COMMERCIAL & RESIDENTIAL CONSTRUCTION TECHNOLOGY
MISSISSIPPI CURRICULUM FRAMEWORK

Program CIP: 46.0401-Buiding/Property Maintenance

2018

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The Office of Curriculum and Instruction (OCI) was founded in 2013 under the Division of Workforce, Career, and Technical Education at the Mississippi Community College Board (MCCB). The office is funded through a partnership with The Mississippi Department of Education (MDE), who serves as Mississippi's fiscal agent for state and federal Career and Technical Education (CTE) Funds. The OCI is tasked with developing statewide CTE curriculum, programming, and professional development designed to meet the local and statewide economic demand.

For information, please contact curriculum@mccb.edu

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NATIONAL CERTIFICATION & STANDARDS

The National Center for Construction Education and Research

NCCER is a not-for-profit 501(c)(3) education foundation created in 1996 as The National Center for Construction Education and Research. It was developed with the support of more than 125 construction CEOs and various association and academic leaders who united to revolutionize training for the construction industry. Sharing the common goal of developing a safe and productive workforce, these companies created a standardized training and credentialing program for the industry. This progressive program has evolved into curricula for more than 70 craft areas and a complete series of more than 70 assessments offered in over 4,000 NCCER-accredited training and assessment locations across the United States.

NCCER develops standardized construction and maintenance curriculum and assessments with portable credentials. These credentials are tracked through NCCER's Registry System that allows organizations and companies to track the qualifications of their craft professionals and/or check the qualifications of possible new hires. NCCER's Registry System also assists craft professionals by maintaining their records in a secure database.

For more information, please visit www.nccer.org.

Industry Job Projection Data

The Maintenance and Repair requires Postsecondary Career and Technical Award. There is expected to be a 6.25% increase in occupational demand at the regional level and the state level and 8.46% increase at the national level. Median annual income for this occupation is $36, 003.57 at the state level. A summary of occupational data from www.swib.ms.gov/DataCenter/ is displayed below:

Table 1: Education Level

Program Occupations	Education Level
Maintenance and Repair Workers	Postsecondary career and technical award

Table 2: Occupational Overview

	Region	State	United States
2014 Occupational Jobs	19574	19574	1947788
2024 Occupational Jobs	20798	20798	2112558
Total Change	1224	1224	164770
Total % Change	6.25%	6.25%	8.46%
2014 Median Hourly Earnings	$17.09	$17.31	$21.59
2014 Median Annual Earnings	$35,547.20	$36,003.57	$44,909.02
Annual Openings	122	122	16477

Table 3: Occupational Breakdown

Description	2014 Jobs	2024 Jobs	Annual Openings	2014 Hourly Earnings	2014 Annual Earnings 2,080 Work Hours
Maintenance and Repair Workers	13160	13767	60	$13.76	$35,547.20

Table 4: Occupational Change

Description	Regional Change	Regional % Change	State % Change	National % Change
Maintenance and Repair Workers	607	4.61%	4.61%	7.68%

Articulation

Articulation credit from Secondary 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-CPAS3.

Articulated Secondary Program	Postsecondary Program	Articulated Postsecondary Course
S 2015 Carpentry (CIP: 46.0201)	PS 2018 Commercial Residential Maintenance (CIP: 46.0401)	CRM 1214 Carpentry

Technical Skills Assessment

Colleges should report the following for students who complete the program with a career certificate, technical certificate, or an Associate of Applied Science Degrees for technical skills attainment. To use the approved Alternate Assessment for the following programs of study, colleges should provide a Letter of Notification to the Director of Career Technical Education at the MS Community College Board. Please see the following link for further instructions: http://www.mccb.edu/wkfEdu/CTDefault.aspx.

CIP Code	Program of Study	
46.0401	Commercial Residential Maintenance	
Level	**Standard Assessment**	**Alternate Assesment**
Career	NCCER Core NCCER Carpentry Level I	
Level	**Standard Assessment**	**Alternate Assesment**

Online And Blended Learning Opportunities

Course content includes lecture and laboratory semester credit hours. Faculty members are encouraged to present lecture related content to students in an online or blended learning environment. Training related to online and blended learning will be available to faculty members through the MS Community College Board.

Instructional Strategies

Instructional strategies for faculty members implementing the curriculum can be found through the Office of Curriculum and Instruction's professional development.

Assessment Strategies

The Office of Curriculum and Instruction's professional development offer assessment strategies to faculty members implementing the curriculum. Additionally, standards were included in course content when appropriate.

Research Abstract

In the fall of 2017, the Office of Curriculum and Instruction (OCI) met with the different industry members who made up the advisory committees for the Commercial Residential Maintenance program. An industry questionnaire was used to gather feedback concerning the trends and needs, both current and future, of their field. Program faculty, administrators, and industry members were consulted regarding industry workforce needs and trends.

Industry advisory team members from the college involved with this program 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 having a positive attitude, being at work every day and on time, and having reading and writing skills to complete work orders and other forms. Occupation-specific skills stated include knowing how to communicate with the customers, basic math skills, troubleshooting with customer concerns, and understanding the importance of confidentiality.

This revision included the identification of NCCER Carpentry Level I as the standard assessment for technical skills/ attainment. Also, there was an increase of the number of Semester Credit Hours for Carpentry (CRM 1214) and Special Problem in Welding (CRM 1714). In addition, Pool and Spa Maintenance (CRM 1422) was removed from the framework.

Revision History

2011, Research and Curriculum Unit, Mississippi State University
2018, Office of Curriculum and Instruction, Mississippi Community College Board

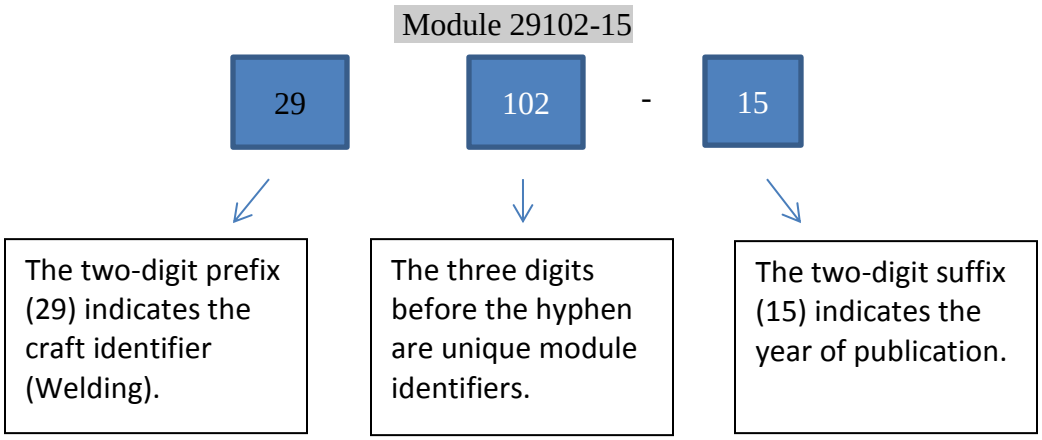
CREDIT BY EXAMINATION

The following **NCCER** modules are aligned to courses listed below. Each module will serve as the state recommended exam to reward credit for prior learning experiences. Colleges have the local autonomy to create a college-level exam when awarding credit.

Course Number and Name	NCCER Credential and Module
CTE 1143 Fundamentals of Construction OR CRM 1112 Industrial Maintenance Core and Safety	NCCER Core Curriculum 1. Module 00101-15 Basic Safety 2. Module 00102-15 Introduction to Construction Math 3. Module 00103-15 Introduction to Hand Tools 4. Module 00104-15 Introduction to Power Tools 5. Module 00105-15 Introduction to Construction Drawing 6. Module 00106-15 Basic Rigging 7. Module 00107-15 Basic Communication Skills 8. Module 00108-15 Basic Employability Skills 9. Module 00109-15 Introduction to Materials Handling
CRM 1215 Carpentry	NCCER Carpentry Level 1 Modules 1. Module 27103-13 Hand & Power Tools 2. Module 27104-13 Introduction to Construction Drawings, Specifications, & Layouts 3. Module 27105-13 Floor Systems 4. Module 27109-13 Introduction to Building Envelope Systems 5. Module 27110-13 Basic Stair Layout 6. Module 27111-13 Wall Systems 7. Module 27112-13 Ceiling Joist and Roof Framing
CRM 1223 Surface Finishes	NCCER Carpentry Level 1 Module 1. Module 27102-13 Building Materials, Fasteners, & Adhesives

How to Decode a Module Number

NCCER module numbers are divided into three parts. This structure allows users to easily track training histories and revisions from one edition to the next.



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. In addition, basic maintenance of heating and cooling systems, electrical, plumbing, welding, and basic carpentry skills and fundamental craftwork are discussed.

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

SUGGESTED COURSE SEQUENCE

Accelerated Integrated Career Pathway

			SCH Breakdown			Program Certifications
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	
CRM 1113 Or CTE 1143	Fundamentals of Maintenance Services or Fundamentals of Construction	3	3	0	45	
CRM 1123	Maintenance Regulations	3	3	0	45	
	Technical Electives	9				
	Total	**15**				

Career Certificate Required Courses

			SCH Breakdown			Program Certifications
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	
CRM 1113 Or CTE 1143	Fundamentals of Maintenance Services or Fundamentals of Construction	3	3	0	45	NCCER CORE
CRM 1123	Maintenance Regulations	3	3	0	45	
CRM 1133	Mathematics and Blueprint Interpretation	3	2	2	60	
CRM 1214	Carpentry	4	2	4	90	NCCER Carpentry Level I
CRM 1413	Plumbing	3	2	2	60	
CRM 1513	Electrical	3	2	2	60	
CRM 1613	Heating, Ventilating, and Air Conditioning	3	2	2	60	
CRM 1222	Surface Finishes	2	0	2	30	NCCER Carpentry Level I
	Technical Elective	6				
	TOTAL	**30**	**16**	**14**	**450**	

Technical Certificate Required Courses

			SCH Breakdown			Program Certifications
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	
CRM 1314	Masonry	4	3	2	75	
CRM 1432	Landscape Irrigation	2	0	4	60	
CRM 1714	Special Problem in Welding	4	0	8	120	
	Technical Electives	5				
	Total	**15**	**3**	**14**	**255**	

General Education Core Courses

To receive the Associate of Applied Science Degree, a student must complete all of the required coursework and a minimum of 15 semester hours of General Education Core. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester or provided primarily within the last semester. Each community college will specify the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college. The Southern Association of Colleges and Schools (SACS) Commission on Colleges Standard 2.7.3 from the Principles of Accreditation: Foundations for Quality Enhancement1 describes the general education core.

Section 2.7.3 In each undergraduate degree program, the institution requires the successful completion of a general education component at the collegiate level that (1) is substantial component of each undergraduate degree, (2) ensures breadth of knowledge, and (3) is based on a coherent rationale. For degree completion in associate programs, the component constitutes a minimum of 15 semester hours or the equivalent. These credit hours are to be drawn from and include at least one course from the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics. The courses do not narrowly focus on those skills, techniques, and procedures specific to a particular occupation or profession.

			SCH Breakdown			Program Certifications
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	
	Humanities/Fine Arts	3				
	Social/Behavioral Sciences	3				
	Math/Science	3				
	Other academic courses per local community college requirements for AAS degree	6				
	TOTAL	**15**				

1 Southern Association of Colleges and Schools Commission on Colleges. (2012). *The principles of accreditation: Foundations for quality enhancement*. Retrieved from http://www.sacscoc.org/pdf/2012PrinciplesOfAcreditation.pdf

COMMERCIAL RESIDENTIAL MAINTENANCE COURSES

*Any course not listed as a required course may be used as an elective.

						Program Certifications
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	
CRM 1113	Fundamentals of Maintenance Services	3	3	0	45	NCCER Core
CRM 1123	Maintenance Regulations	3	3	0	45	
CRM 1133	Mathematics and Blueprint Interpretation	3	2	2	60	
CRM 1214	Carpentry	4	2	4	90	NCCER Carpentry Level I
CRM 1222	Surface Finishes	2	0	2	30	NCCER Carpentry Level I
CRM 1314	Masonry	4	3	2	75	
CRM 1413	Plumbing	3	2	2	60	
CRM 1432	Landscape Irrigation	2	0	4	60	
CRM 1513	Electrical	3	2	2	60	
CRM 1613	Heating, Ventilating, and Air Conditioning	3	2	2	60	
CRM 1714	Special Problem in Welding	4	0	8	120	
CRM 291(1-5)	Special Projects in CRM	1-5	0	2-10	30-150	
	All other electives approved by instructor per local community college policy					

COURSE DESCRIPTIONS

Course Number and Name: **CRM 1113** **Fundamentals of Maintenance Services**

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Prerequisite: Instructor Approved

Student Learning Outcomes:

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

10. Complete the following Modules:

Module 00101-15--Basic Safety

1. Explain the idea of a safety culture and its importance in the construction crafts.
2. Identify causes of accidents and the impact of accident costs.
3. Explain the role of OSHA in job-site safety.
4. Explain OSHA's General Duty Clause and 1926 CFR Subpart C.
5. Recognize hazard recognition and risk assessment techniques.
6. Explain fall protection, ladder, stair, and scaffold procedures and requirements.
7. Identify struck-by hazards and demonstrate safe working procedures and requirements.
8. Identify caught-in-between hazards and demonstrate safe working procedures and requirements.
9. Define safe work procedures to use around electrical hazards.
10. Demonstrate the use and care of appropriate personal protective equipment (PPE).
11. Explain the importance of hazard communications (HazCom) and material safety data sheets (MSDSs).
12. Identify other construction hazards on your job site, including hazardous material exposures, environmental elements, welding and cutting hazards, confined spaces, and fires.

Module 00102-15--Introduction to Construction Math

1. Add, subtract, multiply, and divide whole numbers, with and without a calculator.
2. Use a standard ruler, a metric ruler, and a measuring tape to measure.
3. Add, subtract, multiply, and divide fractions.
4. Add, subtract, multiply, and divide decimals, with and without a calculator.
5. Convert decimals to percentages and percentages to decimals.
6. Convert fractions to decimals and decimals to fractions.
7. Explain what the metric system is and how it is important in the construction trade.
8. Recognize and use metric units of length, weight, volume, and temperature.
9. Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

Module 00103-15--Introduction to Hand Tools

1. Recognize and identify some of the basic hand tools and their proper uses in the construction trade.
2. Visually inspect hand tools to determine if they are safe to use.
3. Safely use hand tools.

Module 00104-15--Introduction to Power Tools

1. Identify power tools commonly used in the construction trades.
2. Use power tools safely.
3. Explain how to maintain power tools properly.

Module 00105-15--Introduction to Construction Drawings

1. Recognize and identify basic construction drawing terms, components, and symbols.
2. Relate information on construction drawings to actual locations on the print.
3. Recognize different classifications of construction drawings.
4. Interpret and use drawing dimensions.

Module 00106-15--Basic Rigging

1. Identify and describe the use of slings and common rigging hardware.
2. Describe basic inspection techniques and rejection criteria used for slings and hardware.
3. Describe basic hitch configurations and their proper connections.
4. Describe basic load-handling safety practices.
5. Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

Module 00107-15--Basic Communication Skills

1. Interpret information and instructions presented in both verbal and written form.
2. Communicate effectively in on-the-job situations using verbal and written skills.
3. Communicate effectively on the job using electronic communication devices.

Module 00108-15--Basic Employability Skills

1. Explain your role as an employee in the construction industry.
2. Demonstrate critical thinking skills and the ability to solve problems using those skills.
3. Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.
4. Define effective relationship skills.
5. Recognize workplace issues such as sexual harassment, stress, and substance abuse.

Module 00109-15--Introduction to Materials Handling

1. Define a load.
2. Establish a pre-task plan prior to moving a load.
3. Use proper materials-handling techniques.
4. Choose appropriate materials-handling equipment for the task.
5. Recognize hazards and follow safety procedures required for materials handling.

Course Number and Name: **CRM 1123 Maintenance Regulations**

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).

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Handle, store, and dispose of hazardous materials.
    a. Recognize signal words and symbols that indicate severity of a hazard.
    b. Describe methods for reducing hazardous waste.
    c. Describe procedures for storing hazardous waste.
    d. Interpret data found on a hazardous Material Safety Data Sheet.
    e. Describe general safety procedures for first aid and cleanup to follow in case of an accident involving hazardous materials.
2. Describe hiring policies.
    a. Discuss American Disabilities Act.
    b. Explore general hiring procedures.
    c. Simulate the steps in the hiring process.
3. Explain federal, state, and local building codes.
    a. Identify which code books are needed.
    b. Discuss the differences among federal, state, and local codes.
    c. Locate various topics in the code books.
    d. Explain the procedures to follow when a code violation is found.

Course Number and Name: **CRM 1134 Mathematics and Blueprint Interpretation**

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Apply the basic principles of mathematics.
   a. Solve problems using fractions.
   b. Solve problems using decimals.
   c. Identify measuring tools.
   d. Read measuring tools.
   e. Apply basic mathematics.
2. Interpret symbols, abbreviations, alphabet of lines, types of views, and title blocks.
   a. Identify the common blueprint symbols.
   b. Interpret information found in the title block of a blueprint.
   c. Interpret the meaning of various parts of a blueprint.
   d. Prepare a building layout.

Course Number and Name: **CRM 1214 Carpentry**

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
4	2	4	90

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Demonstrate safety terms and practices.
    a. Identify safety terms.
    b. Demonstrate safety practices.
    c. Safely use the different ladders.
    d. Recognize and safely use aerial work platforms and scissor lifts.
    2. Explain and apply basic building codes.
3. Identify and demonstrate the safe use of hand tools, power tools, and stationary equipment.
    a. Identify hand tools, power tools, and stationary equipment.
    b. Demonstrate the maintenance of hand tools, power tools, and stationary equipment.
    c. Demonstrate the safe use of hand tools, power tools, and stationary equipment.
4. Construct a project.
    a. Select tools and materials for a specific building task.
    b. Demonstrate procedures to use in storing materials.
    c. Lay out, cut, and assemble a specific building task.
5. Install and/or repair building components.
    a. Install and/or repair underlayment and asphalt shingles.
    b. Install and/or repair a window unit.
    c. Install and/or repair an exterior and interior door unit.
    d. Install and/or repair interior wall covering.
    e. Install and/or repair blanket insulation in walls.
    f. Install and/or repair ceiling tile.
    g. Install and/or repair various hardware.
6. Complete the following modules:

Module 27103-13 Hand and Power Tools

a. Identify the hand tools commonly used by carpenters.
b. Identify the power tools commonly used by carpenters.

Module 27104-13 Introduction to Construction Drawings, Specifications, and Layout

a. Describe the types of drawings usually included in a set of plans and describe the information found.
b. State the purpose of written specifications.
c. Identify the methods of squaring a building.

Module 27105-13 Floor Systems

a. Read and interpret specifications and drawings to determine floor system requirements.
b. Identify the different types of framing systems.
c. Identify floor system components.
d. Describe the construction methods for floor systems, and identify floor system materials.
e. Estimate the amount of material needed for a floor assembly.
f. Identify some common alternative floor system.

Module 27109-13 Introduction to Building Envelope Systems

a. Identify the components of the building envelope.
b. State the requirements for a proper window installation.
c. State the requirements for a proper door installation.
d. Identify the various types of locksets used on exterior doors and explain how they are installed.

Module 27110-13 Basic Stair Layout

a. Identify the types of stairways.
b. Identify the various components associated with stairs.
c. Identify terms associated with stair framing.
d. Describe the procedure used to determine the total rise, number and size of risers, and number and size of treads required for a stairway.
e. Describe the procedure to lay out and cut stringers, risers, and treads.

Module 27111-13 Wall Systems

a. Identify the components of a wall system.
b. Describe the procedure for laying out a wood frame wall, including plates, corner posts, door and window openings, partition Ts, bracing, and fire-stops.
c. Describe the correct procedure to assemble, erect, and brace exterior walls for a frame building.
d. Describe wall framing techniques used in masonry construction.
e. Describe the correct procedure to estimate the materials required to frame walls.
f. Identify alternative wall systems.

Module 27112-13 Ceiling Joist and Roof Framing

a. Identify the components of ceiling framing.
b. Identify common types of roofs used in residential construction.
c. Identify the components and define the terms associated with roof framing.
d. Describe the methods used to lay out a common rafter.
e. Describe how to erect a gable roof.
f. Describe how to frame a basic gable end wall.
g. Recognize the use of trusses in basic roof framing.
h. Describe the basics of roof sheathing installation.
i. Describe how to perform a material takeoff for a roof.

Course Number and Name: **CRM 1222 Surface Finishes**

Description: Various techniques and processes of surface cleaning, preparation, and repair.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	0	2	30

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Discuss and apply general safety rules.
2. Prepare a surface.
   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.
   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.
   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.
   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.
6. Complete the following module:

Module 27102-13 Building Materials, Fasteners, and Adhesives

   a. Identify various types of building materials and describe their uses.
   b. List safety precautions associated with building materials.
   c. Describe the proper method of handling and storing building materials.
   d. Explain how to calculate the quantities of lumber, panel, and concrete products using industry-standard methods.
   e. Describe the fasteners, anchors, and adhesives.

Course Number and Name: **CRM 1314 Masonry**

Description: Techniques of brick, block, and ceramic tile laying and repairing processes to include safety practices.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
4	3	2	75

Prerequisite: Instructor Approved

Student Learning Outcomes:

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

Course Number and Name: **CRM 1414 Plumbing**

Description: Basic design, function, maintenance, repair, and replacement of all types of light commercial and residential plumbing fixtures.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor Approved

Student Learning Outcomes:

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

Course Number and Name: **CRM 1432 Landscape Irrigation**

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	0	4	60

Prerequisite: Instructor Approved

Student Learning Outcomes:

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

Course Number and Name: **CRM 1513 Electrical**

Description: Basic electrical diagnosis and repair techniques including basic circuit theory, safety and grounding essentials, wiring systems, circuitry, and electrical troubleshooting.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
3	2	2	60

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Describe basic electrical safety practices.
   a. Describe hazards of electrical shock.
   b. Describe accident procedures.
   c. Describe basic electrical circuit safety methods.
   d. Describe the operation of current overload devices.
2. Explain and apply basic regional and local electrical codes.
   a. Explain the purpose of the National Electrical Code (NEC).
   b. Explain how to navigate the NEC.
   c. Explain Article 90 of the NEC.
3. Install electrical wiring.
   a. Select tools and materials for a specific task.
   b. Install wiring for various circuits.
   c. Install boxes, cables, receptacles, and switches.
   d. Install simulated wiring circuits of various voltages from the service entrance panel to the receptacles, switches, and load centers.
4. Install and troubleshoot electrical wiring components.
   a. Install a simulated residential electrical system from the weather head to the service entrance panel.

Course Number and Name: **CRM 1613 Heating, Ventilating, and Air Conditioning (HVAC)**

Description: Basic principles, operation, maintenance, and repair of heating, ventilation, and air conditioning in residential and light commercial buildings.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
3	2	2	60

Prerequisite: Instructor Approved

Student Learning Outcomes:

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

Course Number and Name: **CRM 1714 Special Problems in Welding**

Description: Basic course in the development of welding skills in the safe use of the oxyfuel and arc welding techniques.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
4	0	8	120

Prerequisite: Instructor Approved

Student Learning Outcomes:

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

Course Number and Name: **CRM 291(1-5) Special Project in Commercial Residential Maintenance**

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
1	0	2	30
2	0	4	60
3	0	6	90
4	0	8	120
5	0	10	150

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Develop a written plan and blueprints that detail the activities and projects to be completed.
   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.
   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.
   a. Develop and follow a set of written guidelines for the special project.

APPENDIX A: 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. 12 in. Dual –Bevel Compound Miter Saw
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. Recovery/recycling equipment (2)
16. Velometer (Dual purpose – for heating and cooling instruction) (1)
17. Woodwork joiner 6 in. (1)
18. Track Saw
19. Surface Planner (16 in.)
20. Utility Trailer (16 ft. min.)

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 (¼ in. - 1 ½ 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)
185. Construction Calculator (Master pro)-1 per student

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. Interactive display board (1)
5. Laptop computer (1)
6. Printer/Scanner/Copier (1)
7. Projector, overhead (1)
8. DVD/Blueray

APPENDIX B: CURRICULUM DEFINITIONS AND TERMS

- Course Name – A common name that will be used by all community 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 Certificate Required Course – A required course for all students completing a career certificate.
    - Technical Certificate Required Course – A required course for all students completing a technical certificate.
    - Technical Elective – Elective courses that are available for colleges to offer to students.

- Description – A short narrative that includes the major purpose(s) of the course

- 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

- Student Learning Outcomes – A listing of the student outcomes (major concepts and performances) 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 college. 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. Program must include a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college.

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

    - Adding new student learning outcomes to complement the existing competencies and suggested objectives in the program framework
    - Revising or extending the student learning outcomes
    - 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)

Appendix C: COURSE CROSSWALK

COURSE CROSSWALK Commercial Residential Maintenance (CIP: 46.0401)					
Note: Courses that have been added or changed in the 2018 curriculum are highlighted.					
Existing			**Revised**		
2011 MS Curriculum Framework			**2018 MS Curriculum Framework**		
Course Number	**Course Title**	**Hours**	**Course Number**	**Course Title**	**Hours**
CRM 1113	Fundamentals of Maintenance Services	3	CRM 1113	Fundamentals of Maintenance Services	3
CRM 1122	Maintenance Regulations	2	CRM 1122	Maintenance Regulations	2
CRM 1133	Mathematics and Blueprint Interpretation	3	CRM 1133	Mathematics and Blueprint Interpretation	3
CRM 1213	Carpentry	3	CRM 1213	Carpentry	3
CRM 1222	Surface Finishes	2	CRM 1222	Surface Finishes	2
CRM 1313	Masonry	3	CRM 1313	Masonry	3
CRM 1413	Plumbing	3	CRM 1413	Plumbing	3
CRM 1422	Pool and Spa Maintenance	2	CRM 1422	deleted	
CRM 1432	Landscape Irrigation	3	CRM 1432	Landscape Irrigation	3
CRM 1513	Electrical	3	CRM 1513	Electrical	3
CRM 1614	Heating, Ventilating, and Air Conditioning	4	CRM 1614	Heating, Ventilating, and Air Conditioning	4
CRM 1713	Special Problem in Welding	3	CRM 1714	Special Problem in Welding	4
CRM 291(1-5)	Special Projects in CRM	1-5	CRM 291(1-5)	Special Projects in CRM	1-5

APPENDIX D: RECOMMENDED TEXTBOOK LIST

Recommended Commercial & Residential Construction Text Book List CIP: 46.0401-Commercial & Residential Construction Technology		
Book Title	**Author (s)**	**ISBN**
Commercial and Residential Maintenance Volume 1	Kasey Bridges	13 978-1-256-62208-6
Commercial and Residential Maintenance Volume 2	Kasey Bridges	13 978-1-256-62207-9
Commercial Residential Maintenance—Volume 2	National Center for Construction Ed. & Research	1-269-23542-7