70-2300-C

Performance Indicators for Building Maintenance:

A Bridge to Selected Instructional Materials

• National Skill Standards • Missouri Competencies
• All Aspects of the Industry Objectives • Pre- Employment/Work Maturity Skills
• SCANS Competencies • Show-Me Standards

Instructional Materials Laboratory
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INTRODUCTION

This curriculum project includes two components. The first is an updated Building Maintenance competency profile and this performance indicator "bridge" document. The updated profile contains those skills needed in the field as identified and validated by industry personnel. Also, an asterisk (*) identifies those specific skills that are "core" or "essential," which should be interpreted as "those skills industry identifies as required for the first day on the job." Task IDs for VAMS (Missouri's Vocational Administrative Management System) are shown in brackets.

The Performance Indicator Chart connects technical building maintenance skills with leading national organizations (on pages 16-47) and other important, but more general skills needed by students. This document provides instructors and administrators with links between newly updated building maintenance competencies and (1) previous Missouri competencies, (2) Associated Builders and Contractors standards, (3) Associated General Contractors standards, (4) Electrical Construction Worker standards, (5) All Aspects of the Industry objectives, (6) Pre-Employment/Work Maturity Skills, (7) SCANS competencies (addressed in National VICA's Total Quality Curriculum), and (8) Missouri Show-Me Standards. These set of skills are listed after the performance indicator chart.

To use the Building Maintenance Performance Indicator Chart, consider the following example. Duty bands (umbrella-like categories for competencies) are in **bold** type and shaded.

	Page 16 ↘	Page 23 ↘	Page 32 ↘	Page 40 ↘	Page 43 ↘	Page 44 ↘	Page 45 ↘	
Missouri Competency	Previous Mo. Competencies	ABC	AGC	Electrical Standards	AAOI Objectives	Pre-Employment/ Work Maturity Skills	SCANS Competencies	Knowledge (Content)	Performance (Goals)
B. Performing Exterior Carpentry Procedures									
9. Replace/repair roof flashing [B10]	B10	AA-3	(RC) CII 14, 15, 16, 20		D-1, 2	F4	5 B	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6

The second column (Previous Mo. Competencies) is helpful for anyone with curriculum tied to the previous Missouri competency list. Competency B9 is a revised competency, as indicated by the competency listed in the second column. Competency B9 is also related to ABC competency AA-3, AGC's Fundamentals of Residential Carpentry, competency CII 14, 15, 16, 20; and so on. Shown in the last two columns are related Show-Me Standards, the academic skills in Missouri K-12 public classrooms.
This document is not inclusive and should be used as a model for more in-depth articulation with national skills standards, and Missouri Show-Me Standards. Local advisory council input should be solicited and use to validate the competencies/core competencies required in any given geographic location.

For more detail, obtain or contact the following resources.

- *Wheels of Learning Standardized Craft Training*. Rosslyn, VA: National Center for Construction Education and Research (formerly Construction Education Foundation), 1993-1995. * Contact: National Center for Construction Education and Research, ATTN: Craft Training, 1300 N. 17th St., Rosslyn, VA 22209, 703/812-2000. (home page: http://www.abc.org/nccerh.html)
- *Fundamentals of Carpentry, 1993. Residential Carpentry, 1993. Introduction to Bricklaying, 1994. Introduction to Electricity, 1994. Introduction to Heating, Ventilation and Air Conditioning (HVAC), 1994. Introduction to Plumbing,* 1994. Stillwater, OK: Curriculum and Instructional Materials Center; Washington, DC: Associated General Contractors, 1993.* Contact: AGC Publications Division, 1957 E. St., NW, Washington, DC 20006, 202/393-2040. (home page: http://www.agc.org/)
- *Electrical Construction Occupations Handbook Volume One*. Bethesda, MD: U.S. Electrical Construction Industry Skill Standards and Certification Project, 1995. Contact: U.S. Electrical Construction Industry Skill Standards and Certification Project, 3 Bethesda Metro Center, Suite 1100, Bethesda, MD, 20814-5372, 301/215-4512. (Home page: http://www.necanet.org)
- Building Maintenance competency profile (70-2300-C). Contact: Instructional Materials Laboratory, 2613 Industrial Drive, Columbia, MO 65211, 800/669-2465, FAX 573/882=1992. (home page: http://www.iml.coe.missouri.edu)
- *Pre-Employment/Work-Maturity Skills Instructional Resource Guide (30-6000-I).* University of Missouri-Columbia: Instructional Materials Laboratory, 1992. Contact: IML (see above)
- *All Aspects of the Industry (65-9000-I).* University of Missouri-Columbia: Instructional Materials Laboratory, 1994. Contact: IML (see above)
- *Learning a Living: A Blueprint for High Performance (A SCANS Report for America 2000).* Washington, DC, U.S. Department of Labor, 1992.* (home page: http://www.dol.gov)
- *Total Quality Curriculum.* Leesburg, VA: National VICA, 1993.* Contact: Education Dept., National VICA, PO Box 3000, Leesburg, VA 20177, 800/321-VICA (8422). (home page: http://www.vica.org)
- VIMS/VAMS Support Center, 324 Townsend Hall, UMC, Columbia, MO 65211, 573/882-2951, FAX 573-884=5455. (home page: http://www.coe.missouri.edu/~vams)

*These resources are available to Missouri Educators for free loan from the Missouri Vocational Resource Center (MVRC), University of Missouri-Columbia, 8 London Hall, Columbia, MO 65211 (800/392-7217, FAX 573-882=9935).

Building Maintenance Competency Revision Advisory Committee

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Building Maintenance Performance Indicator Chart

Notes: The numbers in brackets represent IDs used in computerized tracking software.
* = Core competencies (essential for the first day on the job)

Show- Me Standards

Missouri Competency	PMO	ABC	AGC	ES	AAOI Objectives	PE/WMS	SCANS Competencies	Knowledge (Content)	Performance (Goals)
1. Orientation to Building Maintenance									
1.1 * Identify building maintenance occupations and related fields [AO1]	A1	G1-4 DD-1, 2	AI 3, 5	I.C1		A1, A2	3	CA3, CA6, SC3, SS4	1.2, 2.5, 3.5, 4.3
1.2 * Identify safe work site procedures/ practices, including fall protection and confined spaces [A02]	A2	A-1, 2, 11, 12 DD-17	AII 1, 2, 3, 4, 21			B1, F6	3	CA3, CA6, HP2, HP5, HP7	1.5, 3.1, 3.2, 4.1, 4.6, 4.7
1.3 * Identify emergency first-aid procedures, including MSDS (material safety data sheets) [A04]	A3	A-18, 19 H-5	AII 11, 17, 18	I.C4	H3	B1	3	CA3, HP1, HP2, HP4, HP7	1.5, 1.7, 3.3, 3.7, 4.6, 4.7,
1.4 * Identify fire safety equipment [AO4]	A4	A-22	AII 9, 20	XVIII.A1	H4	B1	3	CA3, HP7	1.5, 3.2, 4.7
1.5 * Identify hand tools[AO5]	A5	C-3 D-2, 3	CI 1-23	II.A1		B1	3	CA3	1.5
1.6 * Identify power tools [A06]	A6	C-3 D-2, 3	CII 1-7, 18-21 26, 27, 30-33	II.A3		B1	3	CA3	1.5
1.7 * Identify measuring instruments [A07]	A7	B-1 L-4	BI 1-31 BII 1-15 EI 1-10	II. A7	D2	B1	3	CA3, MA1, MA2, MA3 MA4, MA5, MA6, SS7	1.5, 1.6, 3.1
1.8 * Interpret blueprints/ schematics and as built drawings [AO8]	A8	A-8 E-1, 2 H-7 L-2 S-1-9 Z-3 DD-11 II-7	BIII 1-18 DII 25-30	II.A, B	D7	B1, B2	4	CA3, CA5, MA1, MA2, MA3, MA4, MA5, MA6	1.2, 1.5, 3.5, 3.8, 4.6
1.9 * Identify cause-and-effect relationships (e.g., water and dirt intrusion) [A09]		V-4, 7	AII 16, 21 BII 3			B1, B2	3	CA3, SC1, SC2	1.1, 1.2, 1.5, 1.7, 1.8, 3.1, 3.2, 3.3, 3.8, 4.1, 4.5,4.6, 4.7

Missouri Competency	PMO	ABC	AGC	ES	AAOI Objectives	PE/WMS	SCANS Competencies	Knowledge (Content)	Performance (Goals)
1.10 * Identify awareness of the environmental impact of hazardous waste (e.g., asbestos, shingling) [A10]		A-18, 19	AII 10, 13, 16		H1	B1, B2, B6	3	CA3, SC1, SC2, SC8	1.1, 1.2
1.11 * Identify and apply maintenance as it relates to building codes and applicable laws (e.g., ADA) [All]		A-18 D-25 L-1	AII 8 BIII 11, 18	I.C, IV.K3, V, VI.C3, VII.B3, X.B1	H1	B1, B2	3 5	CA3, HP4, HP6, HP&, SS6, SS7	1.1, 1.2
1.12 * Identify anchors and fasteners [A12]		H-1-7 O-4	(RC) B1-16 (RC) DII -7	V11.B3		B1	3	CA3	1.5, 3.1
2. Performing Exterior Carpentry Procedures									
2.1 * Demonstrate carpentry safety practices	B1	A-13-16	AII 1-4			B1	3	CA3, CA6, SC8, SS4	1.2, 1.5, 3.5, 4.3, 4.6, 4.7
2.2 * Demonstrate safe and proper use of a ladder [B02]	B2	A-17	AII 6			F3, F4	5	CA3, HP2, HP5	1.5, 3.1, 3.2, 4.1, 4.6, 4.7
2.3 * Demonstrate safe and proper use of scaffolding [B03]	B3	A-17	AII 5 CIII 3, 7	II.A5		F3, F4	5	CA3, HP2, HP5	1.5, 3.1, 3.2, 4.1, 4.6, 4.7
2.4 * Replace/install exterior doors [B04]	B4	K-4, 9 II-2, 3	(RC) CV 1, 2, 3, 7, 10, 12, 13a, b, d			F4	5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
2.5 * Replace/install exterior door operating hardware [BO5]	B5	II-2, 3	(RC) CV 8, 9, 11, 13c			F4	5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
2.6 * Replace/repair windows [BO6]	B6	II-1-3	(RC) CIV 1-10			F4	5	MA 1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
2.7 * Replace/repair/install siding [BO8]	B8		(RC) CIII 1, 3, 4, 5, 6		D1, D2	F4	5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
2.8 * Replace/repair exterior trim [B09]	B9		(RC) CIII 5		D1, D2	F4	5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
2.9 * Replace/repair roof flashing [B10]	B10	AA-3	(RC) CII 14, 15, 16, 20		D1, D2	F4	5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
2.10 * Replace/repair roofing [B11]	B11	BB-1, 7, 12, 13	(RC) CII 1-13, 17-19, 21, 22		D1, D2	F4	5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
2.11 * Replace/repair downspouts and guttering [B12]	B12	CC-2			D1, D2	F4	5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
2.12 * Perform weatherizing procedures [B13]	B13		(RC) CIII 6				5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3. Performing Plumbing Procedures									
3.1 * Demonstrate plumbing safety practices [CO1]	C1	C-2				B1	3	CA3, CA6, HP2, HP4, HP7, SC8, SS4	1.2, 1.5, 3.5, 4.3
3.2 * Cut, clean, and glue plastic pipe [CO2]	C2	C-2		VII.B1	D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3.3 * Cut, clean and solder copper pipe [CO3]	C3	C-2			D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3.4 * Cut and thread pipe [CO4]	C4	C-2		VII.B1	D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6

Missouri Competency	PMO	ABC	AGC	ES	AAOI Objectives	PE/WMS	SCANS Competencies	Knowledge (Content)	Performance (Goals)
3.5 * Form a flare [CO5]	C5	C-2				F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3.6 * Assemble a compression fitting [CO6]	C6	C-2				F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3.7 Rough-in plumbing fixtures [CO7]	C7				D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3.8 * Replace/repair plumbing fixtures (e.g., stool, urinal, tub) [CO8]	C8					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.4, 4.6
3.9 * Replace/repair/install plumbing accessories	C9					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3.10 * Locate and repair leaks in pipes and lines [C10]	C10				D13	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3.11 * Clean traps, drains, and vents [C11]	C11					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
3.12 * Identify blackflow prevention [C14]						B1, B2	3	CA3, SC2	1.10, 3.1, 3.4, 3.8, 4.3, 4.7
3.13 Service water heater [C15]						F4	5	CA3, SC1	1.1, 1.2, 1.7, 3.1, 3.2, 3.3, 3.4, 3.8
4. Performing Interior Carpentry Procedures									
4.1 * Demonstrate carpentry safety practices [EO1]	E1	HH-1	AII 1-4			B1	3	CA3, CA6, HP2, HP4, HP7, SC8, SS4	1.2, 1.5, 3.5, 4.3
4.2 * Repair drywall/plaster walls [EO2]	E2	HH-11	(RC) DII 1-10		D1,D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
4.3 Replace/repair interior walls [E03]	E3	HH-2, 3 JJ-1, 2	(RC) DIII 1-5, 9a-c		D1,D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
4.4 * Replace/repair interior door operating hardware [EO4]	E4	H-1-3, 5, 6	(RC) DIV 1			F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
4.5 Identify procedures for replacing, repairing, and/or installing floor coverings [EO5]	E5	JJ-5-8	(RC) DVI 1-3, 6-10		D1, D2	B1	3	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
4.6 Replace, repair and/or install suspended ceiling system [EO6]	E6	Z-2, 7, 10	(RC) DIII 6-8, 9d, e		D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
4.7 Install wall and/or ceiling insulation [EO7]	E7	HH-8	(RC) DI 1-11		D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
4.8 Install or replace interior trim [EO8]	E8	JJ-2	(RC) DIV 11, 12, 13f		D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
4.9 Install or replace ceramic tile [EO9]	E9				D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
4.10 * Replace/repair interior doors [E13]		II-1, 2	(RC) DIV 1-10, 13a-e			F4	5	MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
5. Performing Finishing Procedures									
5.1 * Demonstrate finishing safety practices [FO1]	F1					B1	3	CA3, CA6, HP2, HP4, HP7, SC8,	1.2, 1.5, 3.5, 4.3

Missouri Competency	PMO	ABC	AGC	ES	AAOI Objectives	PE/WMS	SCANS Competencies	Knowledge (Content)	Performance (Goals)
								SS4	
5.2 * Prepare surface for finish [FO2]	F2					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
5.3 * Select finishing materials [FO3]	F3	AA-1				B1, F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
5.4 * Prepare finishing materials [FO4]	F4					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
5.5 * Apply finishing materials [FO9]	F5, F6, F7	C-1 AA-2				F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
5.6 * Clean and properly store finishing equipment and materials [FO8]	F8	A-21				F4, F6	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6. Servicing Environmental Control Systems									
6.1 * Demonstrate safety practices for servicing environmental control systems [GO1]	G1					B1	3	CA3, CA6, HP2, HP4, HP7, SC8, SS4	1.2, 1.5, 3.5, 4.3
6.2 * Replace/adjust belts [GO2]	G2					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6.3 * Replace electrical motors [GO3]	G3			XII.B		F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6.4 Service pilot systems [GO4]	G4					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6.5 Clean and/or replace heating elements	G5			XVIII.F3		F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6.6 Clean condensing unit [GO6]	G6					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6.7 Clean an evaporator [GO7]	G7					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6.8 Replace thermostats/controls [GO8]	G8			XII.D2, 3		F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6.9 * Replace furnace or cooling filter [G10]	G10					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
6.10 * Inspect/clean heat exchangers [G11]						B1 F4	5	CA3, MA1, MA2	1.5, 3.1, 3.4
7. Performing Electrical Procedures									
7.1 * Demonstrate electrical safety practices [DO1]	D1			I.A		B1	3	CA3, CA6, HP2, HP4, HP7, SC8, SS4	1.2, 1.5, 3.5, 4.3
7.2 * Use electrical test equipment (e.g., VOM/amp) [DO6]	D6			II.A7		F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
7.3 * Troubleshoot and replace outlets, switches, fuses, conductors, breakers and fixtures [DO2]	D2			IX.1-12		F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6

Missouri Competency	PMO	ABC	AGC	ES	AAOI Objectives	PE/WMS	SCANS Competencies	Knowledge (Content)	Performance (Goals)
7.4 * Identify power supplies (e.g., single-phrase, three-phase) [D08]				IV.J1, XIII.B5, XIV.C1		B1	3	CA3, SC1, SC7	1.1, 1.4, 1.7, 4.1
7.5 Bend and connect conduit [DO3]	D3			VII.D		F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
7.6 * Wire circuits of 120V and 240V according to code [DO4]	D4			VII		F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
7.7 * Wire a low-voltage circuit using a schematic [DO5]	D5			VIII.A4		F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
7.8 Install/replace/service alarms and detectors [DO9]				XVIII.A, B		F4	5	CA3, SC7, SC8	1.5, 3.3, 3.4, 4.6, 4.7
8. Welding (optional)									
8.1 Demonstrate welding safety practices [LO1]			D11 2, 3 DIII 1, 2			B1	3	CA3, HP6, MA1, MA2, MA3, SC2	1.2, 1.5, 3.5, 4.7
8.2 Set up oxyacetylene welding equipment [LO2]			DIII 3-15			F4	5	CA3, MA1	1.2, 1.5, 4.7
8.3 Demonstrate proper use of oxyacetylene welder/cutter [LO3]			DIII 16-18			F4	5	CA1	1.2, 1.5, 3.5
8.4 Demonstrate proper transport and storage of tanks [LO4]						F4	5	CA5, CA6, HP7, SC1, SC2	1.2, 1.5, 3.1, 3.4, 4.7
8.5 Set up arc welder [LO5]			DII 4, 10, 11, 12, 13, 14, 15			F4	5	CA5, CA6, HP7, SC1, SC2	1.2, 1.5, 3.1, 3.4, 4.7
9. Performing Concrete and Masonry Procedures (optional)									
9.1 Demonstrate masonry safety practices [HO1]	H1					B1	3	CA3, CA6, HP2, HP4, HP7, SC8, SS4	1.2, 1.5, 3.5, 4.3
9.2 Set forms [HO2]	H2	O-1, 2 U-1	(RC) AII 1-6 AIII 16a-c		D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
9.3 Mix concrete [HO3]	H3	O-1			D1	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
9.4 Patch and/or repair concrete structures [HO4]	H4	O-5 Q-5				F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
9.5 Pour and finish concrete [HO5]	H5	O-3, 5 Q-5				F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
9.6 Mix mortar [HO6]	H6					F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
9.7 Remove, repair walls and/or replace blocks [HO7]	H7				D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6
9.8 Remove, repair walls and/or replace bricks [HO8]	H8				D1, D2	F4	5	CA3, MA1, MA2	1.5, 3.1, 3.2, 3.5, 4.6

Missouri Competency	PMO	ABC	AGC	ES	AAOI Objectives	PE/WMS	SCANS Competencies	Knowledge (Content)	Performance (Goals)
10. Leadership Competencies									
10.1 Demonstrate an understanding of VICA, its structure and activities [KO1]	K1					B1	4		
10.2 Demonstrate an understanding of one's personal values [KO2]	K2	DD-1				A1	4		
10.3 Perform tasks related to effective personal management skills [KO3]	K3	DD-2, 4, 10				F4	2,5		
10.4 Demonstrate interpersonal skills [KO4]	K4	DD-4, 9	AI 3			G1	2		
10.5 Demonstrate etiquette and courtesy [K05]	K5	DD-9			I14	G2	2		
10.6 Demonstrate effectiveness in oral and written communication [KO6]	K6	DD-6, 9	AI6, 7		D12	D1 E4			
10.7 Develop and maintain a code of professional ethics [KO7]	K7	DD-4, 9			I15	G2	3		
10.8 Maintain a good professional appearance [KO8]	K8	DD-4, 9			I15	F5			
10.9 Perform basic tasks related to securing and terminating employment [KO9]	K9	DD-4, 5				F4	5		
10.10 Perform basic parliamentary procedures in a group meeting [K10]	K10	DD-9				F4 G1	2, 5		

Associated Builders And Contractors Competencies

Source: Wheels of Learning Standardized Craft Training. Rosslyn, VA: National Center for Construction Education and Research (formerly Construction Education Foundation, Associated Builders and Contractors), 1993-1995

Core Curricula Competencies

A. **Basic Safety (Task Module 00101)**

1. Describe how to avoid job site accidents
2. Explain the relationship between housekeeping and safety
3. Appreciate the importance of following all safety rules and company safety policies
4. Explain the importance of reporting all on-the-job injuries, accidents, and near misses
5. Explain the need for evacuation procedures and the importance of following them
6. Explain their employer's substance abuse policy and how it relates to their safety
7. Use proper safety practices when welding or working around welding operations
8. Use proper safety practices when working in or near trenches and excavations
9. Explain the term Proximity Work
10. Follow safe practices when working near pressurized or high-temperature systems
11. Know and follow the safety requirements for working in confined spaces
12. Explain and practice safe lockout/tagout procedures
13. Know the different types of barriers and barricades and where they should be used
14. Recognize and explain personal protective equipment uses
15. Inspect and care for various types of personal protective equipment.
16. Follow safe procedures for lifting heavy objects
17. Inspect and safely work with various types of ladders and scaffolds
18. Demonstrate an understanding of the OSHA Hazard Communication Standard
19. Explain the function of Material Safety Data Sheets
20. Explain the process by which fires start
21. Practice fire prevention in dealing with various flammable materials
22. Explain the classes of fires and the type(s) of extinguishers to use for each
23. Explain why injuries result when electrical contact occurs
24. Practice safe work procedures around electrical hazards
25. Take action if present when an electrical shock occurs

B. **Basic Math (Task Module 00102)**

1. Add, subtract, multiply and divide whole numbers, with and without a calculator
2. Use a standard and metric ruler to measure
3. Add, subtract, multiply and divide fractions
4. Add, subtract, multiply and divide decimals, with and without a calculator
5. Convert decimals to percents and percents to decimals
6. Convert fractions to decimals and decimals to fractions
7. Explain what the Metric System is and its importance in the construction trade
8. Recognize and use metric units of length, weight, volume, and temperature

C. **Introduction to Hand Tools (Task Module 00103)**

1. Recognize basic hand tools used in the construction trade
2. Safely use these basic hand tools
3. Have an awareness of basic maintenance procedures on these hand tools

D. **Introduction to Power Tools (Task Module 00104)**
1. Identify and recognize basic blueprint terms and symbols
2. Recognize safe use of power tools
3. Explain the procedures to properly maintain these power tools

E. **Introduction to Blueprints (Task Module 00105)**
1. Identify and recognize basic blueprint terms and symbols
2. Relate information on prints to real parts and locations

F. **Basic Rigging (Task Module 00106)**
1. Explain and practice rigging safety
2. Identify and explain rigging equipment
3. Inspect rigging equipment
4. Identify, explain, and perform crane hand signals
5. Estimate size, weight and center of gravity
6. Tie knots
7. Identify and explain types of derricks
8. Identify and explain types of cranes
9. Rig and move materials and equipment

G. **Orientation to the Carpentry Trade (Task Module 10101)**
1. Define carpentry
2. Explain the history and nature of the carpentry trade
3. Explain the history of apprenticeship and the makeup of a registered apprenticeship program
4. Understand the responsibilities of the apprentice, contractor and apprenticeship committee in a formal apprenticeship program
5. Explain the basics of a free enterprise system
6. Discuss the basics of human relations and how they contribute to making an employee more productive
7. List and explain the various responsibilities an employee has to the employer

H. **Nails, Fasteners and Adhesives (Task Module 10104)**
1. Identify the different types of nails, screws, staples, and adhesives
2. Explain the application of nails, screws, staples, and adhesives
3. List the basic nail types and their uses
4. List the basic screw types and their uses
5. Explain the purpose of MSDS sheets
6. Describe the two types of adhesives and uses
7. Identify the different types of anchors and describer their uses

I. **Wood Building Materials (Task Module 10105)**
1. Define the terms “lumber” and “wood”
2. Identify various species of soft woods and hard woods
3. Explain and identify the various imperfections in lumber
4. Explain how lumber is graded
5. Explain how lumber is treated, the various types of treatments and the advantages and disadvantages of same
6. Describe how plywood is manufactured and graded
7. Explain grade markings on lumber and plywood
8. Identify and define the various types of building boards and explain where each is used
9. Explain the method of caring for lumber on the construction site
10. List the common types of lumber that are locally available

J. **Floor Systems (Task Module 10201)**
1. Identify the various types of framing systems
2. Explain the various types of sill construction
3. Describe the construction of a center beam-and-post support system, along with constructing one
4. Select floor joints
5. Lay out and construct a floor, including the sill, joists, bridging and openings
6. Identify the various types of bridging
7. Explain the effects of notching and drilling floor joists
8. Describe the types of sub flooring and how it is applied
9. Install sub-flooring

10. Identify the various types of mechanical connectors and explain how each is installed
11. Describe floor construction, using prefabricated joists

K. **Walls Systems (Task Module 10203)**
1. Identify the various types of house framing
2. Explain the effects of shrinkage of wood and its causes
3. Explain the construction of sills, exterior and interior wall, corner posts, window and door openings, partition Ts, bracing and fire stops
4. Construct an exterior and interior partition wall, including sills, corner posts, window and door openings, partition Ts, bracing and fire stops
5. Describe the construction of a facility using plank-and-beam framing technique
6. Define modular framing
7. Describe wall framing techniques in masonry
8. Install furring strips on a masonry wall
9. Install the needed wood framing for window and door openings in a masonry wall
10. Explain the use of metal studs
11. Install the common types of wallboard
12. List the various types of fasteners used for wallboard

L. **Site Preparation (Task Module 10401)**
1. Identify the information contained in the local zoning and building ordinances
2. Identify a plot plan and define the information contained on it
3. Lay out a structure on a plot plan, given the needed information
4. List the five steps, in sequence, of site preparation and startup
5. Lay out a simple building in the field
6. Construct batter boards in the field
7. Establish footing and foundation building lines
8. Define terms relating to site preparation
9. Determine ground elevations in the field

M. **Concrete and Reinforcement Materials (Task Module 10501)**
1. List the materials of which concrete is made
2. List the common types of cement
3. List acceptable types of aggregate for concrete
4. List acceptable water for concrete
5. List the types of concrete admixtures
6. List the reinforcing material used in concrete

N. **Concrete Handling and Placing (Task Module 10502)**
1. Explain proper common handling procedures of concrete
2. List the common methods of conveying concrete on the job site
3. Identify the correct methods of placing concrete into the forms
4. Explain how to correctly finish concrete slabs and identify the tools and equipment used

O. **Forming Foundations and Flatwork (Task Module 10504)**
1. Define the terms related to formwork
2. Explain how to construct foundation and slab formwork
3. State how to strip footing forms and lay out the foundation lines on the footings
4. State how anchor bolts are set in foundations
5. Construct flatwork (slab-on-grade), footing and low wall formwork

P. **Special Floor Systems (Task Module 10202)**
1. Demonstrate knowledge of how dimensional properties affect the strength of a wood member
2. Demonstrate knowledge of various residential floor projections and their adaptability to some commercial areas
3. Demonstrate knowledge of plank-and-beam construction in residential construction
4. Demonstrate knowledge of panelized floor systems, their construction and use in commercial work
5. Demonstrate knowledge of the assembly and construction of steel and concrete floors in the commercial field and in large construction
6. Demonstrate knowledge of types and methods of insulation used in residential and commercial floor systems

Q. **Wall Systems, Tilt Up (Task Module 10204)**

1. Demonstrate knowledge of history and evolution of tilt-up construction
2. Demonstrate knowledge of efficiency of tilt-up construction versus concrete block or poured-in-place concrete walls
3. Demonstrate knowledge of various designs used with tilt-up construction and their applications
4. Demonstrate knowledge of tests performed on concrete as it is being placed in the slab
5. Demonstrate knowledge of methods used in grading and finishing the slab
6. Demonstrate knowledge of methods of forming panels
7. Demonstrate knowledge of methods used in placing lifting and bracing inserts in a panel
8. Demonstrate knowledge of methods that are used in lifting a panel
9. Demonstrate knowledge of methods of bracing panels
10. Demonstrate knowledge of methods of treating a joint between panels

R. **Roof Systems (Task Module 10205)**
1. Locate the five scales on a rafter framing square
2. Describe the terms pitch, span, total rise and rise per foot run
3. Define the various members used in a gable roof and hip roof
4. Perform several functions to find the pitch, rise per foot run and total rise
5. Define and explain the various roofing tables on the rafter framing square
6. Calculate the lengths of common and hip rafters using the rafter framing square
7. Describe and perform functions using the Essex scale
8. Describe the method used to establish the measuring line on a rafter
9. Define the various cuts and miters on a common and hip rafter
10. Explain the method of transferring the marking of a rafter from the measuring line to the top edge of a rafter
11. Describe the method of obtaining various lengths of jack rafters
12. Explain the difference between “theoretical” and “actual” measurements of jack rafters
13. Describe the use of the speed square in the measuring and cutting of various types of rafters
14. Describe the unequal roof pitch
15. Describe the method used to calculate the common rafters for an unequal roof pitch
16. Describe the different types of plank-and-beam roofs
17. Describe the various roof trusses used in the industry today

S. **Reading Plans and Elevations (Task Module 10402)**
1. Identify and draw the different types of lines used on construction drawings
2. Identify and draw the different symbols used in the development of construction drawings to represent items of construction
3. Identify and use abbreviations in the development of basic construction drawings
4. Explain the parts of a title block
5. Identify the parts of a construction drawing
6. Read plans and elevations contained in basic construction drawings
7. Understand and identify the parts of a specification
8. Explain how drawings are dimensioned
9. Explain how a survey plan and site or plot plan is developed

T. **Field Engineering Principles (Task Module 10404)**
1. Understand the scope of field engineering principles
2. Identify the correct definitions of trade terms used in this area
3. Explain the use of diagrams how various trade terms are adaptable to field-engineering principles
4. Correctly use the tools and instruments necessary to perform field-engineering functions
5. Competently and accurately transfer information obtained from construction drawings into its proper perspective in the field

U. **Forming (Task Module 10505)**
1. Identify the various parts of different types of forms
2. Explain the use or different forming materials
3. Construct forms for any purpose for which they are required

V. **Water and Damp Proofing (Task Module 10508)**

1. Identify the areas of construction that require the use of a waterstop
2. Identify characteristics of water vapor
3. Describe how water vapor passes through a structure and when and where to use a vapor barrier
4. Identify reaction of building materials to moisture
5. Identify types of vapor barriers and their uses
6. Describe ventilating a structure
7. Identify the importance and functions of proper ventilation
8. Identify the importance of quality construction and quality control

W. **Stair Construction (Task Module 10310)**

1. Identify various types of stairs
2. Identify the parts of these stairs
3. Describe material used in the construction of stairs
4. Understand construction drawings of stairs
5. Explain methods of constructing various types of stairs
6. Understand the various terms and definitions relating to stairs
7. Explain the procedures for cutting and installing:
   a. Open stairway
   b. Closed stairway
   c. Platform stairway
      (1) U-type stairway
      (2) L-type stairway
   d. Stairway with winder
8. Understand how to lay out stairs

X. **Reinforcing Concrete (Task Module 10311)**

1. Define the trade terms associated with steel reinforcing processes
2. Describe the applications of reinforcing bars, the uses of reinforced structural concrete and basic processes involved in placing reinforcing bars
3. Recognize and identify the bar bends standardized by the American Concrete Institute
4. Read and understand bar lists and describe the information found on a bar list
5. List the materials and types of ties used in securing rebars
6. State the tolerances allowed in the fabrication of reinforcing bars
7. Execute the common ties for reinforcing bars
8. Identify the common types of bar supports and state their applications
9. Describe methods by which rebars maybe cut and bent in the field
10. List the tools and equipment needed for reinforcing installation
11. Explain the necessity of cover in placing reinforcing steel
12. Explain how to place bars in walls, columns, beams, girders, joists and in one-way and two-way slabs
13. Describe lapped, welded and mechanical splices
14. Describe the CADWELD mechanical rebar splice

Y. **Patented Forms (Task Module 10312)**

1. Identify and name different concrete forming systems and their accessories
2. Explain how patented form systems are constructed

Z. **Interior Finish: Ceiling Systems (Task Module 10313)**

1. Identify and describe sound control and conditioning in acoustical ceiling systems
2. Demonstrate the knowledge of working with the tools listed in the module
3. Identify and demonstrate the ability to read shop drawings, reflected ceiling plans and blueprints pertaining to ceiling layout
4. Qualify with the powder-actuated fastening tool
5. Demonstrate the proper method of room layout
6. Demonstrate the method of installing a “stuck up” acoustical ceiling
7. Identify the various types of suspended ceiling systems listed in this task module
8. Demonstrate the ability to install eye pins, inserts and hanger wire or straps
9. Demonstrate the ability to install an exposed grid system, concealed zee bar system, exposed zee bar system, H and T system and furring bar system

10. Identify the main parts for each suspended ceiling system listed above

AA. **Exterior Wall Finished (Task Module 10314)**
1. Identify various types of wall finishes
2. Demonstrate how to install various types of wall finishes
3. Understand the purpose of wall flashing and insulation

BB. **Roofing Applications (Task Module 10315)**
1. Describe the process of applying asphalt or fiberglass shingles
2. Demonstrate the mechanics of installing asphalt or fiberglass shingles on a gable and a hip roof
3. Demonstrate the techniques of closing up a valley with asphalt or fiberglass shingles
4. Explain how to make various roof projections watertight when using asphalt or fiberglass shingles
5. Complete the proper cuts and install the main ridge cap and hip ridge cap with asphalt or fiberglass shingles
6. Determine the layout, cut the material and install a cricket or saddle
7. Describe the process of applying wood shingles and wood shakes
8. Demonstrate the mechanics of installing wood shingles and wood shakes on a gable roof and on the hip roof
9. Demonstrate the techniques of closing up a valley with wood shingles and wood shakes
10. Show how to make various roof projections watertight when using wood shingles and wood shakes
11. Complete the proper cuts and install the main ridge cap and hip ridge cap with wood shingles and wood shakes
12. Identify some of the other types of roofing finishes that are used
13. Explain the necessity for safe working conditions on roof job

CC. **Installation of Cornices, Gutters and Downspouts (Task Module 10316)**
1. Identify various types of comices and demonstrate how to install them
2. Identify the various components of a gutter and downspout system and demonstrate how to install a designated system

DD. **Introduction to Supervision (Task Module 10410)**
1. Explain why both job skills and attitude affect productivity
2. Describe the role of the supervisor in the construction industry
3. Define “organizational chart” and explain why it is important to know where you fit in it
4. List the personal qualities and various traits of an effective leader/supervisor
5. List the laws enforced by the EEOC for the protection of the employee
6. Explain why understanding human relations on the job is important for the supervisor
7. Demonstrate how to communicate effectively
8. Define and demonstrate motivational techniques. Show how they are used to get others to perform
9. Explain the various elements of leadership and how these are used by the supervisor on the job site
10. Describe and demonstrate the systematic problem-solving technique
11. List some of the major construction documents and describe their purposes. Also, explain how certain documents affect the role of the supervisor.
12. Describe what a change order is and the role of a supervisor in its implementation
13. Describe how a job is closed out
14. Explain how an estimate is developed
15. Perform a basic quantity takeoff
16. Define “planning” and explain how to “plan” materials, labor, tools and equipment
17. Explain how to break down a job into activities
18. Describe how to staff a job
19. Explain how to develop a training program and orient a new employee to the company and job
20. Describe how to analyze a job
21. Define scheduling and list several types of project schedules
22. Explain and demonstrate short interval production scheduling
23. Define control, and in the same context, describe how to control material, labor, tools and equipment

24. Explain why it is important to be able to work with other trades
25. Describe the role the supervisor plays in job site safety. Also explain the personal liability of the supervisor if someone is injured.

EE. **Finish Stairs (Task Module 10411)**

1. Identify the various stair parts and their nomenclature
2. Explain the procedure for cutting and installing mitered skirt boards, mitered risers, treads, newel posts, handrails, and balusters
3. Describe the method for finishing:
   a. Service stairs
   b. Main stairs, including closed, combination open/closed and "L" and "U" shaped
4. Explain the use or purpose of a bullnose starting step
5. Explain the use or purpose of a landing newel
6. Explain why metal service stairs are classified as fire stairs
7. Identify what materials can be used to build stairs for commercial construction
8. Identify the technical advances made in steel stair construction

FF. **Laser Instruments (Task Module 10412)**

1. Describe the scope of field-engineering principles as they pertain to lasers
2. Properly identify and correctly explain the instruments and tools used to perform field-engineering functions with lasers
3. Describe safety precautions to be taken when using the laser
4. Explain how to care for the laser

GG. **Supplement to Ceiling Systems (Task Module 10413)**

1. Identify the following special ceiling systems
   a. Metal pan system
   b. Concealed grid system
   c. Integrated ceiling system
   d. Standard and non-standard luminous ceiling
   e. Suspended drywall furring system
2. Identify the main parts of the systems above and the function of each
3. Explain how each system is installed
4. Explain how the systems above differ from the following:
   a. Exposed grid
   b. Concealed zee bar
   c. Exposed zee bar
   d. H and T
   e. Furring bar
5. Demonstrate the ability to install the following:
   a. Metal pan ceiling system
   b. Concealed grid ceiling system
   c. Integrated ceiling system
   d. Standard and non-standard luminous ceiling system
   e. Suspended drywall furring system
6. Identify other designated special ceiling systems

HH. **Metal Studs and Drywall (Task Module 10413)**

1. Understand the terms and definitions relating to metal studs and drywall systems
2. Describe the various uses of metal studs
3. Define the various types of gypsum boards
4. Describe the procedure for single-ply installation of drywall
5. Describe the procedure for installing double-ply drywall
6. Describe the type of screw used for the face-ply gypsum on a double-ply installation
7. Describe the use of diamond lath, ribbed lath and flat rib lath
8. Describe the various sound isolating materials
9. Explain the various uses for:
   a. Perforated lath
   b. Foil-backed gypsum lath
   c. Radiant-heated gypsum lath
10. Describe the nailing schedule for gypsum lath
11. Describe the procedure for finishing drywall with various finishing compounds
12. Identify the type of metal lath that can be used with wider spaced framing members
13. Describe how suspension systems are installed for suspended drywall ceilings
14. Describe how drywall is fastened to suspension grid

15. Understand how metal stud systems are installed
16. Describe how to take off materials from a shop drawing
17. Describe how to develop a material list

II. **Interior Finish: Doors and Windows (Task Module 10415)**
1. Identify various types of doorjambs and frames and demonstrate the installation procedures to place them in different types of interior partitions
2. Identify different types of interior doors and demonstrate the procedures to place and hang them
3. Identify different types of interior doors hardware and demonstrate the procedures of installation
4. Identify various kinds of interior door and window trim and demonstrate the application of them
5. Demonstrate the correct and safe use of hand tools described in this task module
6. Demonstrate the correct and safe use of all power tools described in this task module
7. List and identify specific items included on a typical door schedule

JJ. **Wall and Floor Specialties (Task Module 10416)**
1. Identify various types of paneling and demonstrate installation procedures to place the paneling on stud or concrete block walls and partitions
2. Identify various types of base and ceiling moldings and demonstrate the cutting, fitting, and installation procedures for each
3. Identify various types of hardwood flooring and demonstrate the installation procedures for each
4. Identify various types of hardwood flooring and demonstrate the installation procedures for each
5. Identify various vinyl floor coverings and demonstrate the installation procedures for each
6. Demonstrate the installation procedures for carpeting
7. Demonstrate the correct and safe use of hand tools described in this task module
8. Demonstrate the correct and safe use of all power tools described in this task module

KK. **Cabinetry (Task Module 10417)**
1. Identify the basic woods used in cabinetmaking
2. Identify the different glues used in cabinetmaking
3. Choose the proper wood or plywood used in cabinetmaking
4. Identify and cut a variety of woodworking joints used in cabinetmaking
5. Lay out, cut and assemble materials for case construction
6. Construct lip, flush, overlay and panel doors
7. Construct drawers and drawer fronts
8. Demonstrate the correct and safe use of all power tools described in this task module

KK. **Cabinetry (Task Module 10417)**
1. Identify the basic woods used in cabinetmaking
2. Identify the different glues used in cabinetmaking
3. Choose the proper wood or plywood used in cabinetmaking
4. Identify and cut a variety of woodworking joints used in cabinetmaking
5. Lay out, cut and assemble materials for case construction
6. Construct lip, flush, overlay and panel doors
7. Construct drawers and drawer fronts
8. Properly select and install cabinet hardware
9. Know how to work with plastic laminate
10. Install custom cabinet
11. Be familiar with cabinetmaking terminology
12. Demonstrate the safety procedures for working with the tools listed in this task module

Associated General Contractors Competencies

Source: Fundamentals of Carpentry and Residential Carpentry. Stillwater, OK: Curriculum and Instructional Materials Center; Washington, DC: Associated General Contractors, 1993.

Fundamentals of Carpentry

Unit A 1: **Industry Orientation**

1. List levels of training for carpentry-related jobs
2. List job opportunities open to skilled carpenters
3. Select from a list personal attributes or attitudes that an employer looks for in an employee
4. Select from a list procedures for applying for a carpentry job
5. List documents that an applicant may need when applying for a job
6. Complete a personal information sheet
7. Write a resume

Unit A II: **Safety**

1. Match terms associated with safety to their correct definitions
2. State reasons for safety consciousness on the job
3. State consequences of a worker using alcohol or drugs on the job
4. State job safety rules
5. State safety precautions pertaining to scaffolds
6. State safety precautions pertaining to ladders
7. State safety precautions pertaining to excavations
8. Match colors of the safety color code to their correct applications
9. Match classes of fires to their correct descriptions
10. Match terms associated with toxic substances to their correct definitions
11. State reasons for Material Safety Data Sheets (MSDS)
12. List toxic substances a carpenter may contact on the job
13. List forms of toxic substances
14. State ways toxic substances enter the body
15. Define ways toxic substances affect the body
16. Discuss consequences of exposure to toxic substances
17. State reasons why knowledge of first aid is important
18. Identify personal safety equipment
19. Identify job-site and shop safety violations
20. Match types of fire-extinguisher symbols to given classes of fires
21. Demonstrate the ability to properly lift a heavy object

Unit A III: **Wood Products**

1. Match terms associated with lumber to their correct definitions
2. Select from a list characteristics to consider in using lumber
3. Match common softwoods to their correct uses
4. Match common hardwoods to their correct uses
5. Identify common defects in lumber
6. Match types of softwood lumber to their correct grades
7. Select from a list standard hardwood lumber grades
8. Match letters designating veneers used in softwood plywood to their correct descriptions
9. Distinguish between standard interior and exterior softwood plywood grades by face veneer
10. Match standard hardwood plywood grades to their correct descriptions

11. Match types of reconstituted wood panels to their uses
12. Identify types of plywood core construction
13. Write actual sizes for given nominal sizes of softwood lumber
14. Write actual sizes for given nominal sizes of hardwood lumber
15. Select from a list solid softwoods used for paneling
16. Select from a list solid hardwoods used for paneling
17. Select from a list types of woods used for trim and moldings
18. Identify types of trim and moldings
19. Match types of lumber to their correct units of measure
20. Compute lumber quantities
21. Write a lumber requisition

Unit B I: **Basic Math**

1. Match terms associated with basic math to their correct definitions
2. Match symbols used in math problems to their correct names
3. Label the place values of a whole number
4. Add whole numbers
5. Subtract whole numbers
6. Multiply whole numbers
7. Divide whole numbers
8. Distinguish among types of fractions
9. Reduce fractions to lowest terms
10. Convert mixed numbers to improper fractions
11. Convert improper fractions to mixed numbers
12. Add fractions
13. Subtract fractions
14. Multiply fractions
15. Label the place values of a decimal number
16. Add decimal numbers
17. Subtract decimal numbers
18. Multiply decimal numbers
19. Divide decimal numbers
20. Convert decimal fractions to common fractions
21. Convert common fractions to decimal numbers and percentages
22. Identify decimal and fractional equivalents
23. Convert percentages to fractions and decimals numbers
24. Solve percentage problems
25. Match terms used in geometry to their correct definitions
26. Match types of geometric figures to their correct descriptions
27. Match units of measure to their correct equivalents
28. Calculate the area of geometric figures
29. Calculate volume of solid figures
30. Estimate cubic yards
31. Solve basic ratio and proportion problems

Unit B II: **Measuring**

1. Match to their correct definitions terms associated with measuring
2. Identify basic measuring tools used by carpenters
3. List common errors that contribute to incorrect measurements
4. Identify graduations on a carpenter's rule
5. Read a carpenter's rule to the nearest fraction of an inch
6. Convert fractional inches to hundredths of a foot
7. Identify graduations on an engineer's rule
8. Read an engineer's rule to the nearest hundredth of a foot
9. Identify graduations on a tape
10. Read a tape to the nearest fraction of an inch
11. Describe measuring methods used to square lines
12. Read measurements on carpenter's and engineer's rules
13. Measure dimensions of objects
14. Convert fractional inches to hundredths of a foot
15. Read measurements on tapes
16. Demonstrate the ability to use basic measuring tools and the 3-4-5 method to lay out the perimeter of a building on a concrete slab

Unit B III: **Plan Reading**

1. Match terms associated with plan reading to their correct definitions
2 Match types of drawings usually included in a set of plans to their correct descriptions
3. List information found on types of drawings in a set of plans
4. Match lines in the alphabet of lines to their correct uses
5. Identify lines in the alphabet of lines
6. Identify selected architectural symbols commonly used to represent materials on plans
7. Identify selected electrical symbols commonly used on plans
8. Identify selected mechanical symbols commonly used on plans

9. Identify selected abbreviations commonly used on plans
10. Match architect's conventions to their correct representations
11. State the purpose of written specifications
12. Select from a list of basic information included in a set of written specifications
13. State the purpose of an engineer's scale
14. Use an architect's scale
15. Use an engineer's scale
16. Read plans
17. Interpret a finish schedule
18. Read written specifications

Unit C I: **Hand Tools**

1. Match terms associated with hand tools to their correct definitions
2. State guidelines for care and safe use of hand tools
3. Select from a list hand tools a beginning carpenter needs
4. Match types of hammers to their correct uses
5. Match types of handsaws to their correct uses
6. Match types of squares to their correct uses
7. Match types of planes to their correct uses
8. Match types of measuring instruments to their correct uses
9. Identify types of layout instruments
10. Identify types of boring and drilling hand tools
11. Identify types of screwdrivers
12. Match types of pliers to their correct uses
13. Identify types or wrenches
14. Identify types of files
15. Identify types of chisels
16. Identify types of clamps
17. Identify hand tools used to install drywall
18. Match types of miscellaneous hand tools to their correct uses
19. Hone a wood chisel
20. Use a hacksaw
21. Use a framing square and rule to lay out a corner
22. Use a level
23. Drill and hand tap a hole in a piece of steel

Unit C II: **Power Tools**

1. Match terms associated with power tools to their correct definitions
2. State general safety rules pertaining to power tools
3. Select from a list general guidelines for proper care of power tools
4. Select from a list uses of a table saw
5. State rules for the safe use of a table saw
6. Select from a list uses of a radial arm saw
7. Select rules for the safe use of radial arm saws
8. Select from a list uses of a jointer
9. State rules for the safe use of jointers
10. Select from a list uses of a planer
11. State rules for the safe use of a planer
12. Select from a list uses of a shaper
13. State rules for the safe use of a shaper
14. Select from a list uses of a table band saw
15. State rules for the safe use of table band saws
16. Select from a list uses of a bench grinder
17. State rules for the safe use of bench grinders
18. Select from a list uses of a drill press
19. State rules for the safe use of a drill press
20. Select from a list uses of a combination belt-and-disc sander
21. State rules for the safe use of combination belt-and-disc sanders
22. Select from a list uses of a power miter saw
23. State rules for the safe use of power miter saws
24. Select from a list uses of a sawbuck
25. State rules for the safe use of sawbucks
26. Distinguish between uses of a portable angle grinder and a belt sander
27. State rules for the safe use of portable angle grinders and belt sanders
28. Distinguish among uses of portable power saws
29. State rules for the safe use of portable power saws
30. Distinguish between uses of a router and a trimmer
31. State rules for the safe use of routers and trimmers
32. Distinguish among uses of a portable drill, screwgun, and hammer drill
33. State rules for the safe use of portable drills, screwgun, and hammer drill

34. Select from a list uses of portable power plane

Unit C III: **Equipment**

1. Match terms associated with job site equipment to the correct definitions
2. Identify job site equipment used by carpenters
3. Label the parts of a prefabricated rolling scaffold
4. Identify equipment used for specific construction jobs
5. State safety precautions pertaining to job site equipment
6. Distinguish among hand signals used in maneuvering operations
7. Set up a section of prefabricated scaffolding on a solid base

Unit D I: **Rigging and Material Handling**

1. Match terms associated with rigging and material handling to their correct definitions
2. Identify accessories used for load lifting
3. Identify hitches used for attaching materials and equipment to the hoist
4. Label elements of knots, bends, and hitches
5. Match types of knots to their correct uses
6. State safety rules related to rigging and material handling
7. State precautions to observe when caring for ropes
8. Calculate the safe working load (SWL) of different types and sizes of ropes
9. State the importance of spreading sling angles
10. Calculate sling stress using a formula
11. Distinguish among hand signals used in rigging operations
12. Calculate safe working load (SWL) of different sizes of wire rope
13. Select from a list types of cable fittings
14. Select from a list good rigging practices
15. Distinguish among types of knots
16. Demonstrate the ability to:
    a. Tie knots
    b. Install wire rope clips
    c. Rig and handle different types of loads using proper hand signals

Unit D II: **Arc Welding**

1. Match terms associated with arc welding to their correct definitions
2 State safety precautions to observe when welding
3. Match types of personal safety devices to their uses
4. Select from a list common equipment used in arc welding
5. Identify hand tools used in welding
6. Identify power tools used in welding
7. State guidelines for safe use and care of hand tools
8. State general safety rules pertaining to power tools
9. State guidelines for proper care of power tools
10. Distinguish between reverse and straight polarity
11. Select from a list factors that determine the correct polarity to use
12. Select from a list purposes of electrode flux
13. List factors to consider when selecting electrodes
14. Describe the effects of raising and lowering welding machine amperes
15. Name methods of striking an arc
16. Select from a list characteristics of proper arc length
17. Identify parts of the welding process
18. Match types of welds to their correct descriptions
19. Label types of weld joints
20. Label parts of groove and fillet welds
21. List positions used in arc welding
22. List reasons for poor welds
23. List types of electrode motions (rod manipulations)
24. State characteristics of a good weld
25. Match elements of welding symbols to their correct descriptions
26. Draw symbols showing location of weld
27. Identify basic weld symbols
28. Distinguish between correct and incorrect drawings of symbols with one vertical side
29. Identify supplementary symbols
30. Interpret finish symbols used with contour symbols
31. Construct a pad weld
32. Construct a butt weld
33. Construct a lap-joint fillet weld
34. Construct a T-joint fillet weld in the vertical up position

Unit D III: **Oxyacetylene Cutting**

1. Match terms associated with oxyacetylene cutting to the correct definitions
2. State color codes for oxygen and acetylene
3. Arrange in order stages in the oxyacetylene cutting process
4. Identify parts of an oxyacetylene cutting outfit
5. Identify parts of a torch body and cutting attachment
6. State safety rules for working with oxyacetylene equipment
7. Identify types of oxyacetylene cutting flames
8. Distinguish between flashback and backfire
9. Arrange in order steps to follow in case of flashback
10. Select from a list causes of backfire
11. Match common cutting-torch tips to their correct uses
12. Identify a multi flame heating nozzle (rosebud) and tip
13 List uses of a multi flame heating nozzle (rosebud)
14. Identify temperature sticks (temp-sticks)
15. Describe the selection and use of temperature sticks (temp-sticks)
16. Cut mild steel at a 90-degree angle, stop, and restart the cut
17. Cut round stock
18. Cut ½ inch wire rope

Unit E I: **Levels and Transits**

1. Match terms associated with leveling instruments to their correct definitions
2 List uses of a level
3. Identify types of levels
4. Identify parts of a level
5. List uses of a transit
6. Identify types of transits
7. Label the major components of a transit
8. Identify parts of a transit
9. Identify different types of verniers
10. Interpret readings on different styles of verniers
11. List typical mistakes made in reading verniers
12. Label vertical and horizontal cross hairs and line of sight on a leveling instrument
13. State the rules for proper care of leveling instruments
14. Identify parts of a leveling rod
15. Match parts of a leveling rod to the correct uses
16. Describe commonly used direct-reading rods
17. Read direct-reading rods
18. Identify hand signals used by the instrument person to guide the rod person
19. Accurately read various types of verniers on transits
20. Set up and adjust a level
21. Use a level to check evaluations
22. Use a level to perform differential leveling
23. Tie slip knot for adjusting plumb bob
24. Set up and adjust a transit
25. Use a transit to locate building corners
26. Measure and read angles in the field

Residential Carpentry

Unit A 1: **Concrete Foundations**

1. Match terms associated with concrete foundations to their correct definitions
2. State principal properties of good concrete
3. State factors that affect properties of concrete mixture
4. Match types of admixtures used in concrete to their concrete functions
5. State benefits of admixtures in concrete
6. State advantages of using vibrators in concrete
7. Select from a list types of vibrators used to consolidate concrete
8. List methods used to estimate concrete volume
9. Estimate concrete using methods listed in objective eight
10. Name types of reinforcing used in concrete
11. Match common rebar numbers to their correct diameter sizes
12. Select from a list common sizes of welding wire fabric
13. Label parts of a concrete foundation
14. Identify types of concrete footings and foundations
15. Discuss the design of footings and foundations
16. Arrange in order steps involved when constructing concrete foundations
17. Estimate amount of concrete for a footing.
18. Estimate amount of materials needed to pour a foundation
19. Demonstrate the ability to:

a. Obtain representative fresh concrete test samples for a slump test (ASTM C172-82)
b. Perform a slump test (ASTM C143-78)

Unit A II: **Footing and Foundation Forms**

1. Match terms associated with footing and foundation forms to their correct definitions
2. Discuss external factors that affect form design
3. Identify the parts of a form
4. Identify types of form ties and clamps
5. Name methods of form construction for footings
6. Demonstrate the ability to:
   a. Set forms for a continuous footing
   b. Construct and set forms for a pier footing
   c. Strip pier-footing forms and prepare forms for erection at another location

Unit A III: **Edge Forms**

1. Match terms associated with edge forms to the correct definitions
2. Name types of pours using edge forms
3. Name materials used for edge forms
4. Identify parts of edge forms
5. Match terms associated with joints to their correct definitions
6. Name reasons for using joints in pavements
7. Identify types of joints used in pavements
8. List types of sealants used in joints
9. Identify types of curbs and curb and gutters
10. Label types of stairs
11. Identify parts of a stair form
12. Name types of stair slabs
13. Identify types of stair forms for each type of slab
14. State rules for unit rise and run
15. Calculate number of risers and number and width of treads for a stair of given dimensions
16. Demonstrate the ability to:
    a. Construct edge forms for a slab on grade without foundation
    b. Construct edge forms for a slab on grade with foundation
    c. Construct edge forms for a patio with radius
    d. Construct forms for small set of steps
    e. Construct forms for earth-supported stairs
    f. Construct forms or suspended stairs

Unit A IV: **Special Applications**

1. Match terms associated with special applications to their correct definitions
2. Identify types of special foundations
3. Discuss the classification of piers
4. State the ratio of pier height to minimum transverse dimension
5. Explain the need for different foundation types and sizes in various areas of the Unites States
6. List types of loads that act on a structure
7. Computer maximum height of piers
8. Determine minimum foundation depth for frost penetration

Unit B I: **Floors and Sills**

1. Match terms associated with frame floors and sills to their correct definitions
2. Identify floor and sill framing and support members
3. Name methods used to fasten sills to the foundation
4. Select from a list types of beams/girders
5. List types of floor joists
6. Label types of bridging
7. List types of flooring materials
8. Discuss functional designs used to lay subflooring
9. List purposes of subflooring and underlayment
10. Match fasteners used in floor framing to the correct uses
11. Estimate the amount of material needed to frame a floor assembly
12. Demonstrate the ability to:
    a. Lay out and construct a floor assembly
    b. Install bridging
    c. Install joists for a cantilever floor
    d. Install subfloor materials
    e. Install a single floor system using tongue and groove material

Unit B II: **Walls and Ceilings**

1. Match terms associated with framing walls and ceilings to their

correct definitions
2. Identify framing members used in wall and partition framing
3. Complete drawings of common methods used to construct outside corners of wall frames
4. Complete drawings of common methods used to construct partition Ts
5. Label types of headers
6. Calculate the length of a regular stud
7. Compute rough opening (R.O.) dimensions for doors
8. Calculate the length of trimmers for window and door openings
9. Calculate the length of herders for rough openings
10. Select from a list construction details that should be added during wall framing
11. List methods used to brace walls
12. Select from a list pennyweights of nails most often used in framing
13. Select from a list considerations to be made before selecting joist size and spacing
14. List methods used to support ceiling joists
15. List methods used to anchor joists to partition walls
16. Estimate materials for ceiling joists
17. Describe methods used to prevent joists from twisting or bowing
18. Calculate amount of materials for wall and partition framing
19. Demonstrate the ability to:
    a. Lay out wall and partition locations on floor
    b. Cut studs, trimmers, cripples, and headers to length
    c. Assemble corners, Ts, and headers
    d. Construct wall sections for a single-story structure
    e. Lay out and install ceiling joists

Unit B III: **Roofs**

1. Match terms associated with roof framing to their correct definitions
2. List types of roof supports
3. Identify roof framing members
4. Label roof framing units
5. Discuss slope and pitch ratios
6. Identify parts of a rafter
7. List methods for determining rafter length
8. Use a framing square to compute the length of a common rafter
9. Use a framing square to compute the length of a hip rafter
10. Use a framing square to compute the length of jack rafters
11. Select from a list types of roof openings
12. List types of vents used in roof construction
13. Estimate material needed to frame a roof
14. Demonstrate the ability to:
    a. Lay out rafter locations on top plate and ridgeboard on 2-foot centers
    b. Lay out, cut, and erect rafters for gable roofs
    c. Frame a gable end with a vent opening
    d. Frame an opening in a roof
    e. Erect trusses for a gable roof
    f. Lay out, cut and erect rafters for an interesting hip roof with valley
    g. Lay out, cut, and erect rafters for hip roofs
    h. Apply roof sheathing

Unit B IV: **Special Framing**

1. Match terms associated with special framing to their correct definitions
2. Identify types of special house designs
3. Identify special framing projects
4. Match terms associated with stairs to their correct definitions
5. Identify parts of a staircase
6. Identify basic types of stairs
7. List factors that must be considered when building a staircase
8. State rules of thumb for unit rise and unit run
9. Calculate number and size of risers and treads for a stair of given dimensions
10. Label methods used to secure stringers
11. Estimate materials for housed stairs
12. Construct a stair

Unit C I: **Cornices and Gable Ends**

1. Match terms associated with cornices and gable ends to their correct definitions
2. Label types of cornice designs
3. Identify parts of a box cornice

4. Identify parts of a boxed rake section
5. Identify types of cornice moldings
6. Label types of tail-rafter cuts
7. Select from a list materials used for soffits
8. Select from a list hardware and fasteners used on or with cornices
9. Name exterior wall coverings used on gable ends
10. Estimate material needed for cornices and gable ends
11. Demonstrate the ability to:
    a. Build a horizontal box cornice
    b. Apply siding to a gable end

Unit C II: **Roofs**

1. Match terms associated with roofing to their correct definitions
2. State safety rules pertaining to roofing
3. Identify the parts of a roof
4. Identify traditional residential roof designs
5. Name classes of roofing
6. Match minimum slope requirements to their specific roofing applications
7. List types of roofing materials
8. Identify basic types of asphalt shingles
9. Distinguish between the definitions of wood shingles and wood shakes
10. State decking requirements for applying wood shingles and wood shakes
11. State procedures for applying wood shingles
12. State procedures for applying wood shakes
13. List guidelines for applying underlayment
14. Describe general requirements for applying flashing
15. Select from a list areas where flashing should be used
16. Select from a list types of materials used for flashing
17. Match roofing equipment and tools to their correct uses
18. Select from a list procedures for applying double starter course of asphalt shingles
19. State procedures for applying shingles with cutouts that break joint in half
20. Arrange in order steps for installing flashing at open-valley locations
21. Estimate roofing materials needed for a three-tab asphalt-shingle roof
22. Demonstrate the ability to:
    a. Apply asphalt shingles with 5-inch exposure
    b. Apply wood shingles with 5-inch exposure over spaced sheathing

Unit C III: **Exterior Walls and Trim**

1. Match terms associated with exterior walls and trim to their correct definitions
2. Name types of wall sheathing
3. Identify styles of siding
4. Identify joint details for plywood siding
5. Identify types of exterior moldings and trims
6. List recommendations for waterproofing exterior walls
7. Estimate amounts of siding for given jobs
    a. Estimate siding for a house with a gable roof
    b. Estimate sheathing and siding for a house with a hip roof
8. Demonstrate the ability to:
    a. Install sheathing
    b. Install bevel siding
    c. Install sheathing and plywood siding

Unit C IV: **Windows**

1. Match windows and accessories to their correct descriptions
2. Name types of sliding windows
3. Name types of swinging windows
4. Name types of fixed windows
5. Select from the list types of materials used to construct windows
6. Identify parts of a window installation
7. Select from a list types of materials used for window panes
8. State information a carpenter should know when installing windows
9. State recommendations for a good window installation
10. Demonstrate the ability to install a double-hung wood window unit

Unit C V: **Exterior Doors**

1. Match terms associated with exterior doors to their correct

definitions
2. State basic classifications of exterior doors
3. Identify types of entry doors
4. Identify parts of an exterior door installation
5. List materials used in door construction
6. Name materials used for exterior doorsills
7. Select from a list standard sizes of exterior doors
8. Explain the numbering system for doors
9. Complete statements about recommended finish clearances and dimensions for hanging doors
10. Identify door swing (hand)
11. Identify hardware used with exterior doors
12. List types of thresholds used with entrance doors
13. Demonstrate the ability to:
    a. Install a metal threshold on a concrete floor
    b. Install an exterior prehung door unit
    c. Install entry door frame, casing, door, and lock
    d. Install door frame and inside jambs for an overhead garage door

Unit D I: **Insulation**

1. Match terms associated with insulation to the correct definitions
2. Explain the functions of the two basic kinds of insulation
3. Select from a list benefits of using insulation in a structure
4. List types of insulation commonly used in residential construction
5. Name general classifications of insulation materials
6. List areas where insulation should be used in residential construction
7. List factors that determine the amount of insulation needed for walls, ceilings, and floors
8. Name types of materials used for vapor barriers
9. Select from a list methods used to apply insulation and vapor barriers
10. Estimate the packages of insulation needed to insulate a structure
11. Demonstrate the ability to:
    a. Install vapor barrier and insulation for a concrete slab on grade
    b. Install blanket insulation in walls

Unit D II: **Drywall**

1. Match terms associated with drywall to their correct definitions
2. Name of types of drywall
3. Select from a list standard sizes of drywall
4. Identify standard edge shapes of drywall
5. State benefits of using drywall
6. Describe types of base or construction where drywall is used
7. Identify hardware and fasteners used with drywall
8. Select from a list of types of finishes that may be applied to drywall
9. Estimate materials needed to drywall a structure
10. Demonstrate the ability to:
    a. Install drywall
    b. Finish drywall joints and depressions

Unit D III: **Interior Walls and Ceilings**

1. Match terms associated with wall and ceiling finishes to their correct definitions
2. List materials used to finish walls and ceilings
3. Name styles of paneling
4. Identify joint treatments for paneling
5. Estimate the number of 4’x 8’ sheets needed to panel a room
6. List materials used to fabricate ceiling tile
7. List factors that influence types of ceiling tile to be used
8. Estimate the number of ceiling tiles needed to finish a ceiling
9. Demonstrate the ability to:
    a. Install V-grooved paneling and trim
    b. Install panel wainscot and trim
    c. Install furring strips on masonry wall
    d. Install ceiling title over drywall
    e. Install furring strips on ceiling joists and ceiling tile on furring

Unit D IV: **Interior Doors and Trim**

1. Match terms associated with interior doors and trim to their correct definitions
2. State the general types of interior door construction
3. State the basic classifications of interior doors
4. Identify types of interior doors

5. Identify parts of an interior door unit
6. Select from a list standard sizes of interior doors and jambs
7. Identify hand of a door
8. Select from a list recommended finish clearances and dimensions for hanging doors
9. Compute rough opening size for interior doors
10. Identify hardware used with interior doors
11. Identify types of interior trim
12. Estimate material needed to trim a room
13. Demonstrate the ability to:
    a. Install interior door frame, hang door, lock, and trim
    b. Install split-jamb prehung door unit
    c. Install a solid-jamb prehung door unit
    d. Install a bifold door unit
    e. Install a pocket door unit
    f. Install window trim

Unit D V: **Cabinet and Special Built-Ins**

1. Match terms associated with cabinet installation and special built-ins to their correct definitions
2. Name types of cabinets
3. Identify parts of a cabinet
4. Name the standard sizes of base and top cabinets
5. Label types of cabinet-door installation
6. Label styles of cabinet doors
7. Label types of joints used in cabinet construction
8. Identify hardware used on cabinets
9. List types of material used on counter tops
10. List types of special built-ins
11. Demonstrate the ability to
    a. Install a factory-built cabinet
    b. Install shelves in a closet

Unit D VI: **Flooring**

1. Match terms associated with floor finishes to their correct definitions
2. Name types of underlayment for finish flooring
3. Estimate the number of 4’x 8’ sheets of underlayment needed to floor a room
4. Name types of finish flooring
5. List factors to consider when selecting finish flooring
6. Identify types of hardwood flooring
7. List types of wood used for hardwood flooring
8. Name types of resilient flooring
9. Estimate the number of tiles needed to floor a room
10. Demonstrate the ability to:
    a. Install underlayment
    b. Install tongue-and-groove hardwood strip flooring
    c. Install block flooring
    d. Install resilient tile

Electrical Construction Worker Standards

Source: Electrical Construction Occupations Handbook Volume One. Bethesda, MD: U.S. Electrical Construction Industry Skill Standards and Certification Project, 1995.

1. SAFETY
   - A. General jobsite safety awareness
     1. why safety is important
     2. key factors involved with safe work practices
     3. develop respect for electricity
        a. be aware of dangers of shock
        b. describe locations of potential shock hazards
        c. demonstrate use of no contact voltage indicators and other devices to determine if system is energized
        d. demonstrate techniques for working on energized circuits
     4. hazards created by poor housekeeping on the job
     5. maintain safe work area and tools
     6. be aware of the dangers of falling object
     7. respect and obey job safety rules
   - B. Emergency procedures
     1. first aid training
        a. general
        b. emphasis on electrical shock situations
     2. CPR
     3. means to effect emergency rescues
   - C. Compliance with OSHA and EPA regulations
     1. attend and/or conduct regular safety meeting
     2. general OSHA requirements on the jobsite
     3. the guidelines for OSHA Assured Equipment Grounding and GFCI usage
     4. use of material safety data sheets (MSDS) to identify and properly handle hazardous materials (e.g. cleaning fluids, transformer oils)
   - D. Substance abuse

1. kinds and effects of drugs
2. identifying and dealing with substance abuse
3. identifying sources of information and help

II. TOOLS, MATERIALS, AND HANDLING

A. Proper tool management
1. identify common hand and power tools
2. proper selection and application of hand tools
3. proper selection and application of power tools
4. proper care for tools
5. safe techniques for using ladders
6. defects that make tools unsafe to use
7. use of meters to take readings

B. Proper rigging methods
1. proper knots
2. proper techniques for rigging and hoisting
3. safe capacities for lifting arrangements

C. Proper digging techniques
1. depth and shape of holes for supporting poles
2. proper techniques for digging, grading, and leveling trenches for the installation of duct work

D. Proper use of motorized tools (use of platform lifts, bucket trucks, and truck mounted cranes)

E. Proper material management
1. identify commonly used materials by name
2. proper selection and application of materials

III. MATH

Appropriate mathematical calculations to solve for unknowns
1. arithmetic operators
2. solving word problems
3. problems involving fractions
4. reducing fractions to lowest terms
5. converting decimals to fractions and back
6. angles and sides of triangles
7. unknown angles and sides of triangle
8. metric prefixes and converting different prefixes
9. using powers of ten to perform math functions
10. converting from English to metric measurement systems
11. algebraic formulas
12. square roots
13. ratio, percentages, and proportion
14. problems using direct and inverse relationships

IV. ELECTRICAL THEORY

A. Basic electrical theory
1. define terms, units of measure
2. electron flow
3. producing electrical current
4. products (effects) of electrical current

B. Ohm’s Law, Kirchoff’s Law, Lenz’s law, Thevenin’s and Norton’s Theorems

C. Series circuits
1. components
2. resistance of circuits
3. total resistance
4. effects of changing voltage and resistance
5. law of proportion for series voltage divider circuits
6. power used in circuits
   a. by components
   b. wasted power

D. Parallel circuits
1. components
2. differences between series and parallel circuits
3. Ohm’s law
4. circuits
5. total resistance using product-sum and reciprocal methods
6. alternate current paths
7. currents
8. law of proportion
9. power requirements of components

E. Combination circuits
1. combination circuits
2. components
3. equivalent resistance
4. alternate current paths

5. Ohm's law
6. power use and dissipations

F. Characteristics of voltages in circuits
   1. polarity and flow of electrons
   2. distribution and voltage drops
   3. proper wire size needed to lower losses

G. Characteristics of magnetism/electromagnetism

H. Theory of superposition and solving for multiple voltage source circuits

I. Operation and characteristics of three wire systems

J. Operation and characteristics of three phase systems
   1. identify differences between 3 wire single phase and three phase circuits
   2. voltage drop and power loss

K. AC Theory
   1. terms associated with AC theory
   2. currents and voltages for components and circuits
   3. conductor size using NEC
   4. current and voltage sine waves to demonstrate phase relationships
   5. maximum, effective (rms), average, and peak-to-peak voltage and current
   6. inductance
      a. factors that affect inductance
      b. behavior of current when inductance is present
      c. relationship between current, applied voltage, and counter electromotive force
      d. inductive reactance when frequency and inductance are known
      e. inductance, inductive reactance, and unknowns in various circuits
   7. capacitance
      a. effects on circuits of capacitance
      b. capacitance, capacitive reactance, and frequency
   8. relationships and behaviors of series RL, parallel RL, series RC, parallel RC, series LC, parallel LC, series LCR and parallel LCR circuits
   9. function, operation, and characteristics of rectifiers
      a. actions of full-wave and half-wave rectifiers
      b. schematics
   10. series resonance, parallel resonance and circuits
   11. filters
   12. Power Factor
      a. watts, vars and volt-amperes
      b. reactive power
      c. proper placement of power factor correction capacitors
      d. procedure to recognize and correct poor power factor arrangements
   13. power quality issues
      a. causes of poor quality
      b. the effects of harmonics
      c. locating harmonics through observation and test equipment
      d. techniques to reduce or eliminate effects of harmonics

L. Use of electronics
   1. electron flow through solid state components
   2. precautions against electrostatic discharges around semiconductor devices
   3. functions, operation and characteristics of diodes and zener diodes
      a. characteristic curves
      b. testing procedures
      c. schematics including diodes
   4. functions, operation and characteristics of transducers
      a. operation of transducers
      b. schematics including transducers
   5. functions, operation and characteristics of various types of transistors (diacs, triacs, SCRs, etc.)
      a. operation of transistors
      b. current and voltage values
      c. testing procedures
      d. schematics including transistors
   6. functions, operations, characteristics and circuit configurations of amplifiers
      a. basic circuit configurations for various types of amplifiers

7. functions, operations, and characteristics of integrated circuits (ICs)
    a. schematics of and including ICs
    b. information on data sheets for integrated circuits
8. functions, operations and characteristics of three main categories of photo-operated devices
9. digital and logic circuits
    a. terms associated with digital and logic circuits
    b. types circuits
    c. the operative symbols for AND, OR, NOT operations
    d. the use of Boolean Algebra equations, laws, operations and theorems
    e. truth tables from Boolean equations and digital switching circuits
    f. gate functions and gate circuits
    g. BUFFER and INVERTER amplifiers and accompanying truth tables
    h. operation and characteristics of NAND and NOR logic and accompanying truth tables
    i. operation and characteristics of XOR and XNOR logic and accompanying truth tables
    j. positive and negative logic and its effect on gate operation
    k. digital logic equivalent circuits
    l. various optoelectronic devices

V. CODE REQUIREMENTS

National Electrical Code and local codes

1. Purpose and intent of electrical codes
2. Scope of NEC and local codes
3. How local codes may differ from NEC
4. Utilizing code book
    a. mandatory rules
    b. Fine Print Rules
    c. “neat and workmanlike”
    d. locate definitions
    e. interpretations
    f. recognize and use exceptions
    g. materials recognized by the NEC
    h. identify code markings
    i. distinguish wet, damp, and dry locations
    j. determine if specific installations are acceptable to the Code
    k. requirements for special occupancies and special equipment
    l. answer specific questions
5. Use NEC to calculate various general job requirements
    a. service conductors, feeders, branch circuits
    b. permissible loads on various circuits
    c. allowable cable tray fills
    d. ampacity of various conductors and fill situations
    e. ampacity of various circuits and load types
    f. overload protection for motors, equipment and phase converters
    g. minimum ampacity for motor disconnecting means
    h. horsepower ratings for motors and disconnecting means
    i. grounding requirements
6. Use NEC for hazardous locations
    a. hazardous locations by Class
    b. equipment and wiring methods necessary for particular hazardous locations

VI. CONDUCTORS

A. Various types of conductors
    1. types of conductors and insulators
    2. why some materials are better conductor or insulators than other
    3. effect of heat on insulators
    4. sizing and typing of conductors
        a. use letter symbols to identify insulator types
        b. use American Wire Gauge chart
        c. and convert inches, mils, square mils, and circular mils from one to the other
    5. differences between aluminum and copper conductors
    6. properties of high voltage cable
    7. effects of soil conditions on underground cable

B. Conductor installation techniques
   1. different wiring methods for particular conductors and situations
      a. wire connectors
      b. types, installation, limitations
   2. different methods of installing conductors in conduits, raceways and cable trays
      a. problems which may be encountered
      b. maximum tension allowed
      c. use of pulling machines to assist in installation of wire
   3. proper splicing methods and techniques for various conductors and locations
C. Methods for selecting conductors
   1. using Code to determine type of conductor to use in particular situation
   2. using mathematical calculations to determine current carrying capacity of conductors
   3. calculating or selecting cable ampacity from NEC tables
   4. loads for sizing conductors
   5. Code requirements depending on types of circuits and loads (lighting, appliance, heating, service entrance)
D. Cable fault situations
   1. the types and causes of cable faults
   2. methods and equipment for locating cable faults including terminal, tracing and magnetic detection

VII. CONDUIT, RACEWAYS, PANELBOARDS AND SWITCHBOARDS
A. Terms associated with conduits and raceways
B. Conduit and wiring support systems recognized by Code
   1. select appropriate conduit type
   2. select and utilize appropriate connectors
   3. select and utilize appropriate fastening devices and reinforcements
   4. special considerations
C. Procedures for laying out various types of bends
   1. takeup and gain
   2. kicks and offsets
   3. calculate degrees
   4. back-to-back bends
   5. determine overall length of conduit for specific situations
   6. locating bending points
   7. four techniques for segment bending
   8. techniques and operations for making concentric bends
   9. radius of circle
D. Procedures for making bends when fabricating conduits
   1. hand benders to make bends on small diameter conduit
   2. power benders to make bends on larger diameter pipe
      a. make offsets using “constants” or “shrink” methods
      b. make bends in proper sequence, direction and with necessary accuracy
E. Fabricating raceways and wiring support systems
F. Cable assembly wiring methods recognized by the Code
G. Function, operation and requirements for various panelboards and switchgear
   1. Installation of panels
   2. Installation of components
   3. Wiring and connections
   4. Special considerations and occupancies

VIII. LIGHTING SYSTEMS
A. Function, operation and characteristics of various lighting Systems
   1. incandescent
   2. florescent
   3. HID
   4. low voltage
B. Lighting distribution and layout
C. Installation and connection of fixtures

IX. OVERCURRENT DEVICES
Function, operation, and characteristics of overcurrent protection devices
   1. purpose and location of devices
   2. three consideration necessary for electrical component protection

3. interrupting ratings
4. short circuit currents
5. overload and overcurrent situations
6. 10 and 25 foot tap rules
7. operation and application of fuses
   a. single element and time delay
   b. the effects of heat
8. operation and application of various types of circuit breakers (e.g., molded case, air break)
9. utilize Peak-Let-Thru charts and table
10. function, operation and characteristics of ground fault circuit interrupters
11. function, operation and characteristics of surge protectors
12. appropriate devices for situation and according to Code

X. GROUNDING SYSTEMS
   A. Functions, operations, and characteristics of grounding systems
      1. reasons for grounding systems
      2. general types of faults
      3. grounding electrode systems
   B. Sizing, layout and installation of grounding systems
      1. NEC requirements and interpretations
      2. size of conductors and interpretations
      3. installation of electrodes
      4. installation of conductors and connections to electrodes
      5. the impact of soil conditions on earth grounding systems and equipment
      6. principles and procedures of earth resistance testing
      7. determine when ground fault protection is required
   C. Difference between insulation, isolation and elevation
   D. Difference between grounding, grounded, and bonding
   E. Special circumstances
      1. systems over 1,000 volts
      2. separately derived systems
      3. buildings sharing service

XI. PRINTS AND SPECIFICATIONS
   A. Creation of blueprints, plans, and specifications
      1. utilize symbols used in electrical and related trades
      2. recognize functions of basic line types
      3. identify drawing tools and techniques
         a. orthographic views
         b. types of projections
         c. drafting scales
      4. recognize and apply dimensions
      5. prepare “as-built” drawings
      6. differences between wiring diagrams, line drawings, schematics, and ladder diagrams
         a. given schematics complete wiring diagrams
         b. given panels and equipment layouts create drawings showing conduits and conductors using appropriate scale
   B. Use of blueprints, plans, and specifications
      1. recognize function of various types of plots, sections, details, schedules, specification sheets, addendums, and revisions
      2. determine devices, locations, quantities, feeds, conduit types and sizes and conductor sizes
         a. parts of the electrical service
         b. identifying special purpose outlets and the loads they serve
         c. completing take-off sheets for ordering material
         d. determine costs for job
         e. how cost affect job
      3. interpret non-electrical dimensions and considerations
      4. relationships between architectural considerations and electrical installations
      5. correlate information from other trades plans with electrical plans to determine potential conflicts

XII. MOTORS, MOTOR CONTROLLERS AND PROCESS CONTROLLERS
   A. Function, operation and characteristics of various types of motors (AC, DC, dual voltage, repulsion, universal, 3 phrase, squirrel cage, synchronous)
      1. physical parts of various motors
      2. utilize information sheets, plans, schematics, and motor

nameplates to gain information
3. motor losses
4. starting and operating characteristics
5. methods to identify windings in DC motors
6. means for providing for field failure, current limit, voltage and speed control
7. block diagrams to demonstrate power supplies, armature, field and control features
8. torque, locked rotor current, no-load speed, and slip
9. reasons for low-voltage starting
10. function, operation and characteristics of stepping motors

B. Proper techniques for motor installations
1. necessary calculations for electrical requirements per Code
2. correct power factor
3. proper wire type and size
4. appropriate connections
5. how various motors can be made to run at different speed or in reverse direction
   a. schematics
   b. connections to reverse or change speeds
6. identify unmarked motor leads
7. steps for proper handling of motors
   a. checks for mechanical defects
   b. factors to be checked when a motor arrives at jobsite
   c. methods for putting motor into storage

C. Function, operation and characteristics of motor controllers, circuits, and devices
1. ways and means of starting and stopping motors
2. operation of magnetic soil
3. use of magnetic starters and controllers
4. correct sizing of magnetic starters and controllers
5. difference between starters and contactors
6. function, operation and characteristics of overload protective devices
   a. thermal overload
   b magnetic overload
7. schematics for various control circuits
8. two-wire control circuits
9. three-wire control circuits
10. interlocking methods
11. reversing and sequential controllers
12. jogging, inching, plugging
13. multiple start-stop controls and selector switches
14. phase failure relays
15. various manual and automatic speed control techniques
16. function, operation and characteristics of variable frequency drives
17. function, operation, characteristics and installation procedures for programmable logic controls
18. ladder diagrams
19. function, operation, and characteristics of timers, counters, sequencers
20. utilize appropriate manuals and information for start-up, maintenance and testing
21. utilize schematics for manual starters, automatic starters, speed regulators and controllers

D. Function, operation and characteristics of switches and relays
1. schematics including switches and relays
2. installation and connection methods for various switch types
3. installation and connection methods for various relays
4. function, operation and characteristics of electronic sensor and pilot devices
5. function, operation and characteristics of control transformers
   a. leads of control transformers
   b. proper sizing of control transformers

E. Mechanical connections to utilize motors
1. operation of mechanical clutches and magnetic drives
2. function, operation, characteristics and installation of:
   a. closed loop and open loop systems
   b. feedback control
   c. proportional control
   d. integral control
   e. derivative control

3. block diagrams including control systems and devices
4. the function, operation, and characteristics of sensors and transmitters

XIII. GENERATORS AND POWER SUPPLIES
- A. Principles of electromotive force
- B. Principles of generating electricity
  1. the parts, functions, operation and characteristics of the AC generator
  2. the parts, functions, operation and characteristics of the DC generator
  3. the "left hand rule" for generations
  4. RPM, frequency and number of poles in a given generator
  5. 3 phase generation
  6. wye and delta windings
  7. 3 phase sine wave
- C. Types and configurations of uninterruptible power supplies (UPS)
- D. Types and configurations of battery systems used for UPS Systems

XIV. TRANSFORMERS
- A. Function, operation, and characteristics of transformers
  1. electrical principles involved in transformer operation
  2. transformer classifications and applications
  3. transformer losses
  4. ratios for voltage and amperage with respect to turns
- B. Selection and installation of transformers
  1. nameplate information
  2. techniques for sizing transformers (one and three phase)
  3. determining if given transformer
  4. calculating voltages and currents for load and windings
  5. determining whether to use wye or delta wiring schemes
  6. steps for receiving and preparing transformer for installation
  7. necessary tests to assure proper operation
  8. proper techniques for connecting power and load conductors
  9. methods for determining proper types and values of electrical protective devices
  10. proper grounding procedures
- C. Distribution systems
  1. functions, operation and characteristics of various types of distribution systems
  2. criteria for selecting particular type of distribution system

XV. PERSONAL DEVELOPMENT
- A. Orientation
  1. Make up and organization of the industry
     a. Jobsite chain of command
     (1) owner/customer
     (2) architects/engineers
     (3) inspection authorities
     (4) construction managers
     (5) general contractors
     (6) other contractors and trades
  2. Organizations within industry
     a. manufacturers
     b. distributors
     c. associations
     d. unions
- B. Methods of working with others
  1. the three basic theories of motivation
  2. need levels of humans
  3. the role of supervisors
     a. leadership styles appropriate to certain situations
     b. need for competent supervisors
  4. effective communications
     a. importance of communications in the industry and on the job
     b. barriers to communications
     c. keys to effective communications
- C. Economic considerations
  1. why worker future is tied to employer's
  2. responsibilities to employer
     a. keeping skills current

b. managing your future
3. costs of doing business
4. importance of satisfying customers
5. impact of job performance, behavior and appearance on prospects for future work
6. functions of marketing

XVI. JOBSITE MANAGEMENT
- A. Coordinating tool needs with office of other jobs
- B. Coordinating schedule with other crafts
- C. Developing timetables and progress charts
- D. Completing time sheets, logs and other necessary documentation
- E. Clearances or permits if necessary
- F. Inventory and order necessary equipment according to job Needs
- G. Developing alternative solutions and choose the best Alternative
- H. Planning and organizing tasks to meet deadlines
- I. Supervising and monitoring others
- J. Picturing the way the project will appear when completed

XVII. TESTING
- A. Steps used for various testing processes
  1. acceptance testing of cables
  2. maintenance testing of generators
  3. insulation testing using megohmmeter
- B. Utilizing the results of testing procedures
  1. special requirements for high voltage testing
  2. describe potential safety hazards
  3. characteristics and properties of high voltage cable and insulators
  4. appropriate test methods, voltages and equipment

XVIII. SPECIALTY SYSTEMS
- A. Fire Alarms
  1. functions, operations and characteristics of various types of fire alarm systems and components
  2. Code requirements and use Code to answer specific questions
  3. the functions, operation and characteristics of alarm initiating and indicating devices
  4. multiplexing of system components
  5. various types of areas and methods to protect them
  6. appropriate wiring methods and devices
  7. utilize manuals to start-up and check out system
  8. utilize proper manuals and techniques for system maintenance and troubleshooting
- B. Security Alarms
  1. functions, operations and characteristics of various types of security systems and components
  2. Code requirements and use Code to answer specific questions
  3. the functions, operation and characteristics of alarm initiating and indicating devices
  4. multiplexing of system components
  5. various types of areas and methods to protect them
  6. appropriate wiring methods and devices
  7. utilize manuals to start-up and check out system
  8. utilize proper manuals and techniques for system maintenance and troubleshooting
- C. Voice, Data, TV, Signaling Systems
  1. functions, operation and characteristics of various types of voice, data, TV and signaling systems
  2. the proper cabling systems required for various systems (telephone, data, Local Area Networks, etc.)
  3. installation and connection techniques for cables and devices
  4. how cable defects and installation errors can degrade data transfer
  5. utilize manuals to install, test and start-up and check out systems
  6. utilize proper manuals and techniques for system maintenance and troubleshooting
- D. Lightning Protection Systems
  1. functions, operation and characteristics of lightning

protection systems
2. the sizing, layout and installation of lightning protection systems
3. NEC requirements and interpretations
4. size of conductors and electrodes
5. installation of electrodes
6. installation of conductors and connections to electrodes

E. Fiber Optic Systems
1. functions, operation and characteristics of fiber optic cable
2. proper installation techniques
   a. minimum bend radius
   b. pulling techniques
   c. installation hardware
   d. splicing and termination
3. utilize appropriate manuals and equipment to perform systems test and troubleshooting

F. Heating, Air Conditioning, and Refrigeration
1. the function, operation and characteristics of heating, air conditioning, and refrigeration systems and components
2. the characteristics of heat energy, transfer, and measurement
3. space and process heating
4. the properties and characteristics of refrigerants
5. the appropriate piping techniques for refrigerants
6. utilize appropriate manuals and equipment to perform system tests and troubleshooting

ALL ASPECTS OF THE INDUSTRY

Recent national legislation requires that vocational education programs provide a strong experience in "all aspects of the industry" (AAOI) for industries that students are preparing to enter. AAOI's ultimate goals is to give future workers a sense of the issues involved in the world of work. Such knowledge can empower future workers to make informed decisions about their career paths. This knowledge can also allow workers to make meaningful contributions to the industry, instead of performing mindlessly like another piece of equipment. The main areas of AAOI include:

- Planning
- Management
- Finance

- Technical and Production Skills
- Principles of Technology
- Labor and Community Issues
- Health/Safety/Environment
- Personal Conduct

Duty Bands and Objectives

A. Planning

A1 Describe why industries respond to customer wants and expectations.
A2 List differences in how companies deliver products versus delivering services.
A3 Describe ways a worker can influence company decision-making.
A4 Identify benefits in anticipating technology and market trend changes.
A5 Identify an example of how regulatory laws can impact how a business operates.
A6 Identify an example of how a political organization can impact how a company operates.

B. Management

B1 Identify key components of a company "mission statement."
B2 Identify how a corporate "chain of command" works.
B3 Describe the significance of a company's "corporate culture."

B4 Describe how a company organizes its departments
B5 List typical ways company departments communicate.
B6 City examples of why a worker should adjust to different management styles
B7 Cite an example of how companies are dependent on the national economy.
B8 Cite an example of how a company is dependent upon the local economy.
B9 Describe the importance of achieving internal and external customer satisfaction.
B10 Identify examples of how cultural diversity can affect an industry.
B11 Identify key differences in how private companies and government agencies operate.
B12 List reasons why written policies are used in industry
B13 Identify resources available from professional organizations
B14 Identify how roles and responsibilities in a family business are different than in larger companies
B15 List benefits a worker can get by participating in meetings
B16 List key differences in how a family farm operates versus how another small business operates
B17 Describe how a company's marketing affects all its employees

C. Finance

C1 List typical ways a business obtains capital.
C2 Describe the importance of accounting in a business
C3 Describe key implications for a company which grants credit
C4 Describe how a company estimates and bids for a contract
C5 Describe how paycheck deductions affect a worker
C6 Describe the importance of cost containment in a company

D. Technical and Production Skills

D1 Demonstrate a basic math ability.
D2 Demonstrate the capability to measure quickly and accurately.

D3 Demonstrate the ability to speak and write the English language effectively.
D4 Demonstrate the ability to listen effectively.
D5 Demonstrate the ability to use effective negotiation skills.
D6 Demonstrate the ability to manage time effectively.
D7 Demonstrate the ability to read blueprints and drawings.
D8 Demonstrate the ability to perform basic computer operation.
D9 Describe the importance of deadlines and schedules.
D10 Demonstrate the ability to use team player skills.
D11 Demonstrate the ability to use supervisory and delegation skills.
D12 Demonstrate the ability to utilize good public speaking skills.
D13 Describe the importance of using troubleshooting techniques.
D14 Cite one example of a job that is inter-related with another job.
D15 Demonstrate the ability to obtain technical information.
D16 Identify certification requirements for a specific job.

E. Principles of Technology

E1 Describe the key characteristics of the technology used in your industry.
E2 Describe the importance of analyzing new equipment for possible use.
E3 Describe the importance of continuously upgrading one's job skills.
E4 Describe the importance of adaptability and learning from experience.
E5 Describe the importance of acquiring and analyzing information effectively and making sounds decisions.
E6 Describe the importance of cross-training.

F. Labor

F1 Describe the importance of a written job description.
F2 Describe the importance of knowing your rights as a worker.
F3 Describe the role labor organizations play in your industry (if any.)
F4 List advantages/disadvantages of hourly and salaried pay.
F5 List differences between being a self-employed worker and a worker employed by a company.
F6 Describe the importance of participating in quality enhancement programs.
F7 Describe the importance of understanding why a worker is asked to occasionally work longer hours.
F8 Describe the importance of cultural sensitivity.

G. Community

G1 Describe the importance of recognizing a worker should contribute special skills through volunteer work.
G2 Identify key ways a company helps its community.
G3 Identify key ways a community helps a company.
G4 Identify an impact of buying outside the community.
G5 Describe how a company's public perception is important.
G6 Describe the importance of providing for the access needs of the physically challenged.

H. Health, Safety, and Environment

H1 Describe the importance of complying with federal agency regulations.
H2 Describe why it is important to avoid job-specific health threats.
H3 Read and comprehend major components of a Material Safety Data Sheet
H4 Identify basic safety training (tornado, fire, first aid) techniques.
H5 Describe the importance of participating in preventive medicine programs
H6 Describe the importance of handling stress effectively
H7 Describe the importance of good workplace ergonomics
H8 Identify any effects weather could have on an industry.
H9 Describe the importance of management's responsibility for a safe workplace.

I. Personal Conduct

I1, Describe the importance of recognizing the dignity of all work.

I2. Describe the importance of producing quality and effective work.

I3. Describe the importance of being fit for duty (no drugs, no alcohol).

I4. Describe the importance of exhibiting good attitude, enthusiasm, integrity.

I5. Describe the importance of exhibiting good grooming and appearance.

I6. Describe the importance of good personal financing.

Source: All Aspects of the Industry (65-9000-1). University of Missouri-Columbia: Instructional Materials Laboratory, 1994.

PRE-EMPLOYMENT/WORK MATURITY SKILLS

In 1992, three Missouri agencies co-published the Pre-Employment and Work-Maturity Competencies: A Guide for Practitioners. The Missouri competencies identified in the practitioner's guide are endorsed by all three agencies: the Missouri Department of Elementary and Secondary Education, the Department of Labor and Industrial Relations, and the Department of Economic Development. This list includes seven core competencies and related employability skills. Locally developed learner outcomes may, of course, be added, and local groups are encouraged to utilize the identified state competencies for development of their own pre-employment and work maturity skills.

A. Making Career Decisions
- A1. Perform self assessment
- A2. Explore occupational information
- A3. Perform decision-making process

B. Using Labor Market Information
- B1. Identify sources of information
- B2 . Use labor market information

C. Preparing a Resume
- C1. Collect resume data
- C2. Develop a resume

D. Completing the Job Application Process
- D1. Prepare letters of inquiry
- D2. Provide accurate educational data
- D3. Provide accurate work history data
- D4. Provide accurate personal data
- D5. Provide accurate reference information
- D6. Fill out job application form

E. Demonstrating Effective Interviewing Skills
- E1. Present proper appearance
- E2. Prepare for interview
- E3. Greet the interviewer
- E4. Participate in the interview
- E5. Respond to interview closure
- E6. Prepare a letter of follow-up

F. Demonstrating Knowledge of the Proper Work Attitudes and Behaviors
- F1. Be dependable
- F2. Be punctual
- F3. Maintain a positive attitude and behavior
- F4. Complete tasks effectively with or without supervision
- F5. Practice good grooming and personal hygiene
- F6. Recognize legal issues in the workplace

G. Demonstrating Knowledge of Effective Interpersonal Skills
- G1. Communicate with others
- G2. Maintain relationships with others

SCANS COMPETENCIES

SCANS foundation skills identified by the U.S. Department of Labor describe generic skills needed by nearly everyone. The SCANS competencies, however, are more specific in nature and are listed below. (SCANS is the acronym for the Secretary [of Labor]'s Commission on Achieving Necessary Skills.) National VICA's Total Quality Curriculum incorporates SCANS competencies and Total Quality Management (TQM) principles in a 17-module set of activities.

1. **Resources**
   Allocates Time
   Allocates Money
   Allocates material and facility resources
   Allocates human resources

2. **Interpersonal**
   Participates as a member of a team
   Teaches others
   Serves clients/customers
   Exercises leadership
   Negotiates to arrive at a decision
   Works with cultural diversity

3. **Information**
   Acquires and evaluates information
   Organizes and evaluates information
   Interprets and communicates information
   Uses computers to process information

4. **Systems**
   Understands systems
   Monitors and corrects performance
   Improves and designs systems

5. **Technology**
   Selects technology
   Applies technology to task
   Maintains and troubleshoots equipment

SHOW-ME STANDARDS

The new educational goals and standards are a result of the Outstanding Schools Act of 1993, which calls on Missouri citizens and educators….to define appropriate, rigorous expectations for children's learning. Committees of teachers, citizens, parents, lawmakers and state officials have been working on the proposed goals and standards since then. The goals and standards listed below were approved as a final regulation by the Missouri

State Board of Education, January 18, 1996, and are available through the Missouri Department of Elementary and Secondary Education's home page. (URL http://services.dese.state.mo.us/standards/goal1.html)

Goal 1: Students in Missouri public schools will acquire the knowledge and skills to gather, analyze and apply information and ideas.

Students will demonstrate within and integrate across all content areas the ability to

1.1 develop questions and ideas to initiate and refine research
1.2 conduct research to answer questions and evaluate information and ideas
1.3 design and conduct field and laboratory investigations to study nature and society
1.4 use technological tools and other resources to locate, select and organize information
1.5 comprehend and evaluate written, visual and oral presentations and works
1.6 discover and evaluate patterns and relationships in information, ideas and structures
1.7 evaluate the accuracy of information and the reliability of its sources
1.8 organize data, information and ideas into useful forms (including charts, graphs, outlines) for analysis or presentation
1.9 identify, analyze and compare the institutions, traditions and art forms of past and present societies
1.10 apply acquired information, ideas and skills to different contexts as students, workers, citizens and consumers

Goal 2: Students in Missouri public schools will acquire the knowledge and skills to communicate effectively within and beyond the classroom.

Students will demonstrate within and integrate across all content areas the ability to

2.1 plan and make written, oral and visual presentations for a variety of purposes and audiences
2.2 review and revise communications to improve accuracy and clarity
2.3 exchange information, questions and ideas while recognizing the perspectives of others
2.4 present perceptions and ideas regarding works of the arts, humanities, and sciences
2.5 perform or produce works in the fine and practical arts
2.6 apply communication techniques to the job search and to the workplace
2.7 use technological tools to exchange information and ideas

Goal 3: Students in Missouri public schools will acquire the knowledge and skills to recognize and solve problems.

Students will demonstrate within and integrate across all content areas the ability to

3.1 identify problems and define their scope and elements
3.2 develop and apply strategies based on ways others have prevented or solved problems
3.3 develop and apply strategies bases on one's own experience in preventing or solving problems
3.4 evaluate the processes used in recognizing and solving problems
3.5 reason inductively from a set of specific facts and deductively from general premises
3.6 examine problems and proposed solutions from multiple perspectives
3.7 evaluate the extent to which a strategy addresses the problem
3.8 assess costs, benefits and other consequences of proposed solutions

Goal 4: Students in Missouri public schools will acquire the knowledge and skills to make decisions and act as responsible members of society.

Students will demonstrate within and integrate across all content areas the ability to

4.1 explain reasoning and identify information used to support decisions
4.2 understand and apply the rights and responsibilities of citizenship in Missouri and the United States
4.3 analyze the duties and responsibilities of individuals in societies
4.4 recognize and practice honesty and integrity in academic work and in the workplace
4.5 develop, monitor and revise plans of action to meet deadlines and accomplish goals
4.6 identify task that require a coordinated effort and work with others to complete those tasks
4.7 identify and apply practices that preserve and enhance the safety and health of self and others
4.8 explore, prepare for and seek educational and job opportunities

Communication Arts (CA)

In Communication Arts, students in Missouri public schools will Acquire a solid foundation which includes knowledge of and proficiency in

CA1 speaking and writing standard English (including grammar, usage, punctuation, spelling, capitalization)
CA2 reading and evaluating fiction, poetry and drama
CA3 reading and evaluating nonfiction works and material (such as biographies, newspapers, technical manuals)
CA4 writing formally (such as reports, narratives, essays) and informally (such as outlines, notes)
CA5 comprehending and evaluating the content and artistic aspects of oral and visual presentation (such as story-telling, debates, lectures, multi-media productions)
CA6 participating in formal and informal presentations and discussions of issues and ideas
CA7 identifying and evaluating relationships between language and culture

Fine Arts (FA)

In Fine Arts, students in Missouri public schools will acquire a solid foundation which includes knowledge of

FA1 process and techniques for the production, exhibition or performance of one or more of the visual or performed arts
FA2 the principles and elements of different art forms
FA3 the vocabulary to explain perceptions about and evaluations of works in dance, music, theater and visual arts
FA4 interrelationships of visual and performing arts and the relationships of the arts to other disciplines
FA5 visual and performing arts in historical and cultural contexts

Health/Physical Education (HP)

In Health/Physical Education, students in Missouri public schools will Acquire a solid foundation which includes knowledge of

HP1 structures of, functions of, and relationships among human body systems
HP2 principles and practices of physical and mental health (such as personal health habits, nutrition, stress management)
HP3 diseases and methods for prevention, treatment and control
HP4 principles of movement and physical fitness
HP5 methods used to assess health, reduce risk factors, and avoid high risk behaviors (such as violence, tobacco, alcohol and other drug use)
HP6 consumer health issues (such as the effects of mass media and technologies on safety and health)
HP7 responses to emergency situations

Mathematics (MA)

In Mathematics, students in Missouri public schools will acquire a solid foundation which includes knowledge of

MA1 addition, subtraction, multiplication and division; other number sense, including numeration and estimation; and the application of these operations and concepts in the workplace and other situations.
MA2 geometric and spatial sense involving measurement (including length, area, volume), trigonometry, and similarity and transformations of shapes
MA3 data analysis, probability and statistics

MA4 patterns and relationships within and among functions and algebraic, geometric and trigonometric concepts
MA5 mathematical systems (including real numbers, whole numbers, integers, fractions), geometry, and number theory (including primes, factors, multiples)
MA6 discrete mathematics (such as graph theory, counting techniques, matrices)

Science (SC)

In Science, students in Missouri public schools will acquire a solid foundation which includes knowledge of
SC1 properties and principles of matter and energy
SC2 properties and principles of force and motion
SC3 characteristics and interactions of living organisms
SC4 changes in ecosystems and interactions of organisms with their Environments
SC5 processes (such as plate movement, water cycle, air flow) and interactions of earth's biosphere, atmosphere, lithosphere and hydrosphere

Source: "The Show-Me Standards." Jefferson City, MO: Missouri Department of Elementary and Secondary Education, March 1996.

SC6 composition and structure of the universe and the motions of the objects within it
SC7 processes of scientific inquiry (such as formulating and testing hypotheses)
SC8 impact of science, technology and human activity on resources and the environment

Social Studies (SS)

In Social Studies, students in Missouri public schools will acquire solid foundation which includes knowledge of
SS1 principles expressed in the documents shaping constitutional democracy in the United States
SS2 continuity and change in the history of Missouri, the United States and the world
SS3 principles and processes of governance systems
SS4 economic concepts (including productivity and the market system) and principles (including the laws of supply and demand)
SS5 the major elements of geographical study and analysis (such as location, place, movement, regions) and their relationships to changes in society and environment
SS6 relationships of the individual and groups to institutions and cultural traditions
SS7 the use of tools of social science inquiry (such as surveys, statistics, maps, documents)