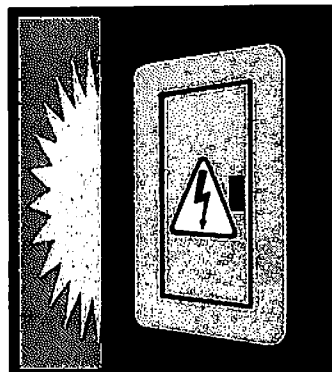


Lewis & Clark Career Center

Curriculum Guide

Electrical Trades



Curriculum Guide For Electrical Trades

Course Rationale, Course Description, Units of Study

Competencies

Crosswalk to Show Me Standards

Articulation Agreements

Employer Survey / Advisory Board Minutes

Instructional Methods

Integrated Lesson Sample

Work Experience Program

SkillsUSA Officers

Teacher Certification

School and Program Policies and Procedures

Inventory

Program Enrollment Data

Placement Data

Program Evaluation

Program Brochures/Enrollment Packet

Miscellaneous

ELECTRICAL TRADES

2 year program; 3 units of credit per year

Prerequisite: Algebra with a "C" or higher

Read at or above Grade Level

This course will teach students to identify, install, and troubleshoot electrical wiring and associated devices that are commonly used in both residential and commercial environments. Students will participate in the construction of a new house. The program includes switches, receptacles, lighting, low voltage communications wiring, service installation, and other wiring associated with residential electricity. Students will also learn fundamental commercial wiring including Start – Stop Stations, single and 3 phase motors, and transformers.

Students must be physically fit and capable of working under adverse weather conditions including both very hot and freezing cold. We work during all types of weather on the school house. We work with real circuits, so the ability to abide by strict safety rules is extremely important. An aptitude for math in general and algebra in particular is required, as is an aptitude to read and produce technical documents and drawings.

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ELECTRICAL TRADES UNITS OF STUDY

- Safety
- Basic Electricity and Math
- Blueprint Reading
- Hand and Power Tools
- Electrical Theory
- Installation of Wiring Devices
- Motors and Generators
- Transformers
- Wiring Methods
- Estimating
- Special Applications
- Residential and Commercial Wiring
- Motor Controls
- Service Installations
- Grounding of Electrical Systems
- Overcurrent Protection
- Conduit Bending and Installation
- Troubleshooting Techniques
- Employability Skills
- SkillsUSA
- **Articulated with: Construction Craft Laborer Apprenticeship
Vatterott College**

RESIDENTIAL WIRING

INSTRUCTOR: MR. RAY

ELECTRICAL TRADES COURSE OUTLINE:

SHOP SAFETY RULES
ELECTRICAL SAFETY RULES
PROPER USE OF HAND TOOLS
PROPER USE OF POWER TOOLS
INTRODUCTION TO ELECTRICAL SYMBOLS
MATHEMATICS FOR THE ELECTRICAL TRADES
ELECTRICAL TERMINOLOGY
BASIC THEORY OF ELECTRICITY
GROUNDING AND THE IMPORTANCE OF GROUNDING
PARALLEL AND SERIES CIRCUITS
PROPER USE OF ELECTRICAL METERS / ANALOG AND DIGITAL
TEST INSULATORS AND CONDUCTORS
INTRODUCTION TO THE NATIONAL ELECTRICAL CODE FOR RESIDENTIAL WIRING
LOW VOLTAGE WIRING
TRANSFORMER BASICS
PROPER WAYS TO INSTALL RESIDENTIAL WIRING
INSTALLING BRANCH CIRCUITS
INSTALLING WIRING DEVICES
READING AND UNDERSTANDING RESIDENTIAL BLUEPRINTS
TROUBLE SHOOTING RESIDENTIAL CIRCUITS
INSTALLATION OF A RESIDENTIAL SERVICE
INSTALLING WIRING FOR RESIDENTIAL HEATING AND COOLING SYSTEMS
INSTALLING WIRING FOR RESIDENTIAL STOVES AND OVENS
INSTALLING LAUNDRY CIRCUITS
INSTALLING WIRING FOR THE KITCHEN AREA'S
INSTALLING OUTDOOR WIRING
PROPERLY APPLYING THE ELECTRICAL CODE AS IT PERTAINS TO RESIDENTS
READING AND UNDERSTANDING TABLES IN THE ELECTRICAL CODE
ESTIMATING THE COST OF A WIRING JOB
PROFESSIONAL SPEAKERS FROM THE ELECTRICAL FIELD
ONE OR TWO FIELDTRIPS IF THEY CAN BE ARRANGED AND TIME PERMITS
TAKING PRIDE IN YOUR WORK
RESUME WRITING

Electrical Trades Grading System

25% is based on Employability Skills.

Being on time, being prepared for class or shop, working safely, good attendance, professional conduct, following directions, behavior, attitude, adhering to school and district policies, etc.

35% is based on shop work.

Being prepared, working safely, completing projects on time, projects meeting code requirements, projects working properly, workmanship, cleaning up shop, staying in designated work area, no horseplay, etc. This includes special projects around the school as assigned and working at the Lewis and Clark House.

25% is based on Test.

Testing on comprehension of math, codes, electrical theory, electrical wiring, schematics, blue prints, ladder diagrams, symbols, etc.

15% is based on Quizzes, Classroom work, & Homework.

Quizzes, classroom, and homework as assigned.

LEWIS & CLARK

CAREER CENTER

STUDENT:

ID NO:

ELECTRICAL TRADES COMPETENCIES

Rating Scale:

3	Mastered
2	Requires Supervision
1	Not Mastered
N	No Exposure

3	2	1	N	A. SAFETY RULES AND PRACTICES
				1. Apply shop rules and regulations
				2. ID safe & unsafe practices when working with electricity
				3. ID & demonstrate proper personal safety procedures
				4. ID techniques & practices of fire prevention
				5. ID appropriate first aid procedures
				6. Demonstrate safe use of tools & related power equipment
				7. Apply techniques of lifting & climbing with ladder

3	2	1	N	B. BASIC THEORY
				1. ID scientific theory of electricity as it relates
				2. Solve problems using Ohm's law
				3. Solve problems using Watt's law
				4. Solve problems using Kirchhoff's law

3	2	1	N	C. BASIC TRADE SKILLS
				1. Cut & ream conduit
				2. Bend conduit to predetermined specs using conduit
				3. Set up and use hacksaw
				4. Use hole punch
				5. Use pouch tools
				6. Operate brace & bit
				7. Operate common electrical power tools
				8. Operate common hydraulic power tools

3	2	1	N	D. TRADE INFORMATION
				1. ID residential wiring practices using NEC as reference
				2. ID commercial wiring practices using NEC as reference
				3. Interpret conduit fill tables using NEC as reference
				4. ID & comply with local compliance codes
				5. ID job classifications & prerequisites for employment
				6. Calculate allowable ampacities for various conduct
				7. Demonstrate techniques of sketching & diagramming

3	2	1	N	E. BLUEPRINTS AND SPECIFICATIONS
				1. ID trade symbols used in electrical drawings
				2. Read & measure from blueprints & specifications
				3. Locate & identify residential construction components
				4. Locate & identify commercial construction components
				5. Estimate & calculate construction costs

3	2	1	N	F. IDENTIFICATION AND USE OF MATERIALS
				1. ID boxes used in electrical construction
				2. ID devices commonly used in electrical construction
				3. ID covers & plates used in electrical construction
				4. ID common supports & anchors
				5. ID common screws, bolts, nuts & nails
				6. ID common connectors terminals and lugs
				7. ID types of conduits & fittings
				8. Determine type & size of electrical wire
				9. ID common load center accessories
				10. ID parts of fusible load center
				11. ID parts of breaker load center
				12. ID interior configurations of common panel
				13. Apply use of trade catalogs & publications

3	2	1	N	G. CIRCUIT LAYOUT AND WIRING
				1. Calculate service entrance loads
				2. ID components & installation procedures for basic
				3. Install basic residential service entrance
				4. ID components & installation procedures for basic
				5. Install basic commercial service entrance
				6. Diagram & install single-pole switching system
				7. Diagram & install three-way switching system
				8. Diagram & install three way & four way switching
				9. Diagram & install GFCI system (ground-fault circuit
				10. Diagram & install small appliance circuits
				11. Diagram & install special circuits, i.e. 240 volt
				12. Diagram & install special appliance circuits i.e.
				13. Design & install residential lighting system
				14. Design & install commercial lighting system
				15. Diagram & install doorbell system
				16. Diagram & install telephone wiring system
				17. Diagram & install low-voltage system

3	2	1	N	H. TESTING/TROUBLESHOOTING
				1. Use volt ohmmeter
				2. Use clamp-on ammeter
				3. Use receptacle polarity testing device

3	2	1	N	I. LEADERSHIP COMPETENCIES
				1. Demo understanding of VICA, its structure & activities
				2. Demo understanding of one's personal values
				3. Perform tasks related to effective personal mgmt
				4. Demo interpersonal skills
				5. Demo etiquette & courtesy
				6. Demo effectiveness in oral & written communication
				7. Develop & maintain code of professional ethics
				8. Maintain good professional appearance
				9. Perform basic tasks related to securing & terminate
				10. Perform basic parliamentary procedures in group meetings

CURRICULUM FOR ELECTRICAL TRADES

[illegible]

TEACHING CODES: L-LECTURE; D-DEMONSTRATION; V-VIDEO; O-OVERHEAD; S-STUDENT STUDY
RESOURCE CODES: C-NATIONAL ELECTRICAL CODE; R-RESIDENTIAL WIRING TEXT; H-HANDOUTS; V-VIDEO; N-NOTES

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CURRICULUM FOR ELECTRICAL TRADES

CODE	COMPETENCY TRADE INFORMATION	TEACHING METHOD	RESOURCES	TESTING METHOD	KNOWLEDGE	PERFORMANCE
D001	ID RESIDENTIAL WIRING PRACTICES USING NATIONAL ELECTRIC CODE	V;L;S;R	R;C;S	LAB;TEST	CA.3	1.1 ; 3.1 ; 3.6
D002	IDENTIFY COMMERCIAL WIRING PRACTICES USING THE NATIONAL ELECTRIC CODE	V;L;S;R	R;C;S	LAB;TEST	CA.3	3.1 ; 3.5 ; 3.6
D003	INTERPRET CONDUIT FILL TABLES USING NATIONAL ELECTRIC CODE	V;L;S;R	C;S;	TEST	CA3	3.4 ; 3.5
D004	ID AND COMPLY WITH LOCAL COMPLIANCE CODES	L;S;		QUIZ;LAB	CA3	3.1 ; 3.4 ; 3.5
D005	ID JOB CLASSIFICATIONS AND PREREQUISITES FOR EMPLOYMENT	H;		QUIZ; ASSIGNMEN T	CA6 ; SS.6	1.2 ; 1.8
D006	CALCULATE ALLOWABLE AMPACITIES FOR VARIOUS CONDUCTORS	D;S;O	C;R	TEST	CA.3 ; MA.1	1.2 ; 1.10:
D007	DEMONSTRATE TECHNIQUES OF SKETCHING AND DIAGRAMING	D;O		CLASSROOM ASSIGN	CA.5 ; MA2	2.1

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[illegible]

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TEACHING CODES: L-LECTURE; D-DEMONSTRATION; V-VIDEO; C-CASE STUDY; P-PROJECT; W-WORKSHEET; E-EVALUATION; R-RESIDENTIAL ELECTRICAL CODE; C-NATIONAL ELECTRICAL CODE; R-RESIDENTIAL WIRING TEXT; H-HANDOUTS; V-VIDEO; N-NOTES

CURRICULUM FOR ELECTRICAL TRADES

CODE	COMPETENCY IDENTIFICATION AND USE OF MATERIALS	TEACHING METHOD	RESOURCES	TESTING METHOD	KNOWLEDGE	PERFORMANCE
F001	ID BOXES USED IN ELECTRICAL CONSTRUCTION	V;D	R;V;O	QUIZ		1.10:
F002	ID DEVICES COMMONLY USED IN ELECTRICAL CONSTRUCTION	V;D;	R;V;O	QUIZ		1.10:
F003	ID COVERS AND PLATES USED IN ELECTRICAL CONSTRUCTION	V;D	R;V;O	QUIZ		1.10:
F004	ID COMMON SUPPORTS AND ANCHORS	D	R	QUIZ		1.10:
F005	ID COMMON SCREWS, BOLTS, NUTS AND NAILS	D	R	QUIZ		1.10:
F006	ID COMMON CONNECTORS, TERMINALS AND LUGS	D	R	QUIZ		1.10:
F007	ID TYPES OF CONDUITS AND FITTINGS	S;L;D	H;R	QUIZ		1.10:
F008	DETERMINE TYPE AND SIZE OF ELECTRICAL WIRE	L;D;S;	C;R;H	TEST		1.10:
F009	ID COMMON LOAD CENTER ACCESSORIES	D;O	H;R	LAB TEST		1.10:
F010	ID PARTS OF A FUSIBLE LOAD CENTER	D;O	H;R	LAB TEST		1.10:
F011	ID PARTS OF A BREAKER LOAD CENTER	D;O	H;R	LAB TEST		1.10:
F012	ID INTERIOR CONFIGURATIONS OF COMMON PANEL	D;O	H;R	LAB TEST		1.10:
F013	APPLY USE OF TRADE CAT.			ASSIGN		1.10:

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CURRICULUM FOR ELECTRICAL TRADES

CODE	COMPETENCY CIRCUIT LAYOUT AND WIRING	TEACHING METHOD	RESOURCES	TESTING METHOD	ACCEPTABLE SCORE	SHOW ME STANDARDS
G001	CALCULATE SERVICE ENTRANCE LOADS	L;O;S	C;R;H	TEST	MA.1	1.10: ; 3.8
G002	ID COMPONENTS AND INSTALLATION PROCEDURES	L;D	H;R;	LAB; TEST	CA.5	1.10:
G003	INSTALL BASIC RESIDENTIAL SERVICE ENTRANCE	L;D	C;V;R	LAB TEST		1.10:
G004	ID COMPONENTS AND INSTALLATION PROCEDURES	L;D;S	H;V;R	TEST ; LAB		
G005	INSTALL A BASIC SERVICE ENTRANCE	D;V;S	C;H;V	TEST;LAB		1.10:
G006	DIAGRAM AND INSTALL SINGLE POLE SWITCHING SYSTEM	L;D;S	H;V;R	LAB		2.1 ; 2.5
G007	DIAGRAM AND INSTALL THREE WAY SWITCHING SYSTEM	L;D;S	H;V;R	LAB		2.1 ; 2.5
G008	DIAGRAM AND INSTALL THREE WAY AND FOUR WAY SWITCHING SYSTEM	L;D;S	H;V;R	LAB		1.10: ; 2.1
G009	DIAGRAM AND INSTALL GFCI SYSTEM	L;D;S	H;V;R	LAB		1.10: ; 2.5
G010	DIAGRAM AND INSTALL SMALL APPLIANCE CIRCUITS	L;D;S	H;V;R	LAB		1.10: ; 2.5
G011	DIAGRAM AND INSTALL SPECIAL CIRCUITS	L;D;S	H;V;R	LAB ASSIGN		1.10: ; 2.5

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CURRICULUM FOR ELECTRICAL TRADES

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CURRICULUM FOR ELECTRICAL TRADES

CODE	COMPETENCY LEADERSHIP	TEACHING METHOD	RESOURCES	TESTING METHOD	KNOWLEDGE	PERFORMANCE
I001	DEMONSTRATE KNOWLEDGE OF VICA	L,S	V,H,N	ORAL PRESENT	CA.1 ; CA.3	4.2 ; 4.3
I002	DEMONSTRATE UNDERSTANDING OF ONE'S PERSONAL VALUES	L,S	V,H,N	ORAL PRESENT		4.4 ; 4.5 ; 4.6
I003	PERFORM TASK RELATED TO EFFECTIVE PERSONAL MANAGEMENT	L,S	V,H,N	LAB	CA.5	4.3 ; 4.4
I004	DEMO INTERPERSONAL SKILLS	L,S	V,H,N	LAB	CA.1	2.1 ; 2.2 ; 2.3 ; 2.7
I005	DEMO ETIQUETTE AND COURTESY	L,S	V,H,N	ORAL PRESENT		2.3 ; 4.4
I006	DEMO EFFECTIVENESS IN ORAL AND WRITTEN COMMUNICATION	L,S	V,H,N	ORAL & WRITTEN	CA.1	2.1:
I007	DEVELOP AND MAINTAIN CODE OF PROFFESIONAL ETHICS	L,S	V,H,N	TEST		4.4:
I008	MAINTAIN GOOD PROFESSIONAL APPEARANCE	L,D,S	V,H,N	EVALUATE		4.3:
I009	PERFORM BASIC TASKS RELATED TO SECURING AND TERMINATING	L,D,S	V,H,N	ORAL PRESENT		2.6 ; 4.8
I010	PERFORM PARLIAMENTARY PROCEDURES	L,D,S	V,H,N	ORAL PRESENT	CA.6	4.6:

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CURRICULUM FOR ELECTRICAL TRADES

CODE	COMPETENCY	TEACHING METHOD	RESOURCES	TESTING METHOD	KNOWLEDGE	PERFORMANCE
J001	DISPLAY SAFE ELECTRICAL WORKING HABITS	V:L;D	H:N	LAB,TEST		
J002	DEMONSTRATE KNOWLEDGE OF THE BASIC FUNDAMENTALS OF ELECTRICITY	D;V	H:N	LAB,TEST		
J003	IDENTIFY WIRING TECHNIQUES	V:L;D	H:N	LAB		
J004	IDENTIFY WIRING COMPONENTS AND DEVICES	V:L;D	H:N	LAB,TEST		
J005	READ ARCHITECTURAL PRINTS AND WIRING PLANS	D;O;S	H:N	TEST,LAB		
J006	IDENTIFY ELECTRICAL SYMBOLS AND ABBREVIATIONS	L;S;O	H:N;R	TEST		
J007	DETERMINE THE NUMBER AND TYPES OF CIRCUITS	L;S;O	H:N;R	TEST		
J008	DIVIDE WIRING INTO CIRCUITS ACCORDING TO SERVICE AND LOAD	L;S;O	H:N;R	TEST,LAB		
J009	DETERMINE THE CURRENT CARRYING CAPACITY OF CIRCUITS	C;L	C;H;R	TEST,LAB		
J010	SIZE AND SELECT CIRCUIT CONDUCTORS, COMPONENT, DEVICES AND OUTLET BOXES	C;S;L	C;R;H	TEST,LAB		
J011	DETERMINE SIZE AND TYPE	L;C;D	C;R;H	TEST,LAB		

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CURRICULUM FOR ELECTRICAL TRADES

	OF SERVICE ENTRANCE CONDUCTORS, METER BASE, CIRCUIT PANEL AND GROUNDING SYSTEM					
J012	CONFORM TO NATIONAL AND LOCAL ELECTRICAL CODES AS WELL AS BUILDERS SPECIFICATIONS	C;L	C;H	TEST, LAB		
J013	DEMONSTRATE SKILL IN THE SELECTION, USE AND CARE OF ELECTRICIANS HAND/POWER TOOLS	D;V	H;N	LAB		
J014	LOCATE AND INSTALL SERVICE ENTRANCE CONDUCTORS, METER BASE, CIRCUIT PANEL AND GROUNDING SYSTEM	D;O	R;H	LAB		
J015	LOCATE AND MARK ROUTE OF INDIVIDUAL CIRCUITS	D;S;	R;H	LAB		
J016	INSTALL OUTLET BOXES	D	R			
J017	CUT, BEND AND INSTALL ELECTRICAL CONDUIT	D	H	LAB		
J018	PULL CONDUCTORS THROUGH CONDUIT AND/OR CIRCUIT ROUTE	D	S	LAB		
J019	ROUGH IN INSTALLATION, CUT, SPLICE AND CONNECT CIRCUIT CONDUCTORS	D	S	LAB		
J020	INSTALL DEVICES, FIXTURES AND APPLIANCES	D;V;S	R;V	LAB		
J021	PERFORM APPROPRIATE	V;D;S	H;V	LAB		

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LEWIS & CLARK CAREER CENTER

EARN COLLEGE CREDIT

Lewis & Clark students who qualify may be able to earn college credit hours or advanced standing with the following institutions. Students must meet eligibility requirements set by the post-secondary institution or apprenticeship program. Arrangements must be made through Lewis & Clark and the cooperating institution or apprenticeship program.

See your instructor or counselor.

<u>PROGRAM</u>	<u>INSTITUTION</u>	<u>HOURS</u>
Auto Collision.....	Ranken	10
Auto Service Technology.....	St. Louis Community College (Forest Park)	9
	Ranken	10
	Linn State Technical College.....	8-9
Brick & Stone Masonry.....	Construction Craft Laborer Apprenticeship	Advanced Standing
Building Trades.....	Associated General Contractors of St. Louis	Advanced Standing
	Construction Craft Laborer Apprenticeship	Advanced Standing
	Floor Layers Apprenticeship	Advanced Standing
	East Central Community College	21
	Ranken	10
Computer Information Systems	St. Charles Community College.....	Credit by Exam
	Ranken	10
	Linn State Technical College.....	6
Computer Maintenance Technology	Linn State Technical College.....	Credit by Exam or Computer Certification
Data Management	St. Charles Community College.....	6
		Additional Credit Subject to Exam
Design Drafting/CAD	East Central Community College	27
	Ranken	14
	Linn State Technical College:	
	 (Drafting).....	21
	 (Civil/Construction Engineering)	3
	St. Charles Community College.....	5
Electrical Trades	Ranken	10
	Construction Craft Laborer Apprenticeship	Advanced Standing
HVAC	East Central Community College	19
	Ranken	15
	Linn State Technical College.....	11
Lawn & Garden Equip. Repair.....	Construction Craft Laborer Apprenticeship	Advanced Standing
Welding	Construction Craft Laborer Apprenticeship	Advanced Standing
	Linn State Technical College	3



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Jim MERRITT
3829 Affirmed
Florissant MO 63034

FARIC CORP - SUPERINTENDENT

Tim Branham - Branham Electric

updated Advisory Board on last years house.

Neal Dalton agreed to chair committee
VICA results from last year

I will send an agenda to Mr. Dalton

Committee suggested I invite Manufacturing Reps. & Electrical Board
Committee suggested I investigate/add low voltage wiring to
my program.

Electrical Trades Advisory Committee Meeting May 21 2003

Red indicates notes from meeting

Attendees included

Rob Weiman Instructor

Vicki Allin Omni Cable

Jim Merritt Paric

Jason Gowert Former Program Student

• What is an Advisory Committee?

- 1) Provides advice and support for Industrial Education programs.
- 2) Indicates direction industry is heading.
- 3) Helps outstanding students develop network.
- 4) Helps obtain donations for program.
- 5) Allows program to tailor instruction to meet industry and higher educational needs

• We need to have a real committee with officers, any takers?

• Highlights of Year

- 1) Assisted Building trades in making new classroom in store.
- 2) Wired new house for school
- 3) VICA
 - a) Residential Wiring 3rd place District
 - b) Residential Wiring Technical Information 2nd District
 - c) Job Skills Demonstration 1st District (Junior)
 - d) Industrial Motor Control 1st, 2nd, 3rd District, 2nd State
 - e) Industrial Motor Control Technical Information 1st, 2nd District, 2nd State (Junior)

• Which way now for Lewis and Clark Electrical Trades?

- 1) Tonight we will decide the future of this program
- 2) More safety
- 3) More Industrial focus or stay mostly residential The committee suggested we add more commercial and do more with relays, PLC's, and motor control.
- 4) Solar? The committee thought we should look into a demonstration project.
- 5) Communications? It was suggested that we look into Smart Home Cable, and that we install intercoms in our homes.
- 6) Sales? The committee suggested we bring in outside speakers to talk about inside/outside sales, and other electrical jobs
- 7) Wireless? The committee suggested

2) Mr. Merritt added the following comments about safety on the job. Stress Clean workspace, Ladder Safety eg. use right ladder, don't lean stepladders, pick up string.

At McCarthy and Alberici the safety program stipulated that:

<u>Non Life-Threatening safety violation</u>		<u>Life Threatening safety violation</u>
<u>1st offense</u>	<u>Written warning</u>	<u>30 days off</u>
<u>2nd offense</u>	<u>3 days off</u>	<u>1 year off</u>
<u>3rd offense</u>	<u>30 days off</u>	<u>termination</u>
<u>4th offense</u>	<u>1 year off</u>	
<u>5th offense</u>	<u>termination</u>	

These steps can normally be mitigated by attending safety programs and doing other safety related training to move back one step.

Mr. Merritt further stated that at smaller construction companies like Paric you would often be fired after the 1st violation..

- Funding cuts in Education, mandate Industry involvement for survival of this program

- Who else should be involved

St. Louis Electrical Board

- Agenda for next meeting in Fall 2003_ NOV. 2003

I. PRELIMINARY INFORMATION:

- A. **CLASS:** Electrical Trades
B. **TITLE OF UNIT:** Residential Wiring Review
C. **TITLE OF LESSON:** Outlets, Switches and Wire oh my
D. **COMPETENCIES ADDRESSED:** Add the competency numbers here
E. **DATE & TIME:** 8/26/02 – 8/30/02 AM PM Classes
F. **WEEK OF INSTRUCTION:** 8//26/2002
G. **INSTRUCTOR:** Rob Weiman

II. OBJECTIVES:

Psychomotor:

Install 120 volt single phase single pole single throw switches, receptacles, light fixtures, 3 way switches, and 4 way switches, GFCI receptacles in compliance with the NEC.
Run Nonmetallic sheathed cable in accordance with the NEC.
Not let any smoke out.

Affective:

Student will learn to work in a "workman" like manner, following safety practices, using all the correct tools and working with confidence.

Cognitive:

Student will know where to look in the NEC to find the appropriate information relating to the installation of nonmetallic sheathed cable, box fill, voltage drop, ampacity, and related issues

III. TEACHING METHODS AND TECHNIQUES:

Demonstration Supervised Lab Work
Illustrated Lecture

Other:

IV. RESOURCES REQUIRED:

Computer Outside Reference Materials
VCR/Tape Text Book

Other: Romex, 4 square boxes, 120 volt 15 amp receptacles, spdt switch, GFCI, light fixture, 3 and 4 way switches, wire staples, 2 screw connectors, raised covers, nonmetallic boxes.

V. INTRODUCTION:

When my son was in Boy Scouts I went though High Ropes training, as part of the training we had

to tie our own harness from nylon webbing, and latter we had to fall and hang from the harness we tied. If we tied it wrong we would fall down about 30 feet. Last year some of you hooked up a lot of circuits in the lab that never got fired up this year we will hang from the harness, (so to speak.) We will fire up anything that we wire up, and see if it passes the smoke test. We will be using this review to bridge the information to commercial wiring practices.

V. CONTENT:

Introduce circuit components, and print symbols.

Installing Romex® (Nonmetallic sheathed cable)

Not in buildings >3 floors (nonhabitable excluded) [336-5] [n/a]

Min. 1/4in. sheathing into box (max. 1in.) [370-17c, local] [4405.4.1]

Protect from physical damage [336-10b] [t 4301.4]

Nail plate req'd when cable is < 1-1/4in. of stud edge [300-4a1] [t 4302.1]

Clamped to box with approved NM clamp [370-17b, c] [4405.4.2]

No clamp ok for one gang of plastic boxes if stapled within 8in. [370-17c.ex.] [4405.4.2]

Bends must be gradual (5 times diameter) [336-16] [n/a]

Staple within 12in. of box and every 4-1/2ft. & clamped to box [336-15] [t 4302.1]

Attic access hole- protect within 6ft. of opening [333-12a] [4302.2.1]

18cu.in. box too small for 3 x 12/2 Romex et-7 [370-16b] [4405.13]

Basements, exposed under joists min. >#8/3 fig. e16 [336-12] [4302.4]

BX (Armor-clad cable)

Stapled min. every 4-1/2in. & within 1/2in. of box [333-7] [t 4302.1]

Insulated bushing at terminations fig. e17 [333-9] [3903.3]

Nail plate req'd where cable <1-1/4in. of stud face [300-4a1] [t 4302.1]

Underside of joists- stapled at each joist fig. e16 [333-11ex.2] [n/a]

In access attic&SHY;guard strip if: exposed <6ft. of scuttle [333-12a] [4302.2.1]

Any wall >2ft. wide req's. receptacle [210-52a] [4401.2]

6ft. cord can be plugged in anywhere along wall [210-52a] [4401.2]

Hallway >10ft. req's. receptacle [210-52h] [4401.11]

staples mess up GFIC breakers, pg

Conduit Systems

General Requirements

Access covers to conduit system must remain accessible [370-29] [4405.10]

No common plastic boxes with metal raceway, BX or MC cable [370-3] [4405.1]

Splicing in conduit bodies only if cu.in. capacity is marked & of sufficient size [370-16c] [4405.14.1]

Bends- max. 360° between pull points [348-10] [t 4302.1]

Crimps (kinks) in pipe not permitted [348-9] [4302.5]

EMT

Electrical metallic tubing not approved for burial unless coated [348-1] [t 4301.4]

Rain-tight fittings outside fig. e20 [348-8] [t 4301.2]

Supported within 36in. of any box and every 10ft. [348-12] [t 4302.1]
Flexible Metal Conduit ("Greenfield")
Dry locations only [350-5] [t 4301.4]
Support min. every 412ft. & within 12in. of box Exceptions: · Lighting whip · 3ft. motor terminals
[350-18] [t 4302.1]
Ground path ok ≤ 6 ft. & up to 20-amp circuit conductors [350-14] [4408.8.1]
Angle connections may not be concealed [350-20] [n/a]

Boxes

Metal boxes grounded with approved method [250-114a] [4408.1]
Min. 6in. of "free conductor" in box [300-14] [3906.10.3]
Wallboard repaired- no gaps $> 1/8$ in. to outlet box [370-21] [4406.6]
Boxes and conduits must remain accessible [370-29] [4405.10]
Outlet boxes shall be flush with combustible finish surfaces [370-20] [4406.5]
Box Fill

3in. (4cu.in.) pancake box too small [370-16b] [4405.13]
4in. (6cu.in.) pancake box end of 14/2 run only [370-16b] [4405.13]
18cu.in. box too small for 3 x 12/2 Romex & device [370-16b] [4405.13]
See table 370-16b and pages 39 - 42 in Electrical Wiring Residential.

General Purpose Circuits

Receptacles

Any wall $\Rightarrow$ 2ft. wide requires a receptacle [210-52a] [4401.2]
6ft. cord can be plugged in anywhere along wall [210-52a] [4401.2]
Hallway $\Rightarrow$ 10ft. requires receptacle [210-52h] [4401.11]

Lights

Recessed light (non-IC1) 3in. from insulation [410-66b] [4504.9]
Recessed light (non-IC**) 12 in. to combustibles [410-66a] [4504.8]
Switched lighting outlets req'd. in all habitable rooms, baths, halls, stairs (3 way/ > 6 steps), garages, outdoor entrances, storage or utility areas, attics and basements [210-70a] [4403.1]
Address number must be illuminated [UBC 502, local] [local]

Paddle Fans

Not to be supported by standard electrical boxes [370-27c] [4405.9]

Bathroom

Separate 20 amp circuit [210-52d] [4402]
GFCI req'd. adjacent to basin [210-52d] [4402.1]
Primary light energy efficient (not incandescent) [energy] [energy]
Space heater- max. watts on general-purpose circuit: 3a] -amp circuit- 900W · 20-amp circuit- 1
[4202.5]

Hydromassage Bathtub Circuit

Must be GFCI-protected [680-70] [4601.9]
Disconnect within sight of motor fig. e18 [422-21b] [4601.7]
Disconnect may be cord and plug [422-22, local] [4601.7]

Utility

Laundry

Separate 20 amp laundry circuit [210-4c] [4203]
Laundry outlet must be < 6 ft. from washer/gas dryer [210-52f] [4203.3]
Electric dryer min. feed 30-amp #10 THHN wire [220-18] [t 4204.3a]

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IX. Relevance to Future Lessons:

Next we will look at running these same circuits in a commercial environment.

Gas Furnace

Fused (125%) disconnect (SSU switch) (unless motor thermally protected) [430-32c1, local] [n/a]

Lighting outlet switched at entry req'd. [210-70c] [4403.3]

Separate circuit [422-7] [4203.1]

120v receptacle on the same level and within 25ft. [UMC 309] [4401.12]

Water Heater

In-sight disconnect [422-21b] [4601.7]

Bond hot, cold and gas pipes [250-80b, local] [local]

Heating Unit

Branch circuit- 125% of (heat watts + motor FLA) [424-3b] [4202.7]

Max. 48 amps unsubdivided load [424-22b] [n/a]

Disconnect Means-No motor >18h.p.: "In-sight circuit breaker switch OR unit switch that opens all ungrounded conductors"

Motor >18h.p.: "In-sight (50ft. rule) or lockable out-of-sight switch" [424-19a2] [t 4601.7]

Air Conditioning (AC)

Window-unit cord and plug ok if controls <6ft. of the floor [440-63] [n/a]

Window-unit cord max. 10ft. [440-64] [n/a]

VI. SUMMARY:

The basic parts of a residential wiring job are nonmetallic sheathed cable, switches, receptacles, breakers, GFCI receptacles, boxes, a panel and the service entrance conductors. This week we learned how to install 80 to 90% of this system. We tied our own harness and hung from it by turning on the juice and doing the smoke test. We have stood 5 feet from the target and shot some arrows, next week we will step back a few feet and shoot a few more.

VII. EVALUATION:*Psychomotor:*

Install a switch, a receptacle, and a light in lab 1.

Install 3 receptacles in parallel, with the top 1/2 of the first receptacle being switched in lab 2.

Install a ground fault in a dedicated circuit, with a switch and a light as it would be in a bathroom in lab 3.

Install 2 GFCI 20 amp circuits, a switched light, and a refrigerator receptacle as it would be in a kitchen in lab 4.

Cognitive:

Student will be able to identify a duplex receptacle, a split receptacle, a light, a switch, a home run, and a GFCI outlet on a print.

Affective:

Student will follow safe work practices as defined by class safety review and class safety test.

Student will follow accepted safe work practices. Student will work in a workmanlike manner. Student will exhibit pride in his or her work.

VIII. ASSIGNMENTS:

(select)

(type text here...)

Ohm's Law 1

Fill in the missing value round to 2 decimal places.

	E	I	R	P
1	120	0.97		
2		32		15360
3	120	4.8		
4		1.92		531.84
5	277	3.64		
6	440			1271.6
7		3.87	124	
8	240			247.2
9	480			3115.2
10		2.13		937.2
11	208	7.43		
12	480			2131.2
13		0.87		180.96
14	240	1.36		
15		1.01		242.4
16	240	1.18		
17	24			3.84
18		1.56	77	
19	24			8.64
20		0.97		232.8
21	240	1.14		
22	240			446.4
23		1.99		955.2
24	120	0.82		98.4
25	120			159.6

P = Watts

$$\text{Watts} = \frac{\text{Volts}^2}{\text{Ohms}}$$

$$\text{Watts} = \text{Amperes}^2 \times \text{Ohms}$$

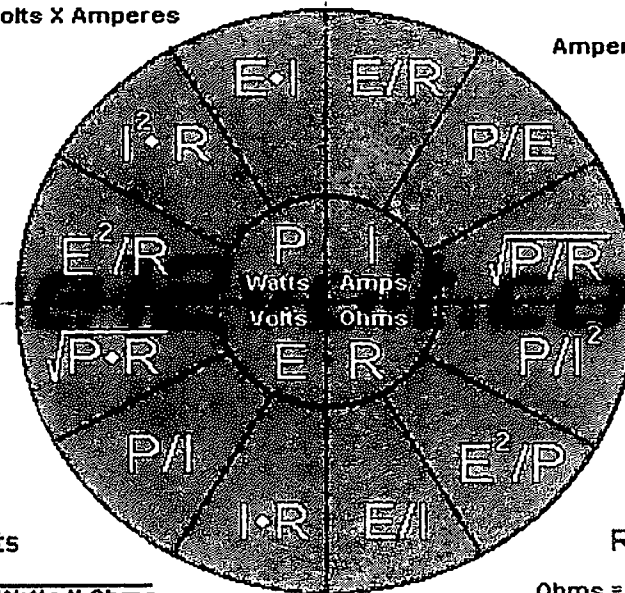
$$\text{Watts} = \text{Volts} \times \text{Amperes}$$

I = Amperes

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

$$\text{Amperes} = \frac{\text{Watts}}{\text{Volts}}$$

$$\text{Amperes} = \sqrt{\frac{\text{Watts}}{\text{Ohms}}}$$



E = Volts

$$\text{Volts} = \sqrt{\text{Watts} \times \text{Ohms}}$$

$$\text{Volts} = \frac{\text{Watts}}{\text{Amperes}}$$

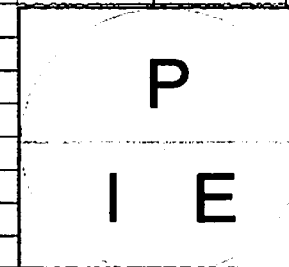
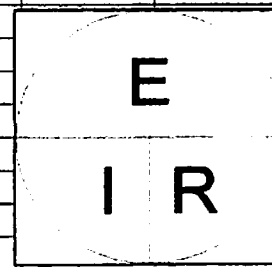
$$\text{Volts} = \text{Amperes} \times \text{Ohms}$$

R = Ohms

$$\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$$

$$\text{Ohms} = \frac{\text{Volts}^2}{\text{Watts}}$$

$$\text{Ohms} = \frac{\text{Watts}}{\text{Amperes}^2}$$



Ohm's Law 1

Fill in the missing value round to 2 decimal places.

	E	I	R	P
1	120	0.97	124	116.4
2	480	32	15	15360
3	120	4.8	25	576
4	277	1.92	144	531.84
5	277	3.64	76	1008.28
6	440	2.89	152	1271.6
7	480	3.87	124	1857.6
8	240	1.03	233	247.2
9	480	6.49	74	3115.2
10	440	2.13	207	937.2
11	208	7.43	28	1545.44
12	480	4.44	108	2131.2
13	208	0.87	240	180.96
14	240	1.36	176	326.4
15	240	1.01	238	242.4
16	240	1.18	204	283.2
17	24	0.16	153	3.84
18	120	1.56	77	187.2
19	24	0.36	67	8.64
20	240	0.97	248	232.8
21	240	1.14	210	273.6
22	240	1.86	129	446.4
23	480	1.99	241	955.2
24	120	0.82	147	98.4
25	120	1.33	90	159.6

P = Watts

$$\text{Watts} = \frac{\text{Volts}^2}{\text{Ohms}}$$

$$\text{Watts} = \text{Amperes}^2 \times \text{Ohms}$$

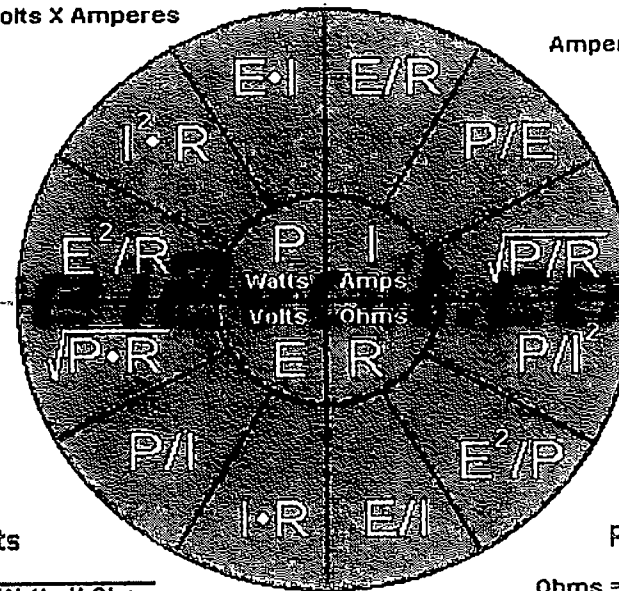
$$\text{Watts} = \text{Volts} \times \text{Amperes}$$

I = Amperes

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

$$\text{Amperes} = \frac{\text{Watts}}{\text{Volts}}$$

$$\text{Amperes} = \sqrt{\frac{\text{Watts}}{\text{Ohms}}}$$



E = Volts

$$\text{Volts} = \sqrt{\text{Watts} \times \text{Ohms}}$$

$$\text{Volts} = \frac{\text{Watts}}{\text{Amperes}}$$

$$\text{Volts} = \text{Amperes} \times \text{Ohms}$$

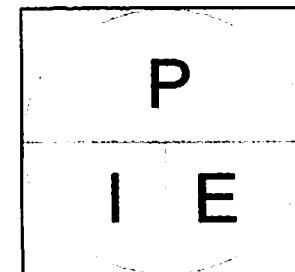
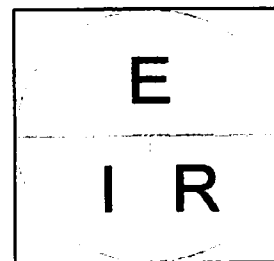
R = Ohms

$$\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$$

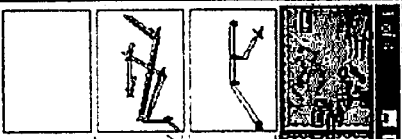
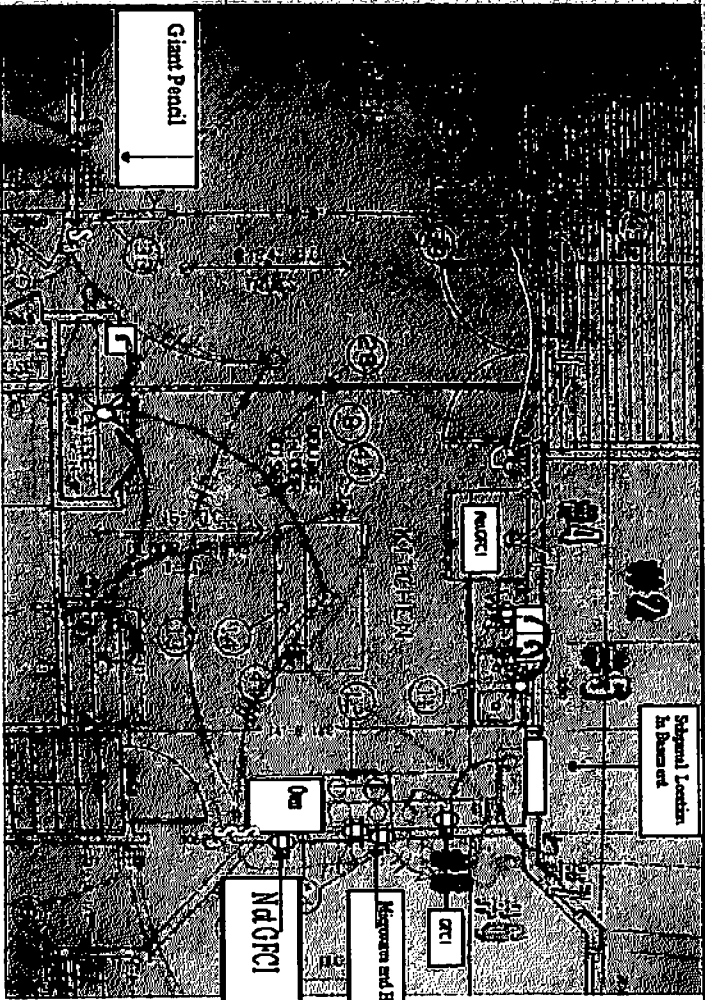
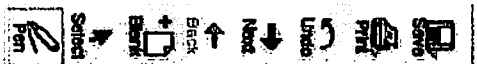
$$\text{Ohms} = \frac{\text{Volts}^2}{\text{Watts}}$$

$$\text{Ohms} = \frac{\text{Watts}}{\text{Amperes}^2}$$

missing information



Ohm's Law 1		A	B	C	D	E		E	I	R	P
1	R =	167	98	133	200	124		120	0.97	124	116.4
2	E =	277	120	480	220	12		480	32	15	15360
3	R =	25	240	211	154	168		120	4.8	25	576
4	E =	12	220	120	24	277		277	1.92	144	531.84
5	R =	125	102	172	134	76		277	3.64	76	1008.28
6	R =	187	152	241	45	55		440	2.89	152	1271.6
7	E =	440	24	12	120	480		480	3.87	124	1857.6
8	R =	123	37	21	233	77		240	1.03	233	247.2
9	R =	74	168	175	102			480	6.49	74	3115.2
10	E =	440	120	240	12	277		440	2.13	207	937.2
11	P =	1625.23	1722.22	1545.44	1326.22	1963.22		208	7.43	28	1545.44
12	I =	4.23	5.22	3.22	45	4.44		480	4.44	108	2131.2
13	E =	120	480	277	208	24		208	0.87	240	180.96
14	R =	115	176	91	2	166		240	1.36	176	326.4
15	E =	120	24	240	277	480		240	1.01	238	242.4
16	R =	204	103	84	250	203		240	1.18	204	283.2
17	I =	0.97	0.45	1.23	0.16	0.61		24	0.16	153	3.84
18	P =	196.3	152.6	245.6		187.2		120	1.56	77	187.2
19	I =	0.36	0.42	0.85	1.26	0.97		24	0.36	67	8.64
20	E =	480	240	120	277	240		240	0.97	248	232.8
21	R =	210	140	176	172	249		240	1.14	210	273.6
22	I =	43	21.36	165	186	0.29		240	1.86	129	446.4
23	E =	277	120	240	24	480		480	1.99	241	955.2
24	R =	107	147	233	108	99		120	0.82	147	98.4
25	I =	1.42	13.3	1.33	2.45	31.31		120	1.33	90	159.6
Correct answer								Missing information			



Press F1 for Help

01:35 PM Full Screen

- | | | | |
|----|---|-------------------------|--------------------------------------|
| 1 | Cooktop | Abenderoth and Abelseth | Westling and Spalding |
| 2 | Dishwasher | | Red and Nick |
| 3 | Cooktop | | Westling and Spalding |
| 4 | Refrigerator, Receptacle by same, Porch light | Foste, McDonald | Tieber and Guffey |
| 5 | Disposal, light over sink | Azar, Galliard | Westling and Spalding |
| 6 | Small Appliance Branch Circuit one | Landolt, Campbel | Brennan and Chappell |
| 7 | Small Appliance Branch Circuit two | Gersman, Montgomery | McNew and Goeswert |
| 8 | Lights, in kitchen, microwave | Wilson, Sachs | Hoosh and Kenny |
| 9 | Oven, | Weaver, Hawkins | Tyler, McClain, Whitehead, McClellan |
| 10 | | | |
| 11 | Oven | Weaver, Hawkins | Tyler, McClain, Whitehead, McClellan |
| | Panel | | Gowert |

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Trade: Electrical

Module Number: 1

Module Name: Trade Orientation And Common Hand Tool Use

Duty: A. Shop Evacuation Plan and Location of Shop Fire Equipment

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Given a mock fire drill, students will utilize any needed safety equipment and will exit the shop area.

Suggested Learning Activities:

1. Demonstrate the fire evacuation plan.
2. Demonstrate fire extinguisher use.
3. Demonstrate fire blanket use.

Suggested Resources for the Instructor:

Student handbook
Fire extinguisher
Fire blanket
Fire safety video

Suggested Tools and Equipment for the Students:

Student handbook
Notebook
Pen or pencil

Suggested Evaluation:

Have a mock fire drill and have students respond, and exit the building.

Trade: Electrical

Module Number: 1

Module Name: Trade Orientation And Common Hand Tool Use

Duty: B. Electrical Trade Introduction

Suggested Instructional Time for the Module: 4 Hours

Competency/Performance Objective:

Demonstrate a basic knowledge of the State apprenticeship program, description of the trade, employment opportunities, work ethics, and ethics of the trade.

Suggested Learning Activities:

1. Have students (in writing) describe the apprenticeship program.
2. Have students describe the many branches of the electrical trade, and the needed specialty training that is required for each.
3. Oversee students practicing (worker/customer) communication skills.
4. Have students demonstrate customer contact and problem appraisal.

Suggested Resources for the Instructor:

State Apprenticeship booklets
Agency for Instructional Technology. (1992) Workplace Readiness, Blooming, IN.
Kubala, T. (1996) Electricity 1, (6th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Kubala, T. (1996) Electricity 1, (6th Ed.), Albany, NY: Delmar Publishers.

Suggested Evaluation:

Students will be able to explain in writing or verbally the State apprenticeship program, work ethics, and employment opportunities with 90% accuracy.

Trade: Electrical

Module Number: 1

Module Name: Trade Orientation and Common Hand Tool Use

Duty: C. Hand Tool Use

Suggested Instructional Time for the Module: 4 Hours

Competency/Performance Objective:

Demonstrate proper hand tool safety by completing various trade related tasks using appropriate tools.

Suggested Learning Activities:

1. Direct students to wire basic projects using their tools (assorted screwdrivers, pliers, strippers, hammer, various handsaws and assorted chisels).
2. Have students employ these skills by installing boxes, forming conductors and then connecting these conductors to various devices.

Suggested Resources for the Instructor:

Kubala, T. (1996) Electricity 1, (6th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Required hand tools
Safety glasses
Notebook
Pen or pencils

Suggested Evaluation:

Students will install and connect various electrical devices in an approved manner using their hand tools in a safe manner with 90% accuracy.

Trade: **Electrical**

Module Number: **2**

Module Name: **Basic Safety With Electricity**

Duty: **A. Identify Potential Danger**

Suggested Instructional Time for the Module: **2 Hours**

Competency/Performance Objective:

Given a list of potential electrical and other worksite dangers, students will be able to recognize the dangers and know what appropriate action should be taken.

Suggested Learning Activities:

1. Demonstrate and develop a worksite survey evaluation.
2. Demonstrate proper procedures for identification of potential dangers.
3. Demonstrate the need for the utilization of protective corrective action.
4. Develop and assess a list of potential dangers.

Suggested Resources for the Instructor:

OSHA Manual
Chalkboard w/chalk

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil

Suggested Evaluation:

Students will be able to recognize potential dangers, and know how to handle and report them.

Trade: Electrical

Module Number: 2

Module Name: Basic Safety with Electricity

Duty: B. Tagout/Lockout

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Given twenty statements regarding Tagout/Lockout (T/L) , students will establish Tagout/Lockout procedures to prevent the unintended release of stored energy which may energize a machine or other equipment, causing injury to another person. Students will perform the proper installation of a Tagout/Lockout device without error.

Suggested Learning Activities:

1. Demonstrate and establish a written program, by conducting a survey of facilities to determine locations of all hazardous energy sources.
2. Present various energy control devices, and explain their function.
3. Administer a periodic inspection program to correct any deviations or inadequacies that are observed.
4. Coordinate essential elements for training and retraining.
5. Demonstrate and explain the basic elements of controlling the unexpected energization or start-up of machinery and equipment or, the unintentional release of stored energy.
6. Illustrate the proper procedures for releasing of a Tagout/Lockout device.
7. Establish guidelines for management and contractors so they may inform each other of respective Tagout/Lockout procedures.
8. Explain the importance of group Tagout/Lockout.
9. Coordinate proper procedures for shift and personnel changes.
10. Demonstrate that exclusions are also a consideration when normal production operations including repetitive, routine minor adjustments and maintenance which are covered under OSHA's compliance.

Suggested Resources for the Instructor:

OSHA manual
Ideal Tagout/Lockout Program cfr. 1910.147
Chalkboard w/chalk
Keyed padlocks
Safety lockouts
Safety tags

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil

Suggested Evaluation:

Students will be able to recognize what equipment must be tagged and locked out. After recognizing the equipment students will apply the proper procedures in applying a tag and lockout device according to OSHA guidelines.

Trade: Electrical

Module Number: 2

Module Name: Basic Safety With Electricity

Duty: C. Using a Meter To Check For Voltage

Suggested Instructional Time for the Module: 1 Hour

Competency/Performance Objective:

Given a completed circuit, students will place their meter to the highest voltage scale. After putting on their safety glasses, students will now take voltage readings from various points in the circuit. They will identify the voltage present with an accuracy of no less than 5 percent.

Suggested Learning Activities:

1. Identify National Electrical Code conductor markings.
2. Determine the source voltage of all equipment and conductors.
3. Identify the ratings of metering equipment.
4. Determine the condition of the testing equipment.
5. Identify the listing and rating of the overcurrent protective device.
6. Conform to other safety standards per OSHA and shop safety policy.

Suggested Resources for the Instructor:

OSHA manual
Chalkboard w/chalk, etc.
Safety glasses
Current National Electric Code

Suggested Tools and Equipment for the Students:

Safety glasses (A.N.S.I.) standard
Notebook
Digital multimeter
Pen or pencil
Current National Electrical Code

Suggested Evaluation:

Students will be able to recognize the voltage rating of equipment, be required to wear safety glasses and place the tester leads on a completed circuit. They will also be required to take voltage readings from various locations on the circuit.

Trade: Electrical

Module Number: 2

Module Name: Basic Safety With Electricity

Duty: D. Insure Proper Grounding

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Given the theory and principles of grounding, students will ensure the proper grounding of all electrical materials. Students will accurately identify the grounding requirements according to the National Electrical Code and other applicable codes.

Suggested Learning Activities:

1. Demonstrate and justify proper grounding of all electrical equipment.
2. Discuss applicable code articles pertaining to grounding.
3. Select a reliable grounding path (demonstrate need for a reliable path).
4. Examine how to establish a good ground.
5. Demonstrate how paint acts as an insulator instead of a conductor.
6. Fabricate a complete electrical circuit, or system and review all aspects of the system high lighting all grounding points.

Suggested Resources for the Instructor:

Current National Electrical Code

Suggested Tools and Equipment for the Students:

Safety glasses

Current National Electric Code

Notebook

Pen or pencil

O'Riley, R. (1996) Electrical Grounding, (4th Ed.), Albany, NY: Delmar Publishers.

Suggested Evaluation:

Students will be able to identify each grounding component of a circuit or system according to the National Electrical Code or any other standards.

Trade: Electrical

Module Number: 2

Module Name: Basic Safety With Electricity

Duty: E. Use of Ground Fault Interrupter

Suggested Instructional Time for the Module: 3 Hours

Competency/Performance Objective:

Given both classes of ground-fault circuit interrupters (GFCI), students will be able to identify the manufacturing and listing on the equipment as a class "A" or class "B" device. Students will be required to install ground fault circuit interrupter on any temporary power circuit according to the N.F.P.A., OSHA requirements, or the school shop safety guidelines.

Suggested Learning Activities:

1. Discuss the principles and theory for both class "A" and "B" ground fault circuit interrupters.
2. Demonstrate how a GFCI operates.
3. Exhibit how to identify both classes of GFCI protection.
4. Discuss the importance of installing GFCI devices.
5. Apply all safety requirements to ensure a safe and reliable GFCI circuit.
6. Construct a proper GFCI protected circuit.

Suggested Resources for the Instructor:

Class A GFCI device (6 milliamperes or greater)	Chalkboard w/chalk
Class B GFCI device (20 milliamperes or greater)	OSHA manual Ground Fault Protection
Demonstrator	Ground fault circuit trainer
Ground fault circuit tester	

Suggested Tools and Equipment for the Students:

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.
Notebook
Pen or pencil

Suggested Evaluation:

Student will be able to identify both classes of GFCI protection. They will be required to install GFCI protection any time the job may require it, or to be in compliance with applicable codes with 100% accuracy.

Trade: Electrical

Module Number: 2

Module Name: Basic Safety With Electricity

Duty: F. Use of Approved/Rated Cords

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Given an extension cord, students will gather data from the listing and manufacturer's rating on the cord and equipment. With this information students will perform proper handling, visual inspection of the portable flexible cords used with portable tools and equipment. These cords must be in compliance with all applicable codes.

Suggested Learning Activities:

1. Explain what each letter (suffix) on an extension cord means.
2. Demonstrate proper procedures to identify rated and listed cords.
3. Define applicable code and industry standards governing the use of flexible cords.
4. Discuss the importance of why flexible cords are not used for raising or lowering of equipment or tools.
5. Demonstrate that flexible cords may not be stapled or otherwise be hung in such a fashion that could damage the outer covering or insulation.
6. Practice that portable cord and plug connected cords and equipment shall be inspected before each use.
7. Discuss that a flexible cord used for grounding-type equipment must contain a grounding conductor.
8. Demonstrate that an attachment plug and receptacles may not be connected or altered in a manner which would prevent proper continuity of the equipment grounding conductor at the point, where plugs are attached to receptacles.
9. Demonstrates why adapters, which interrupt the continuity of the grounding connection, may not be used.
10. Describe the usage of double insulated power tools.

Suggested Resources for the Instructor:

OSHA manual
Chalkboard

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil

Suggested Evaluation:

Students will be able to recognize the various ratings for flexible cords and cables, according to the listing and rating. Assign a written quiz pertaining to National Electric Code and OSHA standards.

Trade: Electrical

Module Number: 2

Module Name: Basic Safety With Electricity

Duty: G. Identify Hazardous Material, Using a Material Safety Data Sheet (MSDS)

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Students will be able to recognize potential dangers associated with the use of products in the industry. They will know what their responsibility is when working with or around these and any other products that may contain chemicals.

Suggested Learning Activities:

1. Describe how to prepare and implement a hazard communication program.
2. Identify and list all chemicals used in both the workplace and in the electrical
3. department.
4. Obtain MSDS sheets and labels for each and every item that contains hazardous
5. chemicals.
6. Illustrate that all material safety data sheets are to be made available to each and every
7. worker and student.
8. Establish procedures and guidelines to maintain a current program.
9. Establish procedures to evaluate the effectiveness of the program.

Suggested Resources for the Instructor:

Complete list of all chemicals used by the electrical department.
Obtain material safety data sheets for all products containing hazardous chemicals used by the department.
Chalk board w/chalk, etc.
OSHA manual
OSHA (MSDS) form #174

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil

Suggested Evaluation:

Given OSHA Hazardous Communication guidelines, students will know how to identify, obtain, develop and communicate hazardous exposure on the job site. Students will be required to prepare an inventory of all chemicals used by the electrical department. The students will obtain from all manufacturers and distributors, from which the electrical department has purchased items, a list of which products contain chemicals. Compiling this list, along with understanding the program, the student must establish an accuracy of no less than 100%.

Trade: Electrical

Module Number: 2

Module Name: Basic Safety With Electricity

Duty: H. Lifting Objects

Suggested Instructional Time for the Module: 1 Hours

Competency/Performance Objective:

Students will be able to recognize potential dangers when lifting any objects. Observe the students lifting objects in or around the shop area.

Suggested Learning Activities:

1. Determine that before lifting or carrying an object, immediate walkways are free of obstacles.
2. Demonstrate that when an object is heavy or bulky, students should get help rather than risk an injury.
3. Demonstrate that when lifting any objects, students should keep backs straight, and use leg muscles to raise the object.
4. Describe how to apply and use back supports when lifting or moving objects.
5. Discuss the proper lifting and carrying techniques unique to items in your department.
6. Describe what types of injuries one might suffer as a result of improper lifting or carrying.
7. Explain the three phases of correct lifting (pre-lift phase, the lifting phase, the setting down phase).

Suggested Resources for the Instructor:

Textbook (instructor's choice)	Chalk board w/chalk, etc.
Instructor made homework	Hooks and handles
Crowbars	Rollers
Handtrucks, dollies, wheelbarrows	Other

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil

Suggested Evaluation:

Given OSHA guidelines regarding the proper precaution and procedures when lifting or carrying objects, students will indicate on a written quiz statements which are true or false with an accuracy of no less than 80%.

Trade: Electrical

Module Number: 2

Module Name: Basic Safety With Electricity

Duty: I. Trenches

Suggested Instructional Time for the Module: 1 Hour

Competency/Performance Objective:

Students will be able to recognize the format that is required when any trenching is to be done on the joist. They also will be required to explain step by step procedures, when working in or around any trench, and describe what their duties would be. Students then will be given an instructor made quiz.

Suggested Learning Activities:

1. Discuss the procedures for gaining a permit before you digging.
2. Explain the procedures of notifying all utilities (Call Before You Dig).
3. Demonstrate and develop a worksite survey evaluation.
4. Demonstrate proper procedures for identifying potential dangers.
5. Demonstrate the need for the utilization of protective corrective action.
6. Demonstrate that any trenches with a wall greater than 5' must have an approved guard with shoring to protect the workers.
7. Demonstrate the importance of inspecting the trenches daily.
8. Demonstrate that ladders or steps allowing entrance to trenches must have no more than 25 feet of lateral travel in trenches 4 feet or more deep.
9. Discuss the importance of keeping runways and sidewalks free of debris.
10. Discuss the need to have trench walls.
11. Demonstrate the proper installation of barricades and warning signs.
12. Demonstrate allowable sloping side angles that are allowed for different types of soil and conditions.
13. Demonstrate the basic rules for safe working in trenches.
14. Demonstrate OSHA requirements pertaining to detecting of hazardous gases or vapors.

Suggested Resources for the Instructor:

OSHA manual
Chalk board w/chalk, etc.
Required text book (instructor's choice)
Instructor made homework
Instructor made quiz

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Completed homework

Suggested Evaluation:

Given OSHA standards governing the requirements when working in or near trenches, students must accurately recognize these and other dangers with an accuracy of 100%.

Trade: Electrical

Module Number: 3

Module Name: Wire-Splices and Installation

Duty: A. Identify Various Conductors

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Students must possess a knowledge of wire covering, sizes and current carrying capacities in order to select proper conductor according to its application and according to applicable codes.

Suggested Learning Activities:

1. Identify and describe various types and sizes of conductors, according to rating and
2. listing.
3. Relate the wire sizes and their listing, to current carrying capacities.
4. Select conductors according to their application.
5. Explain National Electric Code requirements regarding conductors.

Suggested Resources for the Instructor:

Current National Electrical Code
Various cable and conductors

Suggested Tools and Equipment for the Students:

National Electrical Code
Various sizes and types of cable and conductors
Note Book
Pen or pencil

Suggested Evaluation:

Students will be given various cable and conductors, and will be able to identify their application, rating, and current carrying capability, according to their listing and applicable codes with an accuracy of no less than 100%.

Trade: Electrical

Module Number: 3

Module Name: Wire-Splices and Installation

Duty: B. Remove Insulation

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Given a sample piece of cable or conductor, students will be able to perform the proper stripping techniques of conductors.

Suggested Learning Activities:

1. Demonstrate the proper positioning of the cable or conductor before removing the insulation.
2. Assure that the stripping tool or device is both rated and properly used before beginning stripping the conductor.
3. Demonstrate the proper removal of the outer jacket without damaging the under-lying insulation.
4. Discuss and explain how to properly sharpen both stripping tools, and/or, electrician's knife.

Suggested Resources for the Instructor:

Sample of various cables or conductors
Electrician's knife
Cable stripping tools

Suggested Tools and Equipment for the Students:

Safety glasses
Samples of cables and conductors
Electrician's knife

Suggested Evaluation:

Students will demonstrate the proper removal of insulation from various cables or conductors without damaging the individual conductors with an accuracy of no less than 90%. Assign an instructor made quiz. with a proficiency rate of 90%.

Trade: **Electrical**

Module Number: **3**

Module Name: **Wires-Splices and Installation**

Duty: **C. Connecting Screws**

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Given lab projects using copper conductors, students will properly remove the insulation to a measurement listed by the manufacturer, then will properly form the current carrying or copper conductor around the screw terminal facing the right direction and tighten..

Suggested Learning Activities:

1. Demonstrate the proper removal of the insulation.
2. Explain how to properly curve the conductive portion of the conductor without damaging it.
3. Demonstrate and explain why its important the conductor be formed the same way the device tightens.

Suggested Resources for the Instructor:

Safety glasses
Copper conductor
Electrician's knife
Listed device

Suggested Tools and Equipment for the Students:

Safety glasses
Copper conductor
Electrician's knife

Suggested Evaluation:

Students will wire and demonstrate the proper procedures for installing conductors under or around a screw terminal without error.

Suggested Evaluation:

Students will be required to assemble, identify and describe the theory and principle of what effects voltage, current and impedance have on a RC circuit. Student will be required to compile the needed information from their lab project and draft a one page report on RC circuits, describing the importance of this knowledge related to the electrical trade. Students will evaluate their findings and describe the theory behind their findings in an essay form with no less than 75% accuracy.

Trade: Electrical

Module Number: 25

Module Name: Alternating Current (AC) Principles

Duty: D. Wire Resistive and Capacitance (RC) Circuits

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Given the task of wiring a circuit from an instructor made lab project consisting of a circuit containing both resistance (r) and capacitance (c), students will evaluate their findings and describe the theory behind their findings in an essay form.

Suggested Learning Activities:

1. Define and explain RC circuits.
2. Discuss voltage, impedance and current in both series and parallel RC. circuits.
3. Review and demonstrate various examples of calculating for impedance, voltage and current in a RC circuit.
4. Assign homework.

Suggested Resources for the Instructor:

Chalk board w/chalk etc

Volt-Ohm meter

Safety glasses

Hampden kit and/or equal

Instructor made lab project (low voltage)

Herman, S. (1995) Standard Textbook of Electricity. Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Notebook

Pen or pencil

Safety glasses

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Electric/electronic trainer

Hand held digital meter

Instructor made lab project (low voltage)

Volt-Ohm meter

Trade: **Electrical**

Module Number: **25**

Module Name: **Alternating Current (AC) Principles**

Duty: **C. Showing Capacitor Phase Angle**

Suggested Instructional Time for the Module: **6 Hours**

Competency/Performance Objective:

Students will apply the knowledge of the theory and principle of voltage and current relationship of a capacitor.

Suggested Learning Activities:

1. Review the theory and principle of sine waves.
2. Review the basic principles of capacitance.
3. Explain the unit of measurement of capacitance.
4. Demonstrate and explain how frequency effects capacitor current.
5. Demonstrate and explain how the sine wave affects current leads and applies voltage.
6. Assign homework.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Notebook

Pen or pencil

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Suggested Evaluation:

Students will be required to identify, describe the principal of voltage and current relationship of a capacitor. They will answer fifteen questions pertaining to the basic principles and theory of the phase angles when working with capacitors with an accuracy rate of no less than 75%.

Trade: Electrical

Module Number: 25

Module Name: Alternating Current (AC) Principles

Duty: B. Checking a Capacitor Alternating Current (AC) & Direct Current (DC) Response

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Students will be required to correctly check capacitors for both AC & DC response.

Suggested Learning Activities:

1. Discuss the importance of safety.
2. Review the basic principles of capacitance in both AC & DC circuits.
3. Explain the unit of measurement of capacitance.
4. Explain why capacitors are used in industry.
5. Apply and demonstrate the use of the formula " $x_c = 1/2\pi f c$ ".

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Calculator

Safety glasses

Herman, S. (1995) Standard Textbook of Electricity. Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Notebook

Pen or pencil

Safety glasses

Herman, S. (1995) Standard Textbook of Electricity. Albany, NY: Delmar Publishers.

Electric/electronic trainer

Hand held digital meter

Suggested Evaluation:

Students will be required to correctly answer twenty-five questions pertaining to AC/DC response when working with capacitors. They will be given various mathematical computations which they will complete by using the formula " $x_c = 1/2\pi f c$ ", at an accuracy rate of no less than 90% percent.

Trade: Electrical

Module Number: 25

Module Name: Alternating Current (AC) Principles

Duty: A. Checking a Capacitor

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Given the task of demonstrating an out-of circuit test for capacitors, students will use a Volt-Ohm meter to safely observe the capacitor's polarity, and will touch the test probes to the capacitor. They will determine if the capacitor has resistance and determine the state of the Volt-Ohm meter

Suggested Learning Activities:

1. Discuss the importance of safety.
2. Review the basic principles of capacitance.
3. Explain the unit of measurement of capacitance.
4. Demonstrate the proper method of discharging a capacitor.
5. Demonstrate meter reading techniques when working with capacitors.
6. Discuss all applicable code articles pertaining to capacitors.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.	Current National Electric Code book
Safety glasses	Volt-Ohm meter
Various capacitors of different values	
Herman, S. (1995) <u>Standard Textbook of Electricity</u> , Albany, NY: Delmar Publishers.	

Suggested Tools and Equipment for the Students:

Notebook	Safety glasses
Pen or pencil	Various capacitors of different values
Current National Electric Code	
Herman, S. (1995) <u>Standard Textbook of Electricity</u> , Albany, NY: Delmar Publishers.	

Suggested Evaluation:

Students will identify, describe, test and list applicable code articles and industry standards pertaining to the use and installation of capacitors. Students will be given various non-connected capacitors and will safely use their Volt-Ohm meters to determine the proper procedures when testing them.. This task will require completion with a 100% accuracy rate.

Trade: Electrical

Module Number: 24

Module Name Illumination

Duty: A. Determine Lighting Requirements

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Students will determine the proper lighting needed in any situation and install to National Electric Code requirements.

Suggested Learning Activities:

1. Direct students to review a complete set of drawings to include site, elevations and floor plans (this could also work in a combined effort with blueprint).
2. Discuss and make recommendations to the instructor on needed lighting requirements.
3. Demonstrate different ways of installing the different lighting fixtures.
4. Review ladder safety.

Suggested Resources for the Instructor:

Manufacturer's cut sheets
Current National Electric Code
Fastener catalogs
Blueprint teacher

Suggested Tools and Equipment for the Students:

Hand tools
Different lighting fixtures
Current National Electric Code
Assorted lighting catalogs

Suggested Evaluation:

Students will submit a design and projected cost list for required lighting to an accuracy rate of 100%.

Trade: Electrical

Module Number: 23

Module Name: Multifamily Dwelling

Duty: D. Installation of Wire Low Voltage Controls and Annunciators

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Students will wire control circuit and annunciator systems with an accuracy rate of ninety percent (90%).

Suggested Learning Activities:

1. Review wiring multi station annunciator systems.
2. Have students draw an annunciator circuit for apartment to door and to unlock door from remote area.)
3. Direct students to design and wire a remote access annunciator system.
4. Review furnace control wiring .
5. Demonstrate furnace control system .
6. Require students to wire furnace control system.

Suggested Resources for the Instructor:

Current National Electric Code
Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Hand tools	Current National Electric Code
Notebook	Electric heat furnace demonstrator
Oil burner control trainer	Gas control trainer

Suggested Evaluation:

Students will wire a low voltage control system and annunciator system to an accuracy rate of 90%.

Trade: Electrical

Module Number: 23

Module Name: Multifamily Dwelling

Duty: C. Installation of Required Lighting

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Students will determine requirements and install lighting to an accuracy rate of 80%.

Suggested Learning Activities:

1. Discuss lighting requirements for common areas, walkways and basement areas.
2. Review local multifamily lighting requirements.
3. Discuss lighting controls, timers/photocell.
4. Calculate lighting loads.

Suggested Resources for the Instructor:

BOCA codes

Current National Electric Code

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Hand tools

Calculator

Current National Electric Code

Multifamily blueprint

Suggested Evaluation:

Students will explain, calculate and install needed lighting equipment in a multifamily dwelling to an accuracy rate of 80%.

Trade: **Electrical**

Module Number: **23**

Module Name: **Multifamily Dwelling**

Duty: **B. Installation of Service**

Suggested Instructional Time for the Module: **8 Hours**

Competency/Performance Objective:

Students will successfully install all phases of an electrical service according to the requirements of the National Electric Code and local power company requirements.

Suggested Learning Activities:

1. Review ladder safety.
2. Review National Electric Code Art. 230 (Services).
3. Discuss local power company requirements.
4. Review National Electric Code Art. 250 (Grounding).

Suggested Resources for the Instructor:

Current National Electric Code
Power company handbook
Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Current National Electric Code
Notchbook
Power company handbook
Hand tools
Ladders
Service equipment

Suggested Evaluation:

Students will install all service materials for a multifamily service to an accuracy rate of 100%.

Trade: Electrical

Module Number: 25

Module Name: Alternating Current (AC) Principles

Duty: G. Checking Inductor Phase

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Given a drawing of an AC waveform and the basic theory and principle, students will understand the voltage and current relationships pertaining to a circuit containing inductance. Students will be required to explain importance of inductance when installing electrical equipment and raceways.

Suggested Learning Activities:

1. Review the theory and principle of inductance.
2. Explain the factors affecting inductance.
3. Explain why voltage leads current by 90 degrees.
4. Demonstrate and explain how the back electro-motive force (emf) lags current by 90 degrees.
5. Demonstrate and explain why the applied voltage and back emf are 180 degrees out of phase.
6. Assign homework.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.
Current National Electric Code

Suggested Tools and Equipment for the Students:

Notebook

Pen or pencil

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.
Current National Electric Code

Suggested Evaluation:

Students will answer fifteen questions regarding inductive circuits. (This theory will be included later in the course when sizing conduit.) This task will require students to obtain an accuracy rate of no less than 75%.

Trade: Electrical

Module Number: 25

Module Name: Alternating Current (AC) Principles

Duty: F. Check AC & Direct Current (DC) Inductor Response

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Students will be able to discuss and explain the different inductor responses in AC and DC circuits.

Suggested Learning Activities:

1. Review the theory and principle of inductance.
2. Explain the factors affecting inductance.
3. Explain the unit of measurement of inductance.
4. Demonstrate and explain how inductance responses effect both AC & DC circuits.
5. Assign homework.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Notebook

Pen or pencil

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Suggested Evaluation:

Students will answer twenty-five questions pertaining to AC/DC inductor response, with accuracy rate of at least 75%.

Trade **Electrical**

Module Number: **25**

Module Name: **Alternating Current (AC) Principles**

Duty: **E. Checking Inductors**

Suggested Instructional Time for the Module: **6 Hours**

Competency/Performance Objective:

Given the task of developing various student made aircore inductors, student will use their multimeter, when obtaining various readings. The student will see the relationship of many turns of conductor in layers thus producing high inductance.

Suggested Learning Activities:

1. Review the theory and principle of inductance.
2. Explain the factors affecting inductance.
3. Explain the unit of measurement of inductance.
4. Assign homework.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.
Safety glasses
Volt-Ohm meter
Electric/electronic trainer
Hand held digital meter

Suggested Tools and Equipment for the Students:

Notebook Safety glasses
Pen or pencil Volt-Ohm meter
Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Suggested Evaluation:

Students will develop various lab projects, which will consist of devising many different sizes and types of inductors. They then will be required to assembly them into a low voltage lab project, and record and list their findings. This task will require an accuracy rate of no less than 75%.

Trade: Electrical

Module Number: 3

Module Name: Wires-Splices and Installation

Duty: D. Wire Connections

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Given various conductors, students will know how to select the rated solderless wire connector properly according to its application. They will be required to ensure a safe and reliable splice according to the manufacturing listing and applicable codes.

Suggested Learning Activities:

1. Demonstrate the various types and sizes of solderless wire connectors.
2. Describe terminal identification markings.
3. Demonstrate the proper installation of solderless connectors.

Suggested Resources for the Instructor:

Safety glasses
Electrician's knife
Various types and sizes of solderless wire connectors

Suggested Tools and Equipment for the Students:

Safety glasses
Electrician's knife
Hand tools
Conductors
Solderless wire connectors

Suggested Evaluation:

Evaluate students stripping and applying conductors to various solderless wire connectors according to the manufacturer's specifications, and applicable codes without error, to ensure a safe and reliable splice.

Trade: Electrical

Module Number: 4

Module Name: Signal and Communication Wiring

Duty: A. Wiring an Annunciator System

Suggested Instructional Time for the Module: 10 Hours

Competency/Performance Objective:

Given the task of wiring an annunciator system, students will lay out and wire correctly, from two locations.

Suggested Learning Activities:

1. Build a mock up of a doorbell system.
2. Demonstrate proper operation.
3. Demonstrate proper troubleshooting of the system.
4. Correctly list all materials.

Suggested Resources for the Instructor:

Kubala, T. (1996) Electricity 1, (6th Ed.), Albany, NY: Delmar Publishers.
Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Security Alarm System Trainer
Screwdriver, pliers, wire strippers
Chime kit or transformer, buttons, wire
Notebook
Pen or pencil

Suggested Evaluation:

Students will wire and demonstrate the proper operation of doorbell system with 100% accuracy.

Trade: Electrical

Module Number: 4

Module Name: Signal and Communication Wiring

Duty: B. Telephone System Wiring

Suggested Instructional Time for the Module: 10 Hours

Competency/Performance Objective:

Students will lay out and wire a working telephone system.

Suggested Learning Activities:

1. Have students fabricate a telephone system in the shop environment.
2. Initiate (instructor) problems with system once it has worked so students will be exposed to controlled troubleshooting techniques.

Suggested Resources for the Instructor:

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Electronic telephone trainer system
Common hand tools
Telephone wiring
Telephone jacks
Telephone interconnects
Telephones
Telephone wire crimpers
Heathkit EWS-542 Network Topologies and Copper Cabling/and/or Equal

Suggested Evaluation:

Students will wire a working telephone system with no errors.

Trade: **Electrical**

Module Number: **4**

Module Name: **Signal and Communication Wiring**

Duty: **C. Cable Television System Wiring**

Suggested Instructional Time for the Module: **10 Hours**

Competency/Performance Objective:

Students will lay out and construct an operating cable system supplying a minimum of two CATV outlets.

Suggested Learning Activities:

1. Wire a CATV system using a VCR as a source.
2. Install CATV connectors.
3. Wire system to the applicable National Electric Code articles.

Suggested Resources for the Instructor:

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.
Video

Suggested Tools and Equipment for the Students:

Common hand tools
CATV coax cable
Cable connectors
Video Cassette Recorder
Television
Cable crimpers

Suggested Evaluation:

Test the student installed system CATV operation at the two locations and ensure that there are no faults.

Trade: Electrical

Module Number: 5

Module Name: Screws and Fastener Installation

Duty: A. Equipment Installation

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Given a particular working environment, students will successfully and safely mount equipment or fabricate needed supports using screws or fasteners.

Suggested Learning Activities:

1. Drill in wood and masonry.
2. Using toggle bolts or molly bolts mount a support to block wall.
3. Mount equipment to a wooden support using wood or sheetmetal screws.
4. Mount equipment to a concrete wall using lead anchors or expansion shields.

Suggested Resources for the Instructor:

A Wood Wall/A Block Wall

Suggested Tools and Equipment for the Students:

Common hand tools
Toggle bolts
Wood and sheetmetal screws
Lead anchors with set

Suggested Evaluation:

Students will mount equipment in a safe and secure manner with 100% accuracy.

Trade: **Electrical**

Module Number: **5**

Module Name: **Screws and Fastener Installation**

Duty: **B. Equipment Installation: Maintaining Fire Stops**

Suggested Instructional Time for the Module: **6 Hours**

Competency/Performance Objective:

Students will construct and install a wiring system and will maintain fire stopping methods as outlined in all applicable codes.

Suggested Learning Activities:

1. Cut hole for conduit in a block wall and have students apply approved sealing materials.
2. Drill hole in a wooden fire stop and have students seal in an approved manner.

Suggested Resources for the Instructor:

BOCA codes
Current National Electric Code

Suggested Tools and Equipment for the Students:

Drill
Chisel for cutting block
Fire stop materials

Suggested Evaluation:

Construct an installation to approved fire stopping methods.

Trade: **Electrical**

Module Number: **6**

Module Name: **Basic Power Tool Use**

Duty: **A. Drill With Power Drills**

Suggested Instructional Time for the Module: **6 Hours**

Competency/Performance Objective:

Students will be able to drill or cut a series of holes in a wooden structure (2x4).

Suggested Learning Activities:

1. Employ proper cutter selection either wood power bit or hole saw.
2. Perform installing the tool into power drill properly (being sure tool is connected to power).
3. Demonstrate checking power tool to ensure that it is a safe tool.
4. Have students complete drilling holes.
5. Have students perform cutting holes with a hole saw.

Suggested Resources for the Instructor:

Video on tool safety
User sheets that come with tool

Suggested Tools and Equipment for the Students:

Safety glasses
Power drill
Set hole saws
Auger bits for power drill

Suggested Evaluation:

Students will select tool, install bit or saw and drill or cut a series of holes without error.

Trade: **Electrical**

Module Number: **6**

Module Name: **Basic Power Tool Use**

Duty: **B. Cutting with a Sawzall**

Suggested Instructional Time for the Module: **6 Hours**

Competency/Performance Objective:

Students will be able to cut a piece of wood and a piece of metal to a given measurement, in a safe manner.

Suggested Learning Activities:

1. Have students exhibit proper blade selection for the material that has been selected to cut.
2. Demonstrate installing the blade into the tool.
3. Inspect tool for any faults.
4. Instruct students on proper tool usage.
5. Arrange for students to make different cuts.

Suggested Resources for the Instructor:

Manufacturer's equipment sheets
Tool video

Suggested Tools and Equipment for the Students:

Sawzall
Assorted blades
Notebook
Pen or pencil

Suggested Evaluation:

Students will make a series of cuts in both metal and wood without error.

Trade: **Electrical**

Module Number: **6**

Module Name: **Basic Power Tool Use**

Duty: **C. Drill Masonry With Drill or Rotary Hammer**

Suggested Instructional Time for the Module: **4 Hours**

Competency/Performance Objective:

Students will drill a series of holes in concrete or cement block in a safe manner, without error.

Suggested Learning Activities:

1. Proper bit selection and installation of cutting tool.
2. Check tool for sharpness.
3. Check power tool for defects.
4. Supervise students drilling a set of holes.

Suggested Resources for the Instructor:

Tool video
Tool sheets

Suggested Tools and Equipment for the Students:

Rotary hammer
Assorted masonry bits
Notebook
Pen or pencil

Suggested Evaluation:

Students will use a hammer drill and make proper cutting tool selections.

Trade: Electrical

Module Number: 7

Module Name: Current Electricity

Duty: A. Demonstrate Earth as Conductor

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Given the theory of conductivity, students will apply this knowledge to the installation of wiring projects. This will ensure a safe and properly grounded circuit according to the National Electrical Codes and other applicable codes.

Suggested Learning Activities:

1. Discuss the theory of zero potential to ground.
2. Explain all code articles pertaining to grounding.
3. Demonstrate proper installation of grounding electrodes.
4. Explain electrolytic grounding system.
5. Describe proper grounding techniques.
6. Demonstrate ground testing.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Ground rod
Grounding electrodes

Current National Electrical Code
Various ground clamps
Grounding electrode conductor

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Current National Electrical Code Book

Suggested Evaluation:

Students will apply the knowledge of using the earth as a ground into their lab projects, and on the job training to ensure a safe and reliable grounded circuit according to the requirements of the National Electrical Code. This task will be evaluated at a rate of no less than 100%.

Trade: **Electrical**

Module Number: **7**

Module Name: **Current Electricity**

Duty: **B. Conductor Properties**

Suggested Instructional Time for the Module: **6 Hours**

Competency/Performance Objective:

Given the basic principles and theory of conduction in gas, vacuum, and liquids the student will be able to describe the differences of conduction.

Suggested Learning Activities:

1. Define the difference between positive and negative ions.
2. Discuss electrical conduction in a gas.
3. Discuss electrical conduction in a vacuum.
4. Discuss electrical conduction in a liquid.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Notebook

Pen or pencil

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Suggested Evaluation:

Students will be required to maintain an accuracy of at least 80% on a written instructor made quiz.

Trade: Electrical

Module Number: 7

Module Name: Current Electricity

Duty: C. Direction of Flow

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Given the “Conventional” current flow theory, students will be able to apply this knowledge to ohm’s law and demonstrate use of its logic into their lab projects. Students will exhibit a greater understanding of current, and its direction of flow.

Suggested Learning Activities:

1. Define a coulomb, amp, volt, watt and ohm.
2. Discuss the different types of basic circuitry.
3. Explain the “Conventional” current flow theory.
4. Develop a complete instructor made circuit and demonstrate the direction of current flow starting at source.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Electrical/electronic kit

Notebook

Pen or pencil

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Volt-Ohm meter

Hand held digital meter

Suggested Evaluation:

Students will be required to maintain an accuracy of at least 80% on a written instructor made quiz.

Trade: Electrical

Module Number: 7

Module Name: Current Electricity

Duty: D. Varying Rate of Flow (Potentiometer)

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Given the basic principles and theory of current flow, students will apply a potentiometer into their lab projects. Using their meters they will be required to take various current readings at different levels with an accuracy of plus or minus three percent.

Suggested Learning Activities:

1. Review basic circuitry.
2. Discuss the theory and application of a potentiometer.
3. Demonstrate and explain the proper installation of a potentiometer.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Safety glasses

Volt-Ohm meter

Suggested Tools and Equipment for the Students:

Electrical/electronic kit

Notebook

Pen or pencil

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Safety glasses

Volt-Ohm meter

Hand held digital meter

Suggested Evaluation:

Given lab projects using potentiometer, students will be required to take readings at various points using their meters with an accuracy of plus or minus 3%.

Trade: Electrical

Module Number: 7

Module Name: Current Electricity

Duty: E. Circuit Conductivity

Suggested Instructional Time for the Module: 6 Hours

Competency/Performance Objective:

Given a completed circuit, students will identify whether, if there are any shorts, components or conductors, and whether the circuit is properly grounded, according to assignment and applicable codes with an accuracy of no less than 100%.

Suggested Learning Activities:

1. Review basic circuitry.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Safety glasses

Volt-Ohm meter

Suggested Tools and Equipment for the Students:

Electrical/electronic kit

Notebook

Pen or pencil

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Safety glasses

Volt-Ohm meter

Digital hand held meter

Suggested Evaluation:

Given lab projects using potentiometer students will be required to take readings at various points using their meters and recording the data with an accuracy of no less than plus or minus 3%.

Trade: Electrical

Module Number: 8

Module Name: Basic Machine Work

Duty: A. Using a Grinding Wheel to Sharpen and Dress Tools

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Students will perform maintenance on drill bits and various tools that need sharpening and dressing to enable proper and safe use.

Suggested Learning Activities:

1. Arrange for students to be exposed to the operation of a bench grinder.
2. Demonstrate proper sharpening techniques.
3. Have students duplicate this process.
4. Perform tool dressing (screwdriver) and tool sharpening.
5. Have students dress and sharpen tools.

Suggested Resources for the Instructor:

Tool video

Suggested Tools and Equipment for the Students:

Bench grinder
Drill bits
Screwdriver

Suggested Evaluation:

Students will be able to drill holes with a bit that they sharpen, and use a screwdriver to set screws.

Trade: Electrical

Module Number: 8

Module Name: Basic Machine Work

Duty: B. Layout and Drilling Holes In Metal

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Students will be able to layout and drill a series of holes in a piece of metal with 100% accuracy.

Suggested Learning Activities:

1. Demonstrate proper use of a gauge to layout holes.
2. Have students use a gauge to layout holes.
3. Perform process of center punching the layout of holes.
4. Direct students to select the proper size drill.
5. Supervise the drilling of these holes.
6. Complete process by having students ream and counter bore.

Suggested Resources for the Instructor:

Electric drill
Drill bits
Gauge (measuring)
Center punch
Counter bore

Suggested Tools and Equipment for the Students:

Electric drill
Drill bits
Gauge (measuring)
Center punch
Counter bore

Suggested Evaluation:

Evaluate students through use of hands-on quiz, and observe work and layout to ensure accuracy at 100%.

Trade: **Electrical**

Module Number: **8**

Module Name: **Basic Machine Work**

Duty: **C. Use of Hand Taps and Pipe Dies**

Suggested Instructional Time for the Module: **8 Hours**

Competency/Performance Objective:

Students will properly prepare and install threads in metal or pipe, without error.

Suggested Learning Activities:

1. Demonstrate use of oiler.
2. Practice reaming pipe.
3. Demonstrate use of hand threader (pipe).
4. Perform tapping of metal with hand tap.
5. Exhibit different types of pipe threaders.

Suggested Resources for the Instructor:

Instructor based skills
Tool videos

Suggested Tools and Equipment for the Students:

Hand tap
Hand reamer
Pipe threader
Oiler

Suggested Evaluation:

Students will cut, thread pipe, and tap predrilled holes, with 100% accuracy.

Trade: **Electrical**

Module Number: **9**

Module Name: **Fundamentals of Electricity (AC/DC)**

Duty: **A. Reading Volts, Ohms, Amps in a Series Circuit**

Suggested Instructional Time for the Module: **12 Hours**

Competency/Performance Objective:

Given a lab project consisting of a simple series circuit, students will be required to take voltage, resistance, and current reading at various points by using their multimeter. Students will then record their findings. This task will require an accuracy of no less than 90%.

Suggested Learning Activities:

1. Review basic theory of series circuits.
2. Stress lab safety.
3. Demonstrate proper use of multimeters.
4. Describe proper record keeping of readings.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Student made lab project (SERIES CIRCUIT)
Safety glasses
Volt-Ohm meter

Suggested Tools and Equipment for the Students:

Electrical/electronic kit
Notebook
Pen or pencil
Safety glasses
Lab project
Volt-Ohm meter
Hand held digital meter

Suggested Evaluation:

Students will properly assemble a lab project consisting of a series circuit. Students will be required to record various voltage, resistance, and current readings with an accuracy of no less than 90%. On an instructor made quiz, students must maintain at least an 80% accuracy rate.

Trade: Electrical

Module Number: 9

Module Name: Fundamentals of Electricity (AC./DC)

Duty: B. Reading Volts, Ohms, and Amps in a Parallel Circuit

Suggested Instructional Time for the Module: 2 Hours

Competency/Performance Objective:

Given a lab project consisting of a simple parallel circuit, students will be required to take voltage, resistance, and current readings at various points and record the readings with an accuracy of no less than 90%.

Suggested Learning Activities:

1. Review the basic theory principle of a parallel circuit.
2. Stress lab safety.
3. Demonstrate proper use of multimeters.
4. Describe proper record keeping of readings.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Student made lab project (PARALLEL CIRCUIT)
Safety glasses
Volt-Ohm meter

Suggested Tools and Equipment for the Students:

Electrical/electronic kit
Notebook
Pen or pencil
Student made lab project
Safety glasses
Volt-Ohm meter
Hand held digital meter

Suggested Evaluation:

Students will properly assemble a lab project consisting of a parallel circuit, and will be required to record readings at various points. This task will require an accuracy of no less than 90%. Assign an instructor made quiz.

Trade: Electrical

Module Number: 10

Module Name: Climbing/Rigging Work

Duty: A. Ladder & Scaffolding Safety

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given both manufacturing and OSHA safety requirements pertaining to ladder and scaffolding safety, students will demonstrate safe use of ladders and scaffolding.

Suggested Learning Activities:

1. Review safety procedure.
2. Demonstrate and explain each component.
3. Demonstrate poorly maintained or improper use of ladders or scaffolding.
4. Explain proper handling and storage of ladders and scaffolding.
5. Describe the proper pitch, when installing ladders.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Hard hat
Ladders
Scaffolding w/sections
Video

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Hard hat
Ladders
Scaffolding w/sections

Suggested Evaluation:

Students will be given ladders and scaffolding with all sections, which they will be required to properly assemble according to OSHA and manufacturing requirements. This task must be performed without error.

Trade: Electrical

Module Number: 10

Module Name: Climbing/Rigging Work

Duty: B. Climbing on a Step Ladder

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given a step ladder, students will be required to properly fix a step ladder to a firm surface, extend and properly climb the ladder to its rated working height. This task will be done without error.

Suggested Learning Activities:

1. Stress proper safety practice.
2. Demonstrate proper installation of safety ladders.
3. Explain the importance of placing a ladder on a firm surface.
4. Demonstrate proper climbing procedures.
5. Review working height.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Step ladder

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Step ladder

Suggested Evaluation:

Students will be required to properly set-up and climb a stepladder to its rated height without error.

Trade: **Electrical**

Module Number: **10**

Module Name: **Climbing/Rigging Work**

Duty: **C. Raise/Climb Extension Ladder**

Suggested Instructional Time for the Module: **7 Hours**

Competency/Performance Objective:

Given an extension ladder, students will be required to properly fix the ladder to a firm surface, extend, secure and properly climb the ladder to its rated working height. This task will be done without error.

Suggested Learning Activities:

1. Stress proper safety practice.
2. Demonstrate proper installation of safety ladders.
3. Explain the importance of placing a ladder on a firm surface.
4. Demonstrate proper climbing procedures.
5. Review working height.
6. Review OSHA guide lines pertaining to extension ladders.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Extension ladder

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Extension ladder

Suggested Evaluation:

Students will be required to properly set-up and climb an extension ladder to its rated height without error. Assign an instructor made quiz.

Trade: Electrical

Module Number: 10

Module Name: Climbing/Rigging Work

Duty: D. Assemble/Climb Scaffolding

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given a complete section of scaffolding, students will be required to properly identify each component, assemble and climb scaffolding according to its rating and OSHA requirements. This task will be done without error.

Suggested Learning Activities:

1. Stress proper safety practice.
2. Demonstrate proper installation of scaffolding.
3. Explain the importance of placing a scaffolding on a firm surface.
4. Demonstrate proper climbing procedures.
5. Review working height.
6. Review OSHA guidelines pertaining to scaffolding ladders.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Scaffolding w/sections
OSHA manual
Hard hat
Safety tape/ribbon

Suggested Tools and Equipment for the Students:

OSHA manual
Notebook
Pen or pencil
Extension ladder

Suggested Evaluation:

In groups of two, students will be required to properly identify, secure, set-up and climb a section of scaffolding without error. Students will be given a quiz with twenty-five questions that must be answered with an accuracy rate of no less than 80%.

Trade: Electrical

Module Number: 10

Module Name: Climbing/Rigging Work

Duty: E. Wear Safety Harness (OSHA approved)

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given an approved (OSHA/A.N.S.I.) safety harness, students will be required to properly identify its components, and assemble and install it according to its rating, listing and OSHA requirements. This task will be done without error.

Suggested Learning Activities:

1. Stress proper safety practice.
2. Explain and describe each component.
3. Describe application.
4. Discuss limitation.
5. Review OSHA guidelines pertaining to safety harnesses.
6. Explain the importance of maintenance, servicing and proper storage of safety harnesses.
7. Prepare a detailed inspection and maintenance log.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
OSHA manual
Hard hat
Listed safety harness

Suggested Tools and Equipment for the Students:

OSHA manual
Notebook
Pen or pencil
Hard hat
Listed safety harness

Suggested Evaluation:

Students will properly identify, assemble and install a listed safety harness in a particular application. This time on task must be done without error. Assign an instructor made quiz that must be answered with an accuracy rate of no less than 80%.

Trade: Electrical

Module Number: 11

Module Name: Three Phase System

Duty: A. Balanced and Unbalanced Loads

Suggested Instructional Time for the Module: 20 Hours

Competency/Performance Objective:

Given the theory and principle of a three phase system, students will be required to calculate the balanced and unbalanced loads of a three phase system, according to the National Electrical Code.

Suggested Learning Activities:

1. Describe the theory of a three phase system.
2. Demonstrate and explain each component of a three phase system.
3. Compute and explain the proper procedure for calculating three phase system loads.
4. Review applicable codes.
5. Stress the importance of proper balancing.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Calculator

Three phase panel

Suggested Tools and Equipment for the Students:

Notebook

Pen or pencil

Calculator

Suggested Evaluation:

Students will be required to calculate both balanced and unbalance loads of a three phase system, while describing the importance of proper sizing conductors. These calculations will require an accuracy rate of no less than 80%. Assign homework using computations for sizing three phase system.

Trade: Electrical

Module Number: 11

Module Name: Three phase System

Duty: B. Open Neutral

Suggested Instructional Time for the Module: 20 Hours

Competency/Performance Objective:

Given the theory and principle of a three phase system, students will be required to describe and calculate what effect open neutral would have on a system and its equipment. Students will be required to apply all code articles pertaining to neutrals, and explain the importance of a properly grounded system.

Suggested Learning Activities:

1. Describe the theory of a three phase system.
2. Demonstrate and explain each component of a three phase system.
3. Compute and explain the proper procedure for calculating three- phase systems including the neutral.
4. Review applicable codes.
5. Stress the importance of proper balancing and grounding.
6. Discuss the procedures for identifying an open neutral.
7. Explain corrective measures.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.

Herman, S. (1995) Standard Textbook of Electricity, Albany, NY: Delmar Publishers.

Calculator

Three phase four wire panel

Suggested Tools and Equipment for the Students:

Notebook

Pen or pencil

Calculator

Three phase four wire panel

Suggested Evaluation:

Students will be required to explain the importance of a properly grounded system by applying the National Electrical code. Students will be asked to describe the effects of an open neutral on a system and its components, and will be expected to answer with an accuracy rate of no less than 80%.

Trade: **Electrical**

Module Number: **19**

Module Name: **Rigid/Intermediate Metallic Conduit (IMC)**

Duty: **D. Using a Power Bender**

Suggested Instructional Time for the Module: **7 Hours**

Competency/Performance Objective:

Students will set-up an electric power bender, safely following each step of the manufacturers instruction. Once the bender has been set up students will measure, mark and bend various projects, which are instructor made, using a standard ten foot piece of conduit.

Suggested Learning Activities:

1. Stress safety.
2. Discuss conduit bending using a power bender.
3. Explain step by step manufacturing instructions and guide lines.
4. Demonstrate both set up and disassembly of power bender.
5. Demonstrate step by step procedure of measuring, marking and bending conduit using a power bender.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Power bender
Various conduit

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Power bender
Various conduits (threaded)

Suggested Evaluation:

Students will be required to safely and properly set up a power bender, and bend various lab projects consisting of complete ten foot of conduit (threaded). Upon completion, students will be required to disassemble a power bender and properly store it according to the manufacturer's instruction. This task will require 100% accuracy rate.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: E. Using a Hand Threader

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given the task of threading conduit with a hand threader, students will safely follow each step of the manufacturer's instruction and the instructor's guide lines. Once the equipment has been set-up, students will measure, mark and thread various projects, which are instructor made, using a standard ten foot piece of conduit.

Suggested Learning Activities:

1. Stress safety.
2. Discuss the importance of proper set up.
3. Explain step by step manufacturing instructions and guide lines when threading conduit.
4. Demonstrate both set up and disassembly of threading equipment.
5. Demonstrate step by step procedure of measuring, marking and threading conduit using a hand threader.
6. Stress the importance of lubrication.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.	Hand threader/dies
Safety glasses	Reamer/file
Pipe vise	Oiler/oil
Various conduit	Wiping material

Suggested Tools and Equipment for the Students:

Notebook	Various conduit (threaded)
Pen or pencil	Reamer/file
Safety glasses	Wiping material
Pipe vise	Hand threader/dies

Suggested Evaluation:

Students will safely set up a hand threader, and properly thread various lab projects consisting of complete ten foot of conduit (threaded). Upon completion students will then be required to disassemble all equipment and properly store it according to the manufacturers instruction. This task will require 100% accuracy rate.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: F. Using a Power Threader

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given the task of threading conduit with an electric power threader, students will safely follow each set-up step of the manufacturer's instruction and the instructor's guide lines. Once the equipment has been set up students will measure, mark and thread various projects, which are instructor made, using a standard ten foot piece of conduit.

Suggested Learning Activities:

1. Stress safety.
2. Discuss the importance of proper set up.
3. Explain step by step manufacturing instructions and guide lines when threading conduit.
4. Demonstrate both set up and disassembly of threading equipment.
5. Demonstrate step by step procedures of measuring, marking and threading conduit using hand threader.
6. Stress the importance of lubrication.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.	Electric power threader/dies
Safety glasses	Reamer/file
Pipe vise	Oiler/oil
Various conduit	Wiping material

Suggested Tools and Equipment for the Students:

Notebook	Various conduit (threaded)
Pen or pencil	Reamer/file
Safety glasses	Wiping material
Pipe vise	Electric power threader/dies

Suggested Evaluation:

Students will safely and properly thread various lab projects using complete ten foot of conduit (threaded). Upon completion the students will then disassemble all equipment and properly store it according to the manufacturer's instruction. This task will require a 100% accuracy rate.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: G. Performing Knock Out ("K.O.") Punches by Hand or Power

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given the theory and practical applications of using both power and hand punches, students will safely and accurately measure, drill and punch out desired knock-out per instructor's guide lines, in their lab projects. Students will follow all manufacturer's and applicable instructions.

Suggested Learning Activities:

1. Stress safety.
2. Discuss the importance of proper set up.
3. Explain step by step manufacturing instructions and guide lines when using both hand and power tools.
4. Demonstrate both set up and disassembly of knock out tools.
5. Demonstrate step by step procedures measuring, marking, drilling and using knock out sets.
6. Stress the importance of lubrication.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Hand knock out set
Power knock out set
Sheet metal

Suggested Tools and Equipment for the Students:

Notebook	Hand knock out set
Pen or pencil	Power knock out set ½" - 4"
Safety glasses	Sheet metal

Suggested Evaluation:

Students will be required to safely and properly set up, mark, drill and use both hand and power knock out tools on various lab projects using sheet metal. Upon completion, students will disassemble all equipment and properly store it according to the manufacturer's instruction. This task will require an 80% accuracy rate.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: H. Pulling Wire (Hand and Power)

Suggested Instructional Time for the Module: 7 hours

Competency/Performance Objective:

Given the task of pulling wire through a conduit or raceway, students will apply the proper procedures of setting up and making up pulling grip on to snake, rope kellems basket or other pulling techniques. This task will also require the application of wiring pulling lubrications.

Suggested Learning Activities:

1. Stress safety.
2. Discuss the importance of proper set up.
3. Explain step by step manufacturing instructions and guide lines when using both hand and power tools.
4. Demonstrate both set up and disassembly of wiring pulling assemblies.
5. Demonstrate step by step procedures for applying lubrication according to the instructions given.
6. Stress the importance of lubrication.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.	Various conductors
Safety glasses	Listed tape
Pulling ropes	Snake
Power pulling equipment	Kellems grip
Various rated lubrications	MSDS Sheets

Suggested Tools and Equipment for the Students:

Notebook	Various conductors
Pen or pencil	Listed tape
Safety glasses	Snake
Pulling ropes	Kellems grip
Power Pulling equipment	

Suggested Evaluation:

Students will safely and properly set up and pull conductors through various threaded conduits. This task will require the proper stripping of conductors, application, set up, pulling and disassembly of all equipment associated with the pulling of conductors. This task will require a 90% accuracy rate. Assign homework.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: I. Installation of Fittings, Hangers, Channel/Angle Iron

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given the task of applying various fittings, hangers, and channels, students will identify, describe and list the fittings which would be applicable to use for a given job according to the manufacturer's listing and all applicable codes.

Suggested Learning Activities:

1. Stress safety.
2. Discuss applicable code articles and manufacturing instructions.
3. Explain manufacturing instructions and listing.
4. Demonstrate and explain each step of applying fittings, hangers, channels and angle irons.
5. Stress the importance of working free of hazards.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Current National Electrical Code
Hand & power tools
Various threaded fittings, hangers, channel/angle iron

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Current National Electric Code
Hand & power tools
Various threaded fittings hangers, etc.

Suggested Evaluation:

Students will safely and properly identify, describe, select and install various listed fittings, hangers and channels according to their listing and all applicable codes. This task will require an accuracy rate of no less than 100%.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: J. Working in Hazardous Locations

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Students will evaluate, identify, administer and describe the various divisions, classes, and groups pertaining to hazardous locations.

Suggested Learning Activities:

1. Review all applicable code articles pertaining to hazardous locations.
2. Discuss various wiring methods.
3. Demonstrate and explain application of the different types of fittings and enclosures.
4. Describe the step by step procedures of pouring fittings for a hazardous location.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.	Video
Safety glasses	Hand tools
Current National Electric Code	Pipe vise
Hazardous location fitting and enclosures	

Suggested Tools and Equipment for the Students:

Notebook	Hazardous location fittings and enclosures
Pen or pencil	Hand tools
Current National Electric Code	Pipe vise

Suggested Evaluation:

Students will answer twenty-five questions regarding hazardous locations. Students will also describe and apply their knowledge to the application of assembling various fittings in a hazardous location. This task will require a 100% accuracy rate.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: K. Installation in Damp Wet Areas

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given the task of implementing the proper installation of electrical equipment in a damp or wet location, students must identify, select and install the proper listed equipment and wiring method according to all applicable codes.

Suggested Learning Activities:

1. Stress safety.
2. Discuss the importance using listed equipment, fittings.
3. Explain step by step manufacturing instructions and guide lines when installing.
4. Demonstrate the installation of boxes and fittings in a damp or wet location.
5. Stress the importance of lubrication.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.	Hand tools
Safety glasses	Power tools
Current National Electric Code	Listed enclosures & fittings

Suggested Tools and Equipment for the Students:

Notebook	Hand tools
Pen or pencil	Power tools
Safety glasses	Various enclosures & fittings
Current National Electric Code	

Suggested Evaluation:

Students will identify, describe and install the proper equipment and using proper wiring methods in a damp or wet location according to all applicable codes. This task must be done error free. Assign homework.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: L. Installation of Fireproofing Material

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given the task of applying both the theory and practical application of using fire proofing material, students must understand the importance of fireproofing all unused openings in walls and floors. This task will require the gathering of information pertaining to listed fireproofing material and the proper installation of this material.

Suggested Learning Activities:

1. Stress safety.
2. Discuss the importance of fireproofing.
3. Explain step by step manufacturing instructions and guide lines when using and applying fireproofing.
4. Demonstrate each step of applying fireproofing.
5. Demonstrate step by step procedure of recording which areas were done (fireproofed).
6. Stress the importance of lubrication.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Current National Electric Code
Listed fireproofing material
BOCA Code Book

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Current National Electric Code
Listed fireproofing material
BOCA Code Book

Suggested Evaluation:

Students will safely and properly identify areas which are required to be fire rated, and apply a listed fireproofing material. This task must be done without error.

Trade: Electrical

Module Number: 20

Module Name: Rigid Non-Metallic Conduit

Duty: A. Calculate Rigid Non-Metallic Conduit Sizes to National Electric Code

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Students will demonstrate proper sizing of rigid non-metallic conduit to standards set forth by National Electric Code.

Suggested Learning Activities:

1. Calculate various conductors, using cross sectional area.
2. Calculate various rigid non-metallic conduits sizes to handle conductors.

Suggested Resources for the Instructor:

Rigid non-metallic conduits samples
Current National Electric Code
Blackboard
Video
Fire codes
Material specifications data sheets for rigid non-metallic conduits

Suggested Tools and Equipment for the Students:

Calculator
Notebook
Current National Electric Code

Suggested Evaluation:

Students will estimate proper rigid non-metallic conduit size for various conductors without error.

Trade: **Electrical**

Module Number: **15**

Module Name: **Troubleshooting/Meter Check**

Duty: **F. Lamp, Ballast & Lighting Fixture**

Suggested Instructional Time for the Module: **10 Hours**

Competency/Performance Objective:

Given various types of lamps, ballasts and lighting fixtures, students will identify, evaluate and test each component. This task will determine the status of each component by applying step by step testing procedures.

Suggested Learning Activities:

1. Stress safety.
2. Review meter reading procedures.
3. Demonstrate and explain the various types of lamps, ballasts and light fixtures.
4. Discuss the theory and principles of lamps.
5. Describe the function of each device.
6. Explain application and use.
7. Demonstrate the testing of lamps, ballasts and various lighting fixtures.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Multi-meter
Various lamps, ballasts and light fixtures

Suggested Tools and Equipment for the Students:

Hand held digital meter
Notebook
Pen or pencil
Safety glasses
Multi-meter
Various lamps, ballasts and light fixtures

Suggested Evaluation:

Given various types of lamps, ballasts and light fixtures, students will identify, describe and troubleshoot each component. They will do this with a 100% accuracy rate.

Trade: **Electrical**

Module Number: **16**

Module Name: **Residential Wiring Installation**

Duty: **A. Installation of Cable System**

Suggested Instructional Time for the Module: **2 Hours**

Competency/Performance Objective:

Students will size conductor and install to National Electrical Code requirements without error.

Suggested Learning Activities:

1. Calculate load requirements.
2. Size cable to National Electric Code specification.
3. Layout circuits and drill needed holes.
4. Pull cables.

Suggested Resources for the Instructor:

Current National Electric Code
Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Current National Electric Code
Drill
Hand tools

Suggested Evaluation:

Students will correctly size and install conductors to National Electric Code.

Trade: **Electrical**

Module Number: **16**

Module Name: **Residential Wiring Installation**

Duty: **B. Installation and Calculation of Boxes to National Electric Code**

Suggested Instructional Time for the Module: **24 Hours**

Competency/Performance Objective:

Student will calculate and install boxes to the National Electric Code, without error.

Suggested Learning Activities:

1. By using current National Electric Code, calculate box sizes.
2. Install boxes, per application, to National Electric Code.
3. Have students calculate for different applications.

Suggested Resources for the Instructor:

Current National Electric Code

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Boxes

Hand tools

Current National Electric Code

Suggested Evaluation:

Students will calculate and install boxes to proper National Electric Code articles.

Trade: Electrical

Module Number: 16

Module Name: Residential Wiring Installation

Duty: C. Installation of Trim Fixtures

Suggested Instructional Time for the Module: 16 Hours

Competency/Performance Objective:

Students will be able to determine appropriate fixtures and install without error.

Suggested Learning Activities:

1. Instruct students on fixture installation.
2. Have students practice installation of fixtures.
3. Demonstrate installation of fixture trims.
4. Supervise student installation of trims.

Suggested Resources for the Instructor:

Current National Electric Code Book

Fixture catalogs

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Hand tools

Notebook

Pen/pencil

Suggested Evaluation:

Have students demonstrate their proficiency in fixture installation by installing different lighting fixtures in the shop with 100% accuracy.

Trade: **Electrical**

Module Number: **16**

Module Name: **Residential Wiring Installation**

Duty: **D. Installation of Devices**

Suggested Instructional Time for the Module: **20 Hours**

Competency/Performance Objective:

Students will install appropriate devices according to the National Electrical Code without error.

Suggested Learning Activities:

1. Review termination techniques.
2. Install various devices.
3. Check for correct operation.

Suggested Resources for the Instructor:

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.
Get Wired (computer program) from Books That Work
Current National Electric Code

Suggested Tools and Equipment for the Students:

Notebook
Pen/pencil
Hand tools

Suggested Evaluation:

Have students consult National Electric Code for various devices (switches/outlets) check for correct operation and install to National Electric Code specifications to an accuracy of 100%.

Trade: Electrical

Module Number: 16

Module Name: Residential Wiring Installation

Duty: E. Installation of Ground Fault Circuit Interrupter (GFCI)

Suggested Instructional Time for the Module: 12 Hours

Competency/Performance Objective:

Students will be required to determine when and where GFCI protection will be required and will select the type of protection needed.

Suggested Learning Activities:

1. Review National Electric Code Articles on GFCI protection.
2. Build an electrical circuit with GFCI protection.
3. Study fault circuit.
4. Demonstrate effect of fault on GFCI.

Suggested Resources for the Instructor:

Holzman, H. (1996) Modern Residential Wiring, South Holland, IL: Goodheart Wilcox.
Current National Electric Code
Blackboard/chalk
Video

Suggested Tools and Equipment for the Students:

Video player
Hand tools
Notebook
GFCI receptacle
Wire
Boxes

Suggested Evaluation:

Assess students' ability to construct and operate a GFCI circuit by use of hands-on quiz with 100% accuracy.

Trade: Electrical

Module Number: 16

Module Name: Residential Wiring Installation

Duty: F. Installation of Swimming Pool/Spa

Suggested Instructional Time for the Module: 24 Hours

Competency/Performance Objective:

Students will know how to implement proper codes: National Electric Code, BOCA Codes and any local applicable codes, when wiring a swimming pool or spa without error.

Suggested Learning Activities:

1. Review all applicable codes regarding swimming pools and spas.
2. Have students conceptualize and discuss needed materials.
3. Wire a mock installation of a pool.
4. Wire a mock installation of a spa.

Suggested Resources for the Instructor:

BOCA Code
Current National Electric Code
Local codes
Local electrical inspector
Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.
Blackboard
Handouts

Suggested Tools and Equipment for the Students:

Notebook
Pen/pencil
Hand tools

Suggested Evaluation:

In writing have students layout the proper installation, list of materials, and if any, the cause and effects of not having GFCI protection.

Trade: **Electrical**

Module Number: **17**

Module Name: **Residential Appliance Installations**

Duty: **A. Installation of Electric Heat System**

Suggested Instructional Time for the Module: **20 Hours**

Competency/Performance Objective:

Students will analyze and calculate needed heat (watts), and the needed circuit size for various room sizes.

Suggested Learning Activities:

1. Analyze location (insulation, windows, etc.).
2. Calculate all factors to determine needed wattage for heat sources.
3. Evaluate locations for proper thermostat location.
4. Install electric heat and thermostat.
5. Wire and test.

Suggested Resources for the Instructor:

Sample heat loss sheets
Electric heat baseboard
Electric forced air heating trainer
Thermostat
Calculator

Suggested Tools and Equipment for the Students:

Hand tools
Notebook
Pen/pencil
Electric heat furnace control system
Electric heat furnace demonstration
Electric heat service trainer

Suggested Evaluation:

Have students construct a typical electric heat installation to all applicable codes with 95% accuracy.

Trade: **Electrical**

Module Number: **17**

Module Name: **Residential Appliance Installations**

Duty: **B. Installation of Gas Heat System**

Suggested Instructional Time for the Module: **20 Hours**

Competency/Performance Objective:

Students will use the proper controls and will wire a gas heating system without error, ensuring a safe installation.

Suggested Learning Activities:

1. Identify and specify unit purpose of the different controls.
2. Discuss the purpose of each control in the overall control system.
3. Devise a heating unit control system for students to complete.
4. Generate heating control faults (student to trouble shoot).

Suggested Resources for the Instructor:

BOCA National Electric Code
Blackboard
Overhead viewer

Suggested Tools and Equipment for the Students:

Hand tools
Volt Ohm meter
Gas control trainer
Gas fired forced air furnace
Gas head test kit
Gas burner demonstrator

Suggested Evaluation:

Have students wire, without error, a gas furnace so that it operates correctly with an accuracy of 100%.

Trade: **Electrical**

Module Number: **17**

Module Name: **Residential Appliance Installations**

Duty: **C. Installation of Oil Heat System**

Suggested Instructional Time for the Module: **20 Hours**

Competency/Performance Objective:

Students will identify controls and wire an oil heating system with error to ensure a safe installation.

Suggested Learning Activities:

1. Identify and describe each control and its specific purpose.
2. Devise a heating unit control system for students to complete.
3. Generate heating control faults (students will troubleshoot).

Suggested Resources for the Instructor:

BOCA National Electric Code
Blackboard
Overhead projector
Oil heat test kit
Oil burner demonstrator

Suggested Tools and Equipment for the Students:

Hand tools
Oil burner trainer and/or equal
Oil fire baseboard hot water with air condition trainer
Oil pump trainer
CAD cell trainer
Mobile oil burner demonstrator
Mobil duel fueled burner demonstrator

Suggested Evaluation:

Have students wire, without error, an oil furnace to operate correctly with an accuracy of 100%.

Trade: **Electrical**

Module Number: **17**

Module Name: **Residential Appliance Installation**

Duty: **D. Installation of Heating, Ventilating, Air Conditioning (HVAC)**

Suggested Instructional Time for the Module: **20 Hours**

Competency/Performance Objective:

Students will wire, without mistakes, appropriate feeder and control for HVAC operation.

Suggested Learning Activities:

1. Direct students to locate load requirements.
2. Calculate needed wire size.
3. Determine needed control conductors.
4. Employ proper grounding.
5. Wire for heat pump operation.

Suggested Resources for the Instructor:

Blackboard

Video

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Air conditioner heat pump trainer

Single phase compressor Trainer

Suggested Tools and Equipment for the Students:

Notebook

Volt Ohm meter

Hand tools

Heat pump control trainer

HVAC trainer

Suggested Evaluation:

Students will appropriately wire feeder and controls for an HVAC operation according to National Electric Code, with 100% accuracy.

Trade: Electrical

Module Number: 17

Module Name: Residential Appliance Installation

Duty: E. Installation of Common Appliances

Suggested Instructional Time for the Module: 20 hours

Competency/Performance Objective:

Students will be able to calculate loads and will wire common household appliances without error.

Suggested Learning Activities:

1. Review the applicable National Electric Code articles applying to household appliances.
2. Calculate for needed branch circuits.
3. Have students work in teams installing available appliances.

Suggested Resources for the Instructor:

Video
Current National Electric Code
Chalkboard
Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Miscellaneous residential appliances
Notebook
Hand tools
Current National Electric Code
Clamp AMP meter or recording volt-AMP meter

Suggested Evaluation:

Students will work in teams wiring and installing different equipment, alternating among the different household appliances until each student has accurately installed the appliances with 90% accuracy.

Trade: **Electrical**

Module Number: **18**

Module Name: **Electrical Metallic Tubing (EMT)**

Duty: **A. Calculation of Size of Tubing according to National Electric Code Requirements**

Suggested Instructional Time for the Module: **20 Hours**

Competency/Performance Objective:

Given ten problems for calculating the proper sizing of EMT according to the National Electric Code, students will show all code articles and mathematical computations.

Suggested Learning Activities:

1. Review the step by step procedures for the implementation of the National Electric Code.
2. Review the basic needed math skills.
3. Demonstrate various examples of sizing EMT on the chalkboard.

Suggested Resources for the Instructor:

Chalkboard w/chalk
Current National Electric Code
Calculator

Suggested Tools and Equipment for the Students:

Notebook
Pen or Pencil
Current National Electric Code
Calculator

Suggested Evaluation:

Students will calculate and describe each step, according to the National Electric Code when sizing EMT. Students will answer ten questions pertaining to proper sizing of EMT according to the National Electric Code with 80% accuracy..

Trade: **Electrical**

Module Number: **18**

Module Name: **Electrical Metallic Tubing (EMT)**

Duty: **B. Cutting and Reaming of EMT**

Suggested Instructional Time for the Module: **20 Hours**

Competency/Performance Objective:

Given a piece of EMT, students will measure, cut, and ream, resulting in an even measured clean cut piece of EMT, ready for installation.

Suggested Learning Activities:

1. Stress safety.
2. Explain the sequential procedure for measuring, cutting, and reaming EMT.
3. Review the various sizes of EMT according to the National Electric Code.

Suggested Resources for the Instructor:

Chalkboard w/chalk
Current National Electric Code
Safety glasses

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Current National Electrical Code
Pipe vise
Various sizes of EMT
Hacksaw
Tape measure

Suggested Evaluation:

Students will properly measure, cut and ream a piece of EMT to a given measurement, with at least a 90% accuracy rate.

Trade: Electrical

Module Number: 18

Module Name: Electrical Metallic Tubing (EMT)

Duty: C. Hand Bending

Suggested Instructional Time for the Module: 20 hours

Competency/Performance Objective:

Given a piece of EMT, students will measure, bend, cut and ream various projects consisting of box offsets, stub-ups, back to back bends, offsets and saddles. Students will then have an even measured, clean cut piece of EMT properly bent and ready for installation.

Suggested Learning Activities:

1. Stress safety.
2. Explain and demonstrate procedures for measuring, bending, cutting and reaming EMT.
3. Review the various sizes of EMT according to the National Electric Code.
4. Demonstrate and explain all the markings on the EMT bender.
5. Show bending video.

Suggested Resources for the Instructor:

Chalkboard
Current National Electrical Code
Bending video

Suggested Tools and Equipment for the Students:

Pen or pencil	Hacksaw
Notebook	½" to 1" EMT hand benders
Safety glasses	Measuring tape
Pipe vise	Green Lee 555 Speed Bender
Various sizes of EMT	

Suggested Evaluation:

Students will be able to properly measure, bend, cut and ream pieces of EMT according to measurements given, with an 80% accuracy rate.

Trade: **Electrical**

Module Number: **18**

Module Name: **Electrical Metallic Tubing (EMT)**

Duty: **D. Installation of Fittings**

Suggested Instructional Time for the Module: 20 Hours

Competency/Performance Objective:

Given various EMT fittings, students will identify, categorize and install them on conduit. This task will require the student to research applicable code and industry standards as to proper installation.

Suggested Learning Activities:

1. Stress safety.
2. Discuss and review applicable code and industry standards.
3. Describe rating and listing.
4. Demonstrate the installation of each and every fitting.
5. Discuss and describe various applications.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Current National Electrical Code
Safety glasses
Various EMT Fittings
Basic hand tools

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Current National Electric Code
Safety glasses
Various EMT Fittings
Basic hand tools

Suggested Evaluation:

Students will be given various conduit fittings of which they will identify, categorize, explain and properly install according to its rating and listing. Students will also follow all applicable code and industry standards when applying these fittings. This task will require a 100% accuracy rate.

Trade: **Electrical**

Module Number: **18**

Module Name: **Electrical Metallic Tubing (EMT)**

Duty: **E. Power Bender Use**

Suggested Instructional Time for the Module: **20 Hours**

Competency/Performance Objective:

Given an electric power bender, students will safely follow each set-up according to the manufacturers instruction. Once the bender has been set up, students will measure, mark and bend various projects, which will be instructor made, using a standard ten foot piece of EMT.

Suggested Learning Activities:

1. Stress safety.
2. Discuss EMT using a power bender.
3. Explain step by step manufacturing instructions.
4. Demonstrate both set up and disassembling of power bender.
5. Demonstrate step by step procedures of measuring, marking and bending EMT using a power bender.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Power bender

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Power bender

Suggested Evaluation:

Students will be required to safely set up a power bender and, properly bend various lab projects using a complete ten foot of conduit EMT. Upon completion students will then disassemble a power bender, and properly store it according to the manufacturer's instruction. This task will require a 100% accuracy rate.

Trade: Electrical

Module Number: 18

Module Name: Electrical Metallic Tubing (EMT)

Duty: F. Connections to Flexible Conduit/Metal Raceway

Suggested Instructional Time for the Module: 20 Hours

Competency/Performance Objective:

Given various listed fittings, students will be required to properly identify, describe and install these fittings for EMT to various other raceways.

Suggested Learning Activities:

1. Stress safety.
2. Discuss and review each and every code article.
3. Demonstrate and explain each and every fitting while describing its use.
4. Demonstrate the step by step procedure of applying these fittings.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
EMT
Various EMT/raceway fittings (change overs)

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
EMT
Various EMT/raceway fittings

Suggested Evaluation:

Students will describe application, rating, listing and proper installation of various EMT/raceway fittings according to the listing and applicable code requirements. Students will apply these fittings on instructor made lab projects, with no errors.

Trade: **Electrical**

Module Number: **18**

Module Name: **Electrical Metallic Tubing (EMT)**

Duty: **G. Installation of Supports/Clamps**

Suggested Instructional Time for the Module: 20 Hours

Competency/Performance Objective:

Given the various listed supporting clamps, straps, fittings, etc., students will properly identify, explain and install these supports, and clamps according to both its listing and manufacturer's instruction.

Suggested Learning Activities:

1. Stress safety.
2. Discuss listing of clamps and supports according to codes and standards.
3. Explain step by step manufacturing instructions of proper installation application.
4. Demonstrate the application of various supports and clamps.

Suggested Resources for the Instructor:

Chalk Board w/chalk etc.
Safety glasses
Video
Various clamps and supports
Basic hand tools

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Basic hand tools
Various clamps and supports

Suggested Evaluation:

Students will be required to identify and properly install various supports and clamps according to ratings listing and all applicable codes and/or standards. This task will require with 100% accuracy rate.

Trade: **Electrical**

Module Number: **19**

Module Name: **Rigid/Intermediate Metallic Conduit (IMC)**

Duty: **A. Calculation of Size According to National Electric Code**

Suggested Instructional Time for the Module: **7 Hours**

Competency/Performance Objective:

Given ten calculation problems for the proper sizing of rigid and IMC conduit according to the National Electrical Code, students will to show all code articles and mathematical computations.

Suggested Learning Activities:

1. Review the step by step procedures of implementation of the National Electrical Code.
2. Demonstrate basic math skills.
3. Demonstrate various examples of sizing conduit on chalk board, explaining step by step.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Current National Electric Code
Calculator

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Current National Electric Code

Suggested Evaluation:

Students will calculate and describe each step, according to the National Electrical Code, when sizing conduit (Rigid/IMC). Ten questions pertaining to proper sizing of EMT according to the National Electrical Code will be answered with an accuracy rate of 85%.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: B. Installation of Conduit

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given a piece of threaded rigid or IMC, students will make a visual inspection of the conduit to ensure that proper threading and reaming has been done according to the guide lines set forth by the instructor. Students will then apply the proper listed locknut and fittings according to all applicable codes and the manufacturing instruction.

Suggested Learning Activities:

1. Review the step by step procedures of implementation of the National Electrical Code.
2. Discuss and explain manufacturing procedures pertaining to the installation of fittings.
3. Demonstrate while stressing safety, each step of using the proper hand tools when applying and installing threaded conduit.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.	Various conduit (Rigid/IMC)
Current National Electrical Code	Hand tools
Safety glasses	Various Fittings & supports
Pipe Vise	

Suggested Tools and Equipment for the Students:

Notebook	Pipe vise
Pen or pencil	Various conduit (Rigid/IMC)
Current National Electrical Code	Hand tools
Safety glasses	Various fittings & supports

Suggested Evaluation:

Students will be required to properly and safely apply their knowledge of supports and conduit installation to an instructor made lab project. This will require an accuracy rate of no less than 100%. Assign homework.

Trade: Electrical

Module Number: 19

Module Name: Rigid/Intermediate Metallic Conduit (IMC)

Duty: C. Hand Bending

Suggested Instructional Time for the Module: 7 Hours

Competency/Performance Objective:

Given a piece of conduit (Rigid/IMC), students will measure, bend, cut and ream. Students will be given various projects consisting of box offsets, stub-up, back to back bends, offsets, and saddles. This task will result in an even measured clean cut piece of properly bent conduit, ready for installation.

Suggested Learning Activities:

1. Demonstrate how to bend a stub to a given measurement.
2. Demonstrate how to bend an offset to a given measurement.
3. Demonstrate how to bend a saddle to a given measurement.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.	Hacksaw
Current National Electrical Code	25' tape measure
Safety glasses	Rigid hand bender
Pipe vise	Bending guide video
Various sizes of conduit (threaded)	

Suggested Tools and Equipment for the Students:

Notebook	Various conduit (EMT)
Pen or pencil	Hacksaw
Current National Electrical Code	25' tape measure
Safety glasses	Rigid hand bender

Suggested Evaluation:

Students will be required to properly measure, bend, cut and ream pieces of threaded conduit according to measurements given by the instructor. This will require at least an 80% accuracy rate.

Trade: Electrical

Module Number: 12

Module Name: Non-Metallic Sheathed Wire & Boxes

Duty: A. Identify Types and Sizes of Wire and Boxes According to National Electric Code

Suggested Instructional Time for the Module: 10 Hours

Competency/Performance Objective:

Students will, upon receiving load requirement, select proper wire conductor size and remove insulation for splice or termination.

Suggested Learning Activities:

1. Identify various conductors, as to the A.W.G. sizes, and various types of insulation.
2. Demonstrate proper stripping techniques.
3. Perform proper splicing with approved connectors.

Suggested Resources for the Instructor:

Current National Electrical Code book
Trade catalogs (showing various conductors)
Video

Suggested Tools and Equipment for the Students:

Strippers
Wirenuts
Pliers
A.W.G. gauge
Current National Electric Code book

Suggested Evaluation:

Students will size and prepare conductor for approved use.

Trade: Electrical

Module Number: 12

Module Name: Non-Metallic Sheathed Wire and Boxes

Duty: B. Proper Termination and Box Selection

Suggested Instructional Time for the Module: 10 Hours

Competency/Performance Objective:

Students will select the proper box and termination to the standards set forth in the National Electric Code, with 100% accuracy.

Suggested Learning Activities:

1. Students will work in Art. 370 with conductor fill and box deducts.
2. Calculate proper box size to National Electric Code specifications.
3. Students will lay out conductor and box sizing.
4. Ensure National Electric Code specifications are followed.
5. Explain box deductions, grounds, clamps, studs, and hickeyes.

Suggested Resources for the Instructor:

Chalkboard w/chalk
Current National Electric Code
Various boxes
Various conductors

Suggested Tools and Equipment for the Students:

Notebook
A.W.G. gauge
Calculator

Suggested Evaluation:

Students will perform conductor calculations and box fill with 100% accuracy.

Trade: **Electrical**

Module Number: **12**

Module Name: **Non-Metallic Sheathed Wire and Boxes**

Duty: **C. Install Fittings and Devices**

Suggested Instructional Time for the Module: **10 Hours**

Competency/Performance Objective:

Students will demonstrate installation of fittings and devices to the standards of the National Electric Code.

Suggested Learning Activities:

1. Have students construct multipliable workable, project using various fittings and devices.

Suggested Resources for the Instructor:

Current National Electric Code

Kubala, T. (1996) Electricity 1, (6th Ed.), Albany, NY: Delmar Publishers.

Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.

Suggested Tools and Equipment for the Students:

Textbook. (see above)

Current National Electric Code

Pen or pencil

Notebook

Hand tools

Suggested Evaluation:

Students will complete their projects, meeting National Electric Code wiring standards within 90% accuracy.

Trade: Electrical

Module Number: 12

Module Name: Non-Metallic Sheathed Wire and Boxes

Duty: D. Grounding

Suggested Instructional Time for the Module: 10 Hours

Competency/Performance Objective:

Students will lay out and fabricate project to proper sizing (conductor & box). They will connect grounding conductors with 100% accuracy.

Suggested Learning Activities:

1. Demonstrate proper grounding.
2. Discuss At 250 (National Electric Code).
3. Practice connecting grounding conductors.

Suggested Resources for the Instructor:

Current National Electric Code
Mullin, R. (1996) Electrical Wiring-Residential, (12th Ed.), Albany, NY: Delmar Publishers.
Chalkboard w/chalk
Overhead projector
Transparencies

Suggested Tools and Equipment for the Students:

Hand tools
Current National Electric Code
Wire
Boxes

Suggested Evaluation:

Students will develop a project that conforms to the requirements of Art. 250 with 100% accuracy.

Trade: Electrical

Module Number: 13

Module Name: Metal Clad Cable

Duty: A. Selection and Covering Removal

Suggested Instructional Time for the Module: 12 Hours

Competency/Performance Objective:

Given an application, student will select, cut, and terminate cable in an approved manner to specifications set forth in the National Electric Code.

Suggested Learning Activities:

1. Calculate needed size of conductor.
2. Demonstrate proper cutting of the outer covering.
3. Practice this cutting operation.
4. Complete operation by installing the insulator bushing.
5. Have students practice the operation.

Suggested Resources for the Instructor:

Holtzman, H. (1996) Modern Residential Wiring, South Holland, IL: Goodheart Wilcox.
Chalkboard w/chalk
Overhead projector

Suggested Tools and Equipment for the Students:

Hand tools
Hacksaw
Holtzman, H. (1996) Modern Residential Wiring, South Holland, IL: Goodheart Wilcox.
Notebook
Pen or pencil

Suggested Evaluation:

Student will cut and terminate metal clad cable according to the National Electric Code, with accuracy rate of 100%.

Trade: Electrical

Module Number: 14

Module Name: Use of Special Meter/Tester

Duty: A. Use of Volt-Ohm Meter

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Given a volt ohmmeter students will be required to take voltage and resistance readings at various points on a completed lab project.

Suggested Learning Activities:

1. Review safety procedures.
2. Discuss meter reading theory.
3. Demonstrate and describe each procedure of applying a Volt-Ohm meter.
4. Describe meter reading record keeping.
5. Explain and discuss the importance of properly storing the Volt-Ohm meter.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Volt-Ohm meter
Student-made completed project

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Volt-Ohm meter
Hand held digital meter

Suggested Evaluation:

Students will complete a lab project on which they will then take readings with a Volt-Ohm meter. They will take readings and record voltage and resistance at various points. They will do this with an accuracy rate of no less than 80%.

Trade: Electrical

Module Number: 14

Module Name: Use of Special Meter/Tester

Duty: B. Use of a Clamp on Ammeter

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Given an ammeter, students will be required to take current readings at various points on a completed lab project.

Suggested Learning Activities:

1. Review safety procedures.
2. Discuss meter reading theory, both digital and analog.
3. Demonstrate and describe the proper use and care of a clamp on ammeter.
4. Describe meter reading record keeping.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Clamp on ammeter
Energized circuit

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Clamp on ammeter
Energized lab project

Suggested Evaluation:

Students will complete a lab project on which they will use a clamp on an ammeter. They will take readings and record them at various points. They will do this with an accuracy rate of no less than 80%.

Trade: Electrical

Module Number: 14

Module Name: Use of Special Meter/Tester

Duty: C. Use of a Circuit Tracer

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Given a circuit tracer students will be required to properly assemble and use a circuit tracer to identify unknown conductors. Once the conductors and circuits are identified students then be able to properly mark the conductor and circuits with wire markers.

Suggested Learning Activities:

1. Review safety procedures.
2. Demonstrate and explain step by step each procedure of assembling, using a circuit tracer.
3. Demonstrate and describe the proper use and care of a circuit tracer.
4. Demonstrate the proper marking of conductors, by using wire markers.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Circuit tracer
Energized circuit

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Circuit tracer
Energized lab project
Homework

Suggested Evaluation:

Students will be required to properly assemble and use a circuit tracer to identify various unknown circuits and conductors. Students will be required to properly install wire markers on the conductors with an accuracy rate of no less than 100%. Assign homework.

Trade: Electrical

Module Number: 14

Module Name: Use of Special Meter/Tester

Duty: D. Ground Fault Circuit Interrupter

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Given a ground fault circuit interrupter, students will be able to perform the step by step procedure of inserting and testing an energized circuit with the use of a ground fault tester.

Suggested Learning Activities:

1. Review safety procedures.
2. Explain the importance of testing a circuit for faults.
3. Demonstrate and explain each procedure., for using a GFCI tester.
4. Demonstrate and describe the proper care of a circuit tracer.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
GFCI tester
Energized circuit

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
GFCI tester
Energized lab project

Suggested Evaluation:

Students will be required to properly and safely install and test an energized circuit with a ground fault circuit tester. They will do this with an accuracy rate of no less than 100%. Assign homework.

Trade: Electrical

Module Number: 14

Module Name: Use of Special Meter/Tester

Duty: E. Use of a Megohmmeter (MEGGER)

Suggested Instructional Time for the Module: 8 Hours

Competency/Performance Objective:

Given a megger, students will properly install the test leads to a de-energized circuit. Once the circuit has been determined by the instructor to be de-energized, the student then will measure the resistance of the insulation on a circuit conductor or the windings on a motor. They then will record their findings and compare them to the National Electrical Code.

Suggested Learning Activities:

1. Review safety procedures.
2. Review the basic theory of resistance.
3. Explain the importance of testing a circuit or conductor for faults by using a megger.
4. Demonstrate and explain step by step each procedure, for using a megger.
5. Demonstrate and describe the proper care of a Megohmmeter.
6. Record findings.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Megohmmeter
Deenergized circuit

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
GFCI tester
Energized lab project

Suggested Evaluation:

Students will be required to properly and safely install and test a de-energized circuit with a Megohmmeter. They will be required to record their findings and compare them to the National Electrical Code. They will do this with an accuracy rate of no less than 90% Assign homework.

Trade: **Electrical**

Module Number: **15**

Module Name: **Troubleshooting/Meter check**

Duty: **A. Feeders and Branch Circuits**

Suggested Instructional Time for the Module: **10 Hours**

Competency/Performance Objective:

Students will be required to safely identify, and properly install their test equipment on both feeders and branch circuits, to determine the status of the system, with the use of a multi-meter.

Suggested Learning Activities:

1. Stress safety.
2. Identify system and those components that make-up a system.
3. Demonstrate proper installation and use of test equipment.
4. Discuss proper procedures of taking and recording various readings.

Suggested Resources for the Instructor:

Chalkboard w/chalk
Safety glasses
Multi-meter
Circuits containing feeders and branch circuits

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Multi-meter
Hand held digital meter

Suggested Evaluation:

Students will be required to properly identify the difference between feeders and branch circuits, before applying a multi-meter to determine the status of a system. Once they have identified the particular system they will then apply the step by step procedure of taking and recording various readings. This task will be mastered error free.

Trade: **Electrical**

Module Number: **15**

Module Name: **Troubleshooting/Meter Check**

Duty: **B. Fuses/Record Results of Overcurrent Protective Devices**

Suggested Instructional Time for the Module: **10 Hours**

Competency/Performance Objective:

Students will be able to apply a multi-meter using the appropriate scales to test fuses and overcurrent devices and to determine the status of the fuses. This procedure will be performed on an energized circuit of which all safety procedures shall be followed!

Suggested Learning Activities:

1. Stress safety.
2. Review meter-reading procedures.
3. Demonstrate and explain the various types of fuses and overcurrent protection devices.
4. Discuss the theory and principles of fuses and overcurrent protection devices.
5. Demonstrate the testing of fuses and overcurrent protection devices.

Suggested Resources for the Instructor:

Chalkboard w/chalk etc.
Safety glasses
Multi-meter
Various fuses
Energized circuit

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Multi-meter
Energized circuit
Hand held digital meter

Suggested Evaluation:

Students will be required to comply with all shop and safety rules while performing the testing of fuses and overcurrent devices on energized circuits. This task must be mastered without error.

Trade: Electrical

Module Number: 15

Module Name Troubleshooting/Meter Check

Duty: C. Opens, Shorts, and Grounds

Suggested Instructional Time for the Module: 10 Hours

Competency/Performance Objective:

Given a multi-meter with appropriate scales, students will properly perform testing procedures on a circuit to determine if the circuit contains any opens, shorts, or grounds. This task will be performed on an energized circuit of which all safety procedures must be followed.

Suggested Learning Activities:

1. Stress safety.
2. Review meter-reading procedures.
3. Demonstrate and explain the various types of opens, shorts, and grounds which may exist in a circuit or system.
4. Explain the importance of locating and clearing these problem areas.

Suggested Resources for the Instructor:

Chalkboard w/chalk etc.
Safety glasses
Multi-meter
Completed circuit

Suggested Tools and Equipment for the Students:

Notebook
Pen or pencil
Safety glasses
Multi-meter
Completed circuit
Hand held digital meter

Suggested Evaluation:

Students will be required to comply with all shop and safety rules while performing the testing procedure. Students will first inspect the circuit for tell tale signs. After this has been accomplished they will perform the step by step procedure of testing for opens, shorts, or grounds. This task must be completed without error.

Trade: Electrical

Module Number: 15

Module Name: Troubleshooting/Meter Check

Duty: D. Relays, Switches, & Control Devices

Suggested Instructional Time for the Module: 10 Hours

Competency/Performance Objective:

Given a multi-meter, students will apply the theory of troubleshooting to relays, switches, and controls. They will identify each component, define their ratings and characteristics. They will then describe their use and apply step by step procedures of testing these devices.

Suggested Learning Activities:

1. Stress safety.
2. Review meter reading procedures.
3. Demonstrate and explain the various types of relays, switches, and control devices.
4. Discuss the theory and principles of various relays, switches, and control devices.
5. Demonstrate step by step procedures of troubleshooting the above devices.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Multi-meter
Various switches, relays, control devices

Suggested Tools and Equipment for the Students:

Electrical/electronic kit
Notebook
Pen or pencil
Safety glasses
Multi-meter
Switches, relays, and control devices
Hand held digital meter

Suggested Evaluation:

Students will be required to comply with all shop and safety rules while performing the testing of switches, relays, and control devices. This evaluation will determine if any of these devices are malfunctioning. This task must be done without error.

Trade: Electrical

Module Number: 15

Module Name: Troubleshooting/Meter Check

Duty: E. Motors, Transformers, Coils

Suggested Instructional Time for the Module: 10 Hours

Competency/Performance Objective:

Given test equipment, students will perform troubleshooting techniques on motors, transformers, and coils. Students will be required to record their findings.

Suggested Learning Activities:

1. Stress safety.
2. Review meter reading procedures.
3. Demonstrate and explain the various types of motors, transformers, coils and describe their usage.
4. Discuss the basic theory and principles of motors 1, 3 phase, transformers, coils.
5. Demonstrate the testing of the above equipment.

Suggested Resources for the Instructor:

Chalk board w/chalk etc.
Safety glasses
Multi-meter
Various motors, transformers, and coils

Suggested Tools and Equipment for the Students:

Electrical/electronic kit
Notebook
Pen or pencil
Safety glasses
Multi-meter
Various motors, transformers, and coils
Hand held digital meter

Suggested Evaluation:

Students will comply with all shop and safety rules while applying their knowledge of motors, and transformers as they troubleshoot a lab project. This task will require a 90% accuracy rate.

Lewis Clark Career Center

2005 - 2006 Placement Summary

Weiman, Robb

Total Students:	11	
Total Placed:	10	91%
Total Placed Related:	5	45%
Positive MSIP Placement:	8	73%

Employed Related:	4	36%
Employed Not Related:	2	18%
Military Related:	1	9%
Military Not Related:	1	9%
Continuing Education Related:	0	0%
Continuing Education Not Related:	2	18%
Not Available:	0	0%
Not Placed:	1	9%
Status Unknown (Not Found):	0	0%

Guide to Developing a Written Evaluation Plan for Vocational Education Programs

The purpose of this *Guide* is to provide an outline of the components necessary in a written evaluation plan. Evaluation of vocational education programs provides a basis for identifying the strengths and concerns for the various programs and the overall vocational education curriculum. This then leads to the development of objectives and action plans resulting in program improvement. While this *Guide* provides an outline for a written evaluation plan, it is not intended to provide information on how to design and conduct program evaluations.

A plan for the evaluation of vocational education programs should include the following components:

1. The specific goals of the evaluation process.

While program improvement is always the goal of the evaluation process, a more specific goal should be set based on the type of evaluation conducted. The goal of the evaluation could be either (A) a general analysis of the vocational education program performance measures and standards or (B) a goal with a more specific focus on objectives and action plans previously established through the evaluation process.

A. Conducting a General Analysis

A general analysis of vocational education programs will provide a baseline of information from which critical issues or areas for improvement can be identified. This general analysis should use program specific standards or checklists and established performance measures for the program and/or vocational education as a basis for the evaluation process. A general analysis of programs should be conducted at least every five years or when major changes to a program have occurred.

B. Conducting an Evaluation Based on Specific Objectives

A more specific goal for program evaluation would be to determine the achievement of an objective and the effectiveness of action plans developed as a result of a previous program evaluation. This type of goal is appropriate with annual evaluations of program improvement objectives. The basis for this type of evaluation is the vocational improvement plan. The measurable objectives and evaluation procedures established for the vocational improvement plan serve as the goals and procedures for the evaluation. This information can be found on the vocational program improvement plan form, a sample of which is included. Performance standards for vocational education should also be part of the annual evaluation process.

2. A description of the evaluation process.

The description will include the procedure for gathering, analyzing and reporting data generated through the evaluation process. Included in this section should be:

- A description of the specific program components, goals, performance measures, or improvement objectives to be evaluated
- Timelines for gathering and reporting data
- Assignment of responsibilities for the evaluation process
- Dissemination plan for the evaluation report

3. A list of data sources which will be used in the evaluation process.

Data sources which address the evaluation goals must be identified as part of the evaluation plan. These data sources could include, among others, :

- Missouri School Improvement Program reports
- Program specific standards and checklists
- The district's Comprehensive School Improvement Plan
- The district's public report data
- Performance measures for vocational education programs
- Follow-up data on students enrolled in vocational programs
- Labor market and community needs assessments
- Student interest surveys
- Surveys of employers of graduates of vocational programs
- Advisory committee review of programs and recommendations
- Student satisfaction surveys
- Information from administrative/board reviews or evaluation

4. A description of the process for program improvement

This section should include how the information included in the evaluation report will be used in planning for program improvement. Improvement plans must be tied to program standards, vocational education performance indicators, and/or standards for the Missouri School Improvement Program. Improvement plans should include measurable objectives and action plans which address the program improvement issues. The enclosed Vocational Program Improvement Plan form should be used to develop the plans.

Information for this section could include:

- How objectives for improvement will be prioritized and selected
- How the action plans to accomplish the objectives will be determined
- The relationship of the vocational program evaluation process to the building or district level Comprehensive School Improvement Plan.
- How the implementation of the objectives and action plans will be monitored

VOCATIONAL PROGRAM IMPROVEMENT PLAN

Objective # _____

Measurable objective: _____

How objective will be measured: _____

Standard/ Indicator	Action to be taken	Needed Resources	Person Responsible	Start Date	Complete Date

SAMPLE EVALUATION PLAN

General Analysis - 5 year

Vocational Education Evaluation Plan Mytown High School Vocational Education Program

Goal: To identify needed improvements to the Vocational Education program.

Description of evaluation process: The evaluation will be conducted by the Vocational Education teacher with help from the program advisory committee. Data will be gathered related to the program standards and performance standards established for vocational education in the Missouri School Improvement Program. Once data have been gathered, a report will be written which describes the program's standing against these standards and performance measures. The report will be shared with advisory committee members, the principal and other administrators, and other vocational teachers. A timeline for conducting the evaluation is included below.

Evaluation Timeline

	Start	Complete
Review previous MSIP self study and report.	Oct. 1	Oct. 15
Complete program standards profile checklist.	Oct. 15	Oct. 20
Complete MSIP performance standards chart for vocational education.	Oct. 20	Nov. 10
Prepare written report on program and performance standards.	Nov. 10	Jan. 15
Distribute written report to administrator and advisory committee.	Jan. 15	Jan. 20
Prepare advisory committee recommendations.	Jan. 20	Jan. 30
Prepare improvement plan based on recommendations.	Jan. 30	Feb. 15
Present recommendations and improvement plan to administration/board	Feb. 15	Mar. 1
Implement improvement plan and design evaluation process.	Mar. 1	Jun. 30

List of Data Sources:

1997 MSIP Mytown District MSIP Self-Study Report
DESE Report to the District, MSIP 1997
Vocational Program Standards, DESE
Mytown District Annual Performance Report, 1998 and 1999.

Program enrollment and placement data from teacher files

Sample - 5 year analysis

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Program Improvement Process: The Vocational Education Advisory Committee will meet to review the evaluation report. The committee will be asked to prioritize the top three areas for program improvement efforts, and to make specific recommendations on actions which should be taken to improve those areas. The teacher will prepare an improvement plan based on these recommendations. This improvement plan will contain measurable objectives, action plans, and the relationship of each objective to the Mytown District Comprehensive School Improvement Plan. This improvement plan will be submitted to the principal for approval and prepared as a written report and presentation for the Board of Education's evaluation of district programs. This improvement plan will be the basis for the program evaluation improvement plan developed the following year.

SAMPLE

ANNUAL EVALUATION PLAN FOR VOCATIONAL PROGRAMS Mytown Area Vocational Technical Institute

Each vocational program area will annually conduct an evaluation to gather performance information and to determine its success in achieving the objectives of the program improvement plan. A written report will be submitted to the Director prior to July 1. This report will include the findings of the evaluation, recommendations for improvement, and a plan to achieve those improvements.

The Director will prepare a summary of the evaluation reports and an overall school improvement plan based on the program area information. This plan will be integrated with the district's Comprehensive School Improvement Plan when appropriate.

Each vocational program area evaluation will use the following data sources:
enrollment information
completer and placement data
home high school graduation data
appropriate MAP scores
other data sources specifically related to the annual improvement plan objectives

Where possible, advisory committees will be used as part of the evaluation and program improvement process.

May 1	Program leaders assemble data, begin report writing.
July 1	Program Evaluation Reports to Director
Aug 1	Summary report to Superintendent, Board of Education
Sep 1	Program improvement plans approved by director, shared with CSIP committee.

**Missouri School Improvement Program (MSIP)
Third Cycle Documentation File Requirements
Vocational Education Standard 7.3**

- ☒ Curriculum guides for all vocational programs and courses that include as a minimum the following components:
 - Rationale
 - Course description
 - Graduate goals
 - Measurable learner objectives
 - Instructional strategies and activities
 - Assessments, including performance based assessments.
 - Alignment to Show-Me Standards
 - Board approval
- ☒ Student-based assessments (minimum of one)
 - Interest surveys
 - Guidance needs assessments
- ☒ Community-based assessments (minimum of one)
 - Labor market survey
 - Chamber of Commerce survey
 - MOICC supply and demand data
 - Vocational advisory committee input
 - Local Workforce Investment Board (WIB) data
- ☒ Number of students enrolled in each vocational program or course (both AVS and district)
- ☒ Instructional Management System (IMS) for student competency mastery (VIMS/VAMS, competency profile cards, other computerized system, etc.)
- ☒ Membership rosters for all Career and Technical Student Organizations (CTSOs)
- ☒ Current program of work for all CTSOs. The program of work must include but not be limited to the following components:
 - Leadership skills
 - Occupational competency
 - Community service
 - School service
- ☒ List or description of student experiences and activities for off-campus education programs which might include experiential education, cooperative education, internships, apprenticeships, job shadowing, job placement services, etc.
- ☒ Copies of all articulation agreements and/or dual credit agreements with postsecondary institutions for all vocational programs or courses.
- ☒ Written plan to evaluate the effectiveness of all vocational programs and/or courses. The plan must include the following components:
 - Measurable objectives
 - Established performance measures for each measurable objective
 - Level of performance for each measure
 - Established procedure for gathering, analyzing and reporting data relevant to each measure of performance

- Established procedure for reporting outcomes and corrective action for all measurable objectives
- ☒ Advisory committee minutes documenting review of improvement plans.
- ☒ Copy of District CSIP, which indicates vocational education improvements.