1. Computer with operating software with multimedia kit (1)
2. Data projector (1)
3. Digital camera (1)
4. Digital scanner with Optical Character Recognition (OCR) (1)
5. Interactive display board (1)
6. Laptop computer (1)
7. Printer (1)
8. Projector, overhead (1)
9. Scientific calculator (1)
10. VCR/DVD (1)

Appendix A: Contren Learning Series Best Practices¹

CONTREN CORE

C1 BASIC SAFETY

- BSM1 Identify the responsibilities and personal characteristics of a professional craftsman.
- BSM2 Explain the role that safety plays in the construction crafts.
- BSM3 Describe what job-site safety means.
- BSM4 Explain the appropriate safety precautions around common job-site hazards.
- BSM5 Demonstrate the use and care of appropriate personal protective equipment.
- BSM6 Follow safe procedures for lifting heavy objects.
- BSM7 Describe safe behavior on and around ladders and scaffolds.
- BSM8 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
- BSM9 Describe fire prevention and fire fighting techniques.
- BSM10 Define safe work procedures around electrical hazards.

C2 INTRODUCTION TO CONSTRUCTION MATH

- ICM1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
- ICM2 Use a standard ruler and a metric ruler to measure.
- ICM3 Add, subtract, multiply, and divide fractions.
- ICM4 Add, subtract, multiply, and divide decimals, with and without a calculator.
- ICM5 Convert decimals to percents and percents to decimals.
- ICM6 Convert fractions to decimals and decimals to fractions.
- ICM9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

C3 INTRODUCTION TO BLUEPRINTS

- BLU1 Recognize and identify basic blueprint terms, components, and symbols.
- BLU2 Relate information on blueprints to actual locations on the print.
- BLU3 Recognize different classifications of drawings.
- BLU4 Interpret and use drawing dimensions.

C4 BASIC RIGGING

- RIG1 Identify and describe the use of slings and common rigging hardware.
- RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
- RIG3 Describe the basic hitch configurations and their proper connections.
- RIG4 Describe basic load-handling safety practices.
- RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

¹ *Contren learning series*. Retrieved March 1, 2006, from <http://www.nccer.org/>

C5 COMMUNICATION SKILLS

- COM1 Demonstrate the ability to understand information and instructions that are presented in both written and verbal form.
- COM2 Demonstrate the ability to communicate effectively in on-the-job situations using written and verbal skills.

C6 EMPLOYABILITY SKILLS

- EMP1 Explain the construction industry, the role of the companies that make up the industry, and the role of individual professionals in the industry.
- EMP2 Demonstrate critical thinking skills and the ability to solve problems using those skills.
- EMP3 Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.
- EMP4 Demonstrate effective relationship skills with teammates and supervisors, exhibit the ability to work on a team, and demonstrate appropriate leadership skills.
- EMP5 Be aware of workplace issues such as sexual harassment, stress, and substance abuse.

CREW LEADER

C7 PROJECT CONTROL

- PCC1 Describe the three phases of a construction project.
- PCC2 Define the three types of project delivery systems.
- PCC3 Define planning and describe what it involves.
- PCC4 Explain why it is important to plan.
- PCC5 Describe the two major stages of planning.
- PCC6 Explain the importance of documenting one's work.
- PCC7 Describe the estimating process.
- PCC8 Explain how schedules are developed and used.
- PCC9 Identify the two most common schedules.
- PCC10 Explain short-interval production scheduling (SIPS).
- PCC11 Describe the different costs associated with building a job.
- PCC12 Explain the supervisor's role in controlling costs.
- PCC13 Illustrate how to control the main resources of a job: materials, tools, equipment, and labor.
- PCC14 Define the terms production and productivity and explain why they are important.

ELECTRICAL

Level I

C8 ELECTRICAL SAFETY

- ESM1 Demonstrate safe working procedures in a construction environment.
- ESM2 Explain the purpose of OSHA and how it promotes safety on the job.
- ESM3 Identify electrical hazards and how to avoid or minimize them in the workplace.

ESM4 Explain safety issues concerning lockout/tagout procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection systems.

C9 INTRODUCTION TO THE NATIONAL ELECTRICAL CODE

NEC1 Explain the purpose and history of the National Electrical Code (NEC).

NEC2 Describe the layout of the NEC.

NEC3 Explain how to navigate the NEC.

NEC4 Describe the purpose of the National Electrical Manufacturers' Association (NEMA) and the National Fire Protection Association (NFPA).

NEC5 Explain the role of testing laboratories.

C10 WIRING: RESIDENTIAL

WR1 Describe how to determine electric service requirements for dwellings.

WR2 Explain the grounding requirements of a residential electric service.

WR3 Calculate and select service-entrance equipment.

WR4 Select the proper wiring methods for various types of residences.

WR5 Explain the role of the NEC in residential wiring.

WR6 Compute branch circuit loads and explain their installation requirements.

WR7 Explain the types and purposes of equipment grounding conductors.

WR8 Explain the purpose of ground fault circuit interrupters and tell where they must be installed.

WR9 Size outlet boxes and select the proper type for different wiring methods.

WR10 Describe rules for installing electric space heating and HVAC equipment.

WR11 Describe the installation rules for electrical systems around swimming pools, spas, and hot tubs.

WR12 Explain how wiring devices are selected and installed.

WR13 Describe the installation and control of lighting fixtures.

CARPENTRY

Level I

C11 HAND AND POWER TOOLS

HPT1 Identify the hand tools commonly used by carpenters and describe their uses.

HPT2 Use hand tools in a safe and appropriate manner.

HPT3 State the general safety rules for operating all power tools, regardless of type.

HPT4 State the general rules for properly maintaining all power tools, regardless of type.

HPT5 Identify the portable power tools commonly used by carpenters and describe their uses.

HPT6 Use portable power tools in a safe and appropriate manner.

HPT7 Identify the stationary power tools commonly used by carpenters and describe their uses.

HPT8 Use stationary power tools in a safe and appropriate manner.

C12 WALL AND CEILING FRAMING

- WCF1 Identify the components of a wall and ceiling layout.
- WCF2 Describe the procedure for laying out a wood frame wall, including plates, corner posts, door and window openings, partition Ts, bracing, and firestops.
- WCF3 Describe the correct procedure for assembling and erecting an exterior wall.
- WCF4 Describe the common materials and methods used for installing sheathing on walls.
- WCF5 Lay out, assemble, erect, and brace exterior walls for a frame building.
- WCF6 Describe wall framing techniques used in masonry construction.
- WCF7 Explain the use of metal studs in wall framing.
- WCF8 Describe the correct procedure for laying out a ceiling.
- WCF9 Cut and install ceiling joists on a wood frame building.
- WCF10 Estimate the materials required to frame walls and ceilings.

C13 WINDOWS AND EXTERIOR DOORS

- WED1 Identify various types of fixed, sliding, and swinging windows.
- WED2 Identify the parts of a window installation.
- WED3 State the requirements for a proper window installation.
- WED4 Install a pre-hung window.
- WED5 Identify the common types of skylights and roof windows.
- WED6 Describe the procedure for properly installing a skylight.
- WED7 Identify the common types of exterior doors and explain how they are constructed.
- WED8 Identify the parts of a door installation.
- WED9 Identify the types of thresholds used with exterior doors.
- WED10 Install a threshold on a concrete floor.
- WED11 Install a pre-hung exterior door with weather-stripping.
- WED12 Identify the various types of locksets used on exterior doors and explain how they are installed.
- WED13 Explain the correct installation procedure for a rollup garage door.
- WED14 Install a lockset.

PAINT

Level I

C14 BASIC SURFACE PREPARATION

- BSP1 Describe preparation tools and materials:
- Cleaning agents
 - Surface conditioning agents
 - Repair agents
 - Hand tools
 - Power tools
- BSP2 Describe or demonstrate preparation methods:
- Washing and cleaning
 - Hand tool cleaning

- Power tool cleaning
- Etching and neutralization
- Vacuuming
- Checking for moisture in concrete, stucco, masonry, wood, or plaster substrates
- Repair/replacement of substrates

BSP3 Describe or demonstrate general preparation procedures for various types of surfaces/substrates:

- Wood
- Concrete and masonry
- Plaster and drywall
- Metal
- Synthetic

C15 BRUSHING AND ROLLING PAINTS AND COATINGS

BRC1 Recognize the various types of paint brushes and select the proper paint brush for the application.

- Wall brushes
- Varnish brushes
- Sash and trim brushes
- Stain brushes
- Special purpose brushes
- Decorative brushes

BRC2 Recognize the different kinds of rollers and roller covers and select the proper roller and cover for the application.

- Dip rollers
- Self-feeding rollers
- Special purpose rollers

BRC3 Demonstrate how to properly mix paint.

BRC4 Demonstrate how to properly apply paint to surfaces using the brush and the roller.

BRC5 Demonstrate how to clean and store paint brushes and rollers.

MASONRY

Level I

C16 INTRODUCTION TO MASONRY

ITM1 Discuss the history of masonry.

ITM2 Describe modern masonry materials and methods.

ITM3 Explain career ladders and advancement possibilities in masonry work.

ITM4 Describe the skills, attitudes, and abilities needed to work as a mason.

ITM5 State the safety precautions that must be practiced at a work site, including the following:

- Safety practices
- Fall-protection procedures
- Forklift-safety operations

ITM6 Perform the following basic bricklaying procedures:

- Mixing of mortar
- Laying a mortar bed
- Laying bricks

ITM7 Put on eye protection, respiratory protection, and a safety harness.

ITM8 Use the correct procedures for fueling and starting a gasoline-powered tool.

C17 SAFETY REQUIREMENTS

SAR1 Identify and name the tools used in performing masonry work.

SAR2 Identify and name the equipment used in performing masonry work.

SAR3 Describe how each tool is used.

SAR4 Describe how the equipment is used.

SAR5 Associate trade terms with the appropriate tools and equipment.

SAR6 Demonstrate the correct procedures for assembling and disassembling scaffolding according to federal safety regulations, under the supervision of a competent person.

C18 MASONRY UNITS AND INSTALLATION TECHNIQUES

MIT1 Describe the most common types of masonry units.

MIT2 Describe and demonstrate how to set up a wall.

MIT3 Lay a dry bond.

MIT4 Spread and furrow a bed joint, and butter masonry units.

MIT5 Describe the different types of masonry bonds.

MIT6 Cut brick and block accurately.

MIT7 Lay masonry units in a true course.

PLUMBING

Level I

C19 PLUMBING SAFETY

PSA1 Describe the common unsafe acts and unsafe conditions that cause accidents.

PSA2 Describe how to handle unsafe acts and unsafe conditions.

PSA3 Explain how the cost of accidents and illnesses affects everyone on site.

PSA4 Demonstrate the use and care of appropriate personal protective equipment.

PSA5 Identify job-site hazardous work specific to plumbers.

PSA6 Demonstrate the proper use of ladders.

PSA7 Demonstrate how to maintain power tools safely.

PSA8 Explain how to work safely in and around a trench.

PSA9 Describe and demonstrate the lockout/tagout process.

C20 PLUMBING TOOLS

PLT1 Identify the basic hand and power tools used in the plumbing trade.

PLT2 Demonstrate the proper use of plumbing tools.

- PLT3 Demonstrate the ability to know when and how to select the proper tool(s) for tasks.
- PLT4 Demonstrate the proper maintenance for caring for hand and power tools.
- PLT5 Demonstrate how to prepare a surface for tool use.
- PLT6 Describe the safety requirements for using plumbing tools.

C21 PLASTIC PIPE AND FITTINGS

- PPF1 Identify types of materials and schedules of plastic piping.
- PPF2 Identify proper and improper applications of plastic piping.
- PPF3 Identify types of fittings and valves used with plastic piping.
- PPF4 Identify and determine the kinds of hangers and supports needed for plastic piping.
- PPF5 Identify the various techniques used in hanging and supporting plastic piping.
- PPF6 Properly measure, cut, and join plastic piping.
- PPF7 Explain proper procedures for the handling, storage, and protection of plastic pipes.

C22 COPPER PIPE AND FITTINGS

- CPF1 Identify the types of materials and schedules used with copper piping.
- CPF2 Identify the material properties, storage, and handling requirements of copper piping.
- CPF3 Identify the types of fittings and valves used with copper piping.
- CPF4 Identify the techniques used in hanging and supporting copper piping.
- CPF5 Properly measure, ream, cut, and join copper piping.
- CPF6 Identify the hazards and safety precautions associated with copper piping.

C23 CARBON STEEL PIPE AND FITTINGS

- CSF1 Recognize proper applications of carbon steel piping.
- CSF2 Identify the material properties, storage, and handling requirements of carbon steel piping.
- CSF3 Identify the various techniques used in hanging and supporting carbon steel piping.
- CSF4 Properly measure, cut, groove, thread, and join carbon steel piping.

C24 FIXTURES AND FAUCETS

- FAF1 Identify the basic types of materials used in the manufacture of plumbing fixtures.
- FAF2 Discuss common types of sinks, lavatories, and faucets.
- FAF3 Identify and discuss common types of bathtubs, bath-shower modules, shower stalls, and shower baths.
- FAF4 Discuss common types of toilets, urinals, and bidets.
- FAF5 Identify and describe common types of drinking fountains and water coolers.
- FAF6 Discuss common types of garbage disposals and domestic dishwashers.

C25 INTRODUCTION TO DRAIN, WASTE, AND VENT (DWV) SYSTEMS

- DWV1 Explain how waste moves from a fixture through the drain system to the environment.
- DWV2 Identify the major components of a drainage system and describe their functions.
- DWV3 Identify the different types of traps and their components, explain the importance of traps, and identify the ways that traps can lose their seals.

- DWV4 Identify the various types of drain, waste, and vent (DWV) fittings and describe their applications.
- DWV5 Identify significant code and health issues, violations, and consequences related to DWV systems.

Level IV

C26 SWIMMING POOLS AND HOT TUBS

- PHT1 Explain swimming pool and hot tub systems and their components.
- PHT2 Explain the local procedures and codes for plumbing a swimming pool.
- PHT3 Explain the local procedures and codes for plumbing a hot tub.
- PHT4 Discuss water quality issues related to swimming pools and hot tubs.
- PHT5 Identify and discuss backflow requirements for swimming pools and hot tubs according to local procedures and codes.

SPRINKLER FITTING

Level III

C27 CONSTRUCTION AND PLANS

- CAP1 Read drawings and identify items that are required by NFPA 13.
- CAP2 Identify the different drawing views.
- CAP3 Identify structural symbols and standard sprinkler system symbols used on design drawings.
- CAP4 Identify cut lengths on a blueprint.
- CAP5 Identify and locate critical information on a blueprint such as the types of sprinkler heads, fittings, hangers, and other materials required.
- CAP6 Explain the design process and recognize potential problems in the field.
- CAP7 Identify the major factors that affect sprinkler system layout.
- CAP8 Explain the different hazard classifications outlined by NFPA 13.
- CAP9 Calculate the maximum coverages allowable for each hazard classification as they apply to schedule and hydraulically calculated systems.
- CAP10 Calculate the number of sprinklers required and the maximum allowable spacing for a given room size.
- CAP11 Lay out and coordinate a sprinkler system on blueprints.
- CAP12 Identify the codes and NFPA standards that are critical to the design of fire protection systems.

HEATING, VENTILATION, and AIR CONDITIONING

Level I

C28 INTRODUCTION TO HVAC

- INT1 Explain the basic principles of heating, ventilation, and air conditioning.
- INT2 Identify career opportunities available to people in the HVAC trade.
- INT3 Explain the purpose and objectives of an apprentice training program.
- INT4 Describe how certified apprentice training can start in high school.
- INT5 Describe what the Clean Air Act means to the HVAC trade.

C29 BASIC ELECTRICITY

- BE1 State how electrical power is distributed.
- BE2 Describe how voltage, current, resistance, and power are related.
- BE3 Use Ohm's law to calculate the current, voltage, and resistance in a circuit.
- BE4 Use the power formula to calculate how much power is consumed by a circuit.
- BE5 Describe the difference between series and parallel circuits and calculate loads in each.
- BE6 Describe the purpose and operation of the various electrical components used in HVAC equipment.
- BE7 State and demonstrate the safety precautions that must be followed when working on electrical equipment.
- BE8 Make voltage, current, and resistance measurements using electrical test equipment.
- BE9 Read and interpret common electrical symbols.

C30 INTRODUCTION TO COOLING

- ITC1 Explain how heat transfer occurs in a cooling system, demonstrating an understanding of the terms and concepts used in the refrigeration cycle.
- ITC2 Calculate the temperature and pressure relationships at key points in the refrigeration cycle.
- ITC3 Under supervision, use temperature- and pressure-measuring instruments to make readings at key points in the refrigeration cycle.
- ITC4 Identify commonly used refrigerants and demonstrate the procedures for handling these refrigerants.
- ITC5 Identify the major components of a cooling system and explain how each type works.
- ITC6 Identify the major accessories available for cooling systems and explain how each type works.
- ITC7 Identify the control devices used in cooling systems and explain how each type works.
- ITC8 State the correct methods to be used when piping a refrigeration system.

C31 INTRODUCTION TO HEATING

- ITH1 Explain the three methods by which heat is transferred and give an example of each.
- ITH2 Describe how combustion occurs and identify the by-products of combustion.
- ITH3 Identify the various types of fuels used in heating.

- ITH4 Identify the major components and accessories of a forced-air furnace and explain the function of each component.
- ITH5 State the factors that must be considered when installing a furnace.
- ITH6 Identify the major components of a gas furnace and describe how each works.
- ITH7 With supervision, use a manometer to measure and adjust manifold pressure on a gas furnace.
- ITH8 Identify the major components of an oil furnace and describe how each works.
- ITH9 Describe how an electric furnace works.
- ITH10 With supervision, perform basic furnace preventive maintenance procedures such as cleaning and filter replacement.

Level III

C32 LEAK DETECTION, EVACUATION, RECOVERY, AND CHARGING

- LDE1 Identify the common types of leak detectors and explain how each is used.
- LDE2 Demonstrate skill in performing leak detection tests.
- LDE3 Identify the service equipment used for evacuating a system and explain why each item of equipment is used.
- LDE4 Demonstrate skill in performing system evacuation and dehydration.
- LDE5 Identify the service equipment used for recovering refrigerant from a system and for recycling the recovered refrigerant, and explain why each item of equipment is used.
- LDE6 Demonstrate skill in performing refrigerant recovery.
- LDE7 Demonstrate or explain how to use a recycle unit.
- LDE8 Identify the service equipment used for charging refrigerant into a system, and explain why each item of equipment is used.
- LDE9 Demonstrate skill in charging refrigerant into a system.

WELDING

Level I

C33 WELDING SAFETY

- WSM1 Identify some common hazards in welding.
- WSM2 Explain and identify proper personal protection used in welding.
- WSM3 Demonstrate how to avoid welding fumes.
- WSM4 Explain some of the causes of accidents.
- WSM5 Identify and explain uses for material safety data sheets.
- WSM6 Demonstrate safety techniques for storing and handling cylinders.
- WSM7 Explain how to avoid electric shock when welding.
- WSM8 Demonstrate proper material handling methods.

C34 OXYFUEL CUTTING

- OCM1 Identify and explain the use of oxyfuel cutting equipment.
- OCM2 Set up oxyfuel equipment.

- OCM3 Light and adjust an oxyfuel torch.
- OCM4 Shut down oxyfuel cutting equipment.
- OCM5 Disassemble oxyfuel equipment.
- OCM6 Change empty cylinders.
- OCM7 Perform oxyfuel cutting:
- Straight line and square shapes
 - Piercing and slot cutting
 - Bevels
 - Washing
 - Gouging
- OCM8 Operate a motorized, portable oxyfuel gas cutting machine.

C35 SMAW – EQUIPMENT AND SETUP

- SES1 Identify and explain shielded metal arc welding (SMAW) safety.
- SES2 Identify and explain welding electrical current.
- SES3 Identify and explain arc welding machines.
- SES4 Explain setting up arc welding equipment.
- SES5 Set up a machine for welding.
- SES6 Identify and explain tools for weld cleaning.

C36 SMAW – BEADS AND FILLET WELDS

- SBF1 Set up shielded metal arc welding (SMAW) equipment.
- SBF2 Describe methods of striking an arc.
- SBF3 Properly strike and extinguish an arc.
- SBF4 Describe causes of arc blow and wander.
- SBF5 Make stringer, weave, and overlapping beads.
- SBF6 Make fillet welds in the:
- Horizontal (2F) position
 - Vertical (3F) position
 - Overhead (4F) position

Appendix B: Related Academic Standards²

Reading

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare–contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)

Mathematics Computation

- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations

Applied Mathematics

- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

Language

- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

Spelling

- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

² CTB/McGraw-Hill LLC. (2005). *Tests of adult basic education, forms 9 and 10*. Monterey, CA: Author. Reproduced with permission of CTB/McGraw-Hill LLC. TABE is a registered trademark of The McGraw-Hill Companies, Inc. Copyright 2005 by CTB/McGraw-Hill LLC. Reproduction of this material is permitted for educational purposes only.

Appendix C: 21st Century Skills³

CSS1-21st Century Themes

CS1 Global Awareness

1. Using 21st century skills to understand and address global issues
2. Learning from and working collaboratively with individuals representing diverse cultures, religions and lifestyles in a spirit of mutual respect and open dialogue in personal, work and community contexts
3. Understanding other nations and cultures, including the use of non-English languages

CS2 Financial, Economic, Business, and Entrepreneurial Literacy

1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy in society
3. Using entrepreneurial skills to enhance workplace productivity and career options

CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national and global levels
3. Understanding the local and global implications of civic decisions

CS4 Health Literacy

1. Obtaining, interpreting and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

CS5 Environmental Literacy

1. Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water and ecosystems
2. Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.)
3. Investigate and analyze environmental issues, and make accurate conclusions about effective solutions
4. Take individual and collective action towards addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues)

CSS2-Learning and Innovation Skills

CS6 Creativity and Innovation

1. Think Creatively
2. Work Creatively with Others

³ *21st century skills*. (n.d.). Washington, DC: Partnership for 21st Century Skills.

3. Implement Innovations

CS7 Critical Thinking and Problem Solving

1. Reason Effectively
2. Use Systems Thinking
3. Make Judgments and Decisions
4. Solve Problems

CS8 Communication and Collaboration

1. Communicate Clearly
2. Collaborate with Others

CSS3-Information, Media and Technology Skills

CS9 Information Literacy

1. Access and Evaluate Information
2. Use and Manage Information

CS10 Media Literacy

1. Analyze Media
2. Create Media Products

CS11 ICT Literacy

1. Apply Technology Effectively

CSS4-Life and Career Skills

CS12 Flexibility and Adaptability

1. Adapt to change
2. Be Flexible

CS13 Initiative and Self-Direction

1. Manage Goals and Time
2. Work Independently
3. Be Self-directed Learners

CS14 Social and Cross-Cultural Skills

1. Interact Effectively with Others
2. Work Effectively in Diverse Teams

CS15 Productivity and Accountability

1. Manage Projects
2. Produce Results

CS16 Leadership and Responsibility

1. Guide and Lead Others
2. Be Responsible to Others