Create Date: 1/5/2004

Georgia Learning Connections

Browse Quality Core Curriculum Standards by subject

Subject: Trade & Industrial Education

Grade: 9-12

Course: Construction: Core Skills

1 **Topic:** Basic Skills

Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills

Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills

Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills

Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills

Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills

Standard: Identify problems, alternative solutions, and consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15

Topic: Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16

Topic: Interpersonal Skills

Standard: Share knowledge and skills with others.

17

Topic: Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18

Topic: Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19

Topic: Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20

Topic: Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21

Topic: Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22

Topic: Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23

Topic: Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24

Topic: Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25

Topic: Technology

Standard: Utilize a variety of technologies.

26

Topic: Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27

Topic: Business Aspects

Standard: Identify forms of business ownership.

28

Topic: Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29

Topic: Business Aspects

Standard: Demonstrate understanding of the individual’s role, responsibilities, and relationships in the organizational structure of a business.

30

Topic: Business Aspects

Standard: Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

31

Topic: Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32

Topic: Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33

Topic: Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34 **Topic:** Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

Course: AST: Core Skills for Automotive Service Technology

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Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33

Topic: Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34

Topic: Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

35 **Topic:** Career Planning
Standard: Identify the breadth and scope of the automotive service technology industry.

36 **Topic:** Career Planning
Standard: Identify major trends and issues in automotive service technology.

37 **Topic:** Career Planning
Standard: Identify auto technician career opportunities and the duties of a suspension and steering system technician.

38 **Topic:** Career Planning
Standard: Identify auto technical career opportunities and the duties of a brake system technician.

39 **Topic:** Career Planning
Standard: Identify auto technician career opportunities and the duties of an electrical/electronics systems technician.

40 **Topic:** Career Planning
Standard: Identify auto technician career opportunities and the duties of an engine performance technician.

41 **Topic:** Suspension And Steering
Standard: Identify the safe use of chemicals used in the suspension and steering system.

42 **Topic:** Suspension And Steering
Standard: Identify the safe use of hand tools used in the suspension and steering system.

43 **Topic:** Suspension And Steering
Standard: Identify the safe use of power tools used in the suspension and steering system.

44 **Topic:** Suspension And Steering
Standard: Identify the safe use of protective clothing and equipment for working in the suspension and steering system.

45 **Topic:** Suspension And Steering
Standard: Identify the safe use of fire protection equipment for working in the suspension and steering system.

46 **Topic:** Suspension And Steering
Standard: Identify the safe use of shop equipment for working in the suspension and steering system.

47 **Topic:** Suspension And Steering
Standard: Follow Environmental Protection Agency (EPA) and Occupational Safety and Health Act (OSHA) regulations for working in the suspension and steering system.

48 **Topic:** Suspension And Steering
Standard: Communicate with customers and write suspension and steering system repair orders.

49 **Topic:** Suspension And Steering
Standard: Estimate time and cost for suspension and steering system job and order parts.

50 **Topic:** Suspension And Steering
Standard: Obtain appropriate suspension and steering system repair information from shop manuals.

51 **Topic:** Suspension And Steering
Standard: Practice clean and orderly work habits (vehicle, tools, and work area).

52 **Topic:** Suspension And Steering
Standard: Identify the basic function and operation of the suspension and steering system components.

53 **Topic:** Suspension And Steering
Standard: Inspect power steering fluid levels and condition.

54 **Topic:** Suspension And Steering
Standard: Flush, fill, and bleed a power steering system.

55 **Topic:** Suspension And Steering
Standard: Diagnose power steering fluid leakage; determine necessary action.

56 **Topic:** Suspension And Steering
Standard: Remove, inspect, replace, and adjust a power steering pump belt.

57 **Topic:** Suspension And Steering
Standard: Remove, inspect, and replace a power steering pump, mounts, seals, and gaskets.

58 **Topic:** Suspension And Steering
Standard: Remove, inspect, and replace a power steering pump pulley; check alignment.

59 **Topic:** Suspension And Steering
Standard: Inspect and replace power steering hoses and fittings.

60 **Topic:** Suspension And Steering
Standard: Lubricate suspension and steering systems.

61 **Topic:** Suspension And Steering
Standard: Inspect, remove, and replace shock absorbers.

62 **Topic:** Suspension And Steering
Standard: Remove, inspect, and service or replace front and rear wheel bearings.

63 **Topic:** Suspension And Steering
Standard: Diagnose tire wear patterns; determine necessary action.

64 **Topic:** Suspension And Steering
Standard: Inspect tires; check and adjust air pressure.

65 **Topic:** Suspension And Steering
Standard: Rotate tires according to the manufacturer’s recommendations.

66 **Topic:** Suspension And Steering
Standard: Reinstall a wheel; torque lug nuts.

67 **Topic:** Brakes
Standard: Identify the safe use of chemicals used with brakes.

68 **Topic:** Brakes
Standard: Identify the safe use of hand tools used with brakes.

69 **Topic:** Brakes
Standard: Identify the safe use of power tools used with brakes.

70 **Topic:** Brakes
Standard: Identify the safe use of protective clothing and equipment for working with brakes.

71 **Topic:** Brakes
Standard: Identify the safe use of fire protection equipment for working with brakes.

72 **Topic:** Brakes
Standard: Identify the safe use of shop equipment for working with brakes.

73 **Topic:** Brakes

Standard: Follow Environmental Protection Agency (EPA) and Occupational Safety and Health Act (OSHA) regulations for working with brakes.

74 **Topic:** Brakes

Standard: Communicate with customers and write brake repair orders.

75 **Topic:** Brakes

Standard: Estimate time and cost for a brake job and order parts.

76 **Topic:** Brakes

Standard: Obtain appropriate brake repair information from shop manuals.

77 **Topic:** Brakes

Standard: Practice clean and orderly work habits (vehicle, tools, and work area).

78 **Topic:** Brakes

Standard: Select, handle, store, and install brake fluids to proper level.

79 **Topic:** Brakes

Standard: Remove, clean (using proper safety procedures), inspect, and measure brake drums; service or replace as needed.

80 **Topic:** Brakes

Standard: Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/selfadjusters, other related brake hardware, and backing support plates; lubricate and reassemble.

81 **Topic:** Brakes

Standard: Remove, inspect, and install wheel cylinders.

82 **Topic:** Brakes

Standard: Pre-adjust brake shoes and the parking brake before installing brake drums or drum/hub assemblies and wheel bearings.

83 **Topic:** Brakes

Standard: Install a wheel, torque lug nuts, and make final checks and adjustments.

84 **Topic:** Brakes

Standard: Remove a caliper assembly from mountings; clean and inspect for leaks and damage to the caliper housing; determine necessary action.

85 **Topic:** Brakes

Standard: Clean and inspect a caliper mounting and slides for wear and damage; determine necessary action.

86 **Topic:** Brakes

Standard: Remove, clean, and inspect pads and retaining hardware; determine necessary action.

87 **Topic:** Brakes

Standard: Clean, inspect, and measure a rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace.

88 **Topic:** Brakes

Standard: Install a wheel, torque lug nuts, and make final checks and adjustments.

89 **Topic:** Brakes

Standard: Remove and replace a rotor.

90 **Topic:** Brakes

Standard: Diagnose wheel-bearing noises, wheel shimmy, and vibration concerns; determine necessary action.

91 **Topic:** Brakes

Standard: Remove, clean, inspect, repack, and install wheel bearings and replace seals; install the hub and adjust wheel bearings.

92 **Topic:** Brakes

Standard: Check the operation of a brake stoplight system; adjust and service as needed.

93 **Topic:** Brakes

Standard: Replace a wheel bearing and race.

94 **Topic:** Electrical/Electronic Systems

Standard: Identify the safe use of chemicals used in electrical/electronic systems.

95 **Topic:** Electrical/Electronic Systems

Standard: Identify the safe use of hand tools used in electrical systems.

96 **Topic:** Electrical/Electronic Systems

Standard: Identify the safe use of power tools used in electrical systems.

97 **Topic:** Electrical/Electronic Systems

Standard: Identify the safe use of protective clothing and equipment for working in electrical systems.

98 **Topic:** Electrical/Electronic Systems

Standard: Identify the safe use of fire protection equipment used in electrical systems.

99 **Topic:** Electrical/Electronic Systems

Standard: Identify the safe use of shop equipment for working in electrical systems.

100 **Topic:** Electrical/Electronic Systems

Standard: Follow Environmental Protection Agency (EPA) and Occupational Safety and Health Act (OSHA) regulations for working in electrical systems.

101 **Topic:** Electrical/Electronic Systems

Standard: Communicate with customers and write electrical systems repair orders.

102 **Topic:** Electrical/Electronic Systems

Standard: Estimate time and cost for an electrical systems job and order parts.

103 **Topic:** Electrical/Electronic Systems

Standard: Obtain appropriate electrical system repair information from shop manuals.

104 **Topic:** Electrical/Electronic Systems

Standard: Practice clean and orderly work habits (vehicle, tools, and work area).

105 **Topic:** Electrical/Electronic Systems

Standard: Identify the basic function and operation of the electrical/electronics systems components.

106 **Topic:** Electrical/Electronic Systems

Standard: Check electrical circuits with a test light; determine necessary action.

107 **Topic:** Electrical/Electronic Systems

Standard: Check voltage and voltage drop in electrical/electronic circuits using a digital multimeter (DMM); determine necessary action.

108 **Topic:** Electrical/Electronic Systems

Standard: Check current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.

109 **Topic:** Electrical/Electronic Systems

Standard: Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter; determine necessary action.

110 **Topic:** Electrical/Electronic Systems

Standard: Check electrical circuits using jumper wires; determine necessary action.

111 **Topic:** Electrical/Electronic Systems

Standard: Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

112 **Topic:** Electrical/Electronic Systems

Standard: Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.

113 **Topic:** Electrical/Electronic Systems

Standard: Perform a battery state-of-charge test; determine needed service.

114 **Topic:** Electrical/Electronic Systems

Standard: Perform a battery capacity test; determine needed service.

115 **Topic:** Electrical/Electronic Systems

Standard: Maintain or restore electronic memory functions.

116 **Topic:** Electrical/Electronic Systems

Standard: Inspect, clean, fill, and replace a battery.

117 **Topic:** Electrical/Electronic Systems

Standard: Perform a slow/fast battery charge.

118 **Topic:** Electrical/Electronic Systems

Standard: Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.

119 **Topic:** Electrical/Electronic Systems

Standard: Start a vehicle using jumper cables and a battery or auxiliary power supply according to the manufacturer's recommended specifications.

120 **Topic:** Electrical/Electronic Systems

Standard: Perform starter current draw tests; determine necessary action.

121 **Topic:** Electrical/Electronic Systems

Standard: Perform a charging system output test; determine necessary action.

122 **Topic:** Electrical/Electronic Systems

Standard: Inspect and adjust a generator (alternator drive belts); replace as needed.

123 **Topic:** Engine Performance

Standard: Identify the safe use of chemicals used in engine performance.

124 **Topic:** Engine Performance

Standard: Identify the safe use of hand tools used in engine performance.

125 **Topic:** Engine Performance

Standard: Identify the safe use of power tools used in engine performance.

126 **Topic:** Engine Performance

Standard: Identify the safe use of protective clothing and equipment for working in engine performance.

127 **Topic:** Engine Performance

Standard: Identify the safe use of fire protection equipment for working in engine performance.

128 **Topic:** Engine Performance

Standard: Identify the safe use of shop equipment for working in engine performance.

129 **Topic:** Engine Performance

Standard: Follow Environmental Protection Agency (EPA) and Occupational Safety and Health Act (OSHA) regulations for working in engine performance.

130 **Topic:** Engine Performance

Standard: Communicate with customers and write engine performance repair orders.

131

Topic: Engine Performance

Standard: Estimate time and cost for an engine performance job and order parts.

132

Topic: Engine Performance

Standard: Obtain appropriate repair information on engine performance from shop manuals.

133

Topic: Engine Performance

Standard: Practice clean and orderly work habits (vehicle, tools, and work area).

134

Topic: Engine Performance

Standard: Identify the basic function and operation of engine performance components.

135

Topic: Engine Performance

Standard: Interpret and verify engine performance concerns; determine necessary action.

136

Topic: Engine Performance

Standard: Inspect an engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.

137

Topic: Engine Performance

Standard: Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.

138

Topic: Engine Performance

Standard: Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and engine diagnostic equipment; determine necessary action.

139

Topic: Engine Performance

Standard: Prepare a 4 or 5 gas analyzer; inspect and prepare vehicle for test and obtain exhaust readings; interpret readings and determine necessary action.

140

Topic: Engine Performance

Standard: Obtain and interpret digital multimeter (DMM) readings.

141

Topic: Engine Performance

Standard: Access and use electronic service information.

142

Topic: Engine Performance

Standard: Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).

143

Topic: Engine Performance

Standard: Inspect and test ignition system secondary circuit wiring and components; perform necessary action.

144

Topic: Engine Performance

Standard: Check and adjust (where applicable) an ignition system timing and timing; advance/retard.

145

Topic: Engine Performance

Standard: Check fuel for contaminants and quality; determine necessary action.

146

Topic: Engine Performance

Standard: Replace fuel filters.

147

Topic: Engine Performance

Standard: Verify engine operating temperature; determine necessary action.

Course: AST: 47.57200 Foundations of Automotive Service Technology

35

Topic: Suspension And Steering

Standard: Diagnose MacPherson strut suspension system noises, body sway, and uneven riding height concerns; determine necessary action.

36 **Topic:** Suspension And Steering

Standard: Remove, inspect, and install a MacPherson strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.

37 **Topic:** Suspension And Steering

Standard: Remove, inspect, and install a MacPherson strut cartridge or assembly, strut coil spring, and insulators (silencers).

38 **Topic:** Suspension And Steering

Standard: Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.

39 **Topic:** Suspension And Steering

Standard: Measure wheel, tire, axle, and mid hub run-out; determine necessary action.

40 **Topic:** Suspension And Steering

Standard: Diagnose a tire pull (lead) problem; determine necessary action.

41 **Topic:** Suspension And Steering

Standard: Balance a wheel and tire assembly (static and dynamic).

42 **Topic:** Suspension And Steering

Standard: Dismount, inspect, repair, and remount a tire on a wheel.

43 **Topic:** Brakes

Standard: Measure and adjust pedal height.

44 **Topic:** Brakes

Standard: Disassemble and clean a caliper assembly; inspect parts for wear, rust, scoring, and damage; replace a seal, boot, and damaged or worn parts.

45 **Topic:** Brakes

Standard: Reassemble, lubricate, and reinstall a caliper, pads, and related hardware; seat pads and inspect for leaks.

46 **Topic:** Brakes

Standard: Test pedal-free travel with and without the engine running; check the power assist operation.

47 **Topic:** Brakes

Standard: Check the vacuum supply (manifold or auxiliary pump) to a vacuum-type power booster.

48 **Topic:** Brakes

Standard: Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed.

49 **Topic:** Brakes

Standard: Check parking brake operation; adjust as needed.

50 **Topic:** Brakes

Standard: Check the operation of a parking brake indicator light system.

51 **Topic:** Electrical/Electronic Systems

Standard: Use wiring diagrams during the diagnosis of electrical circuit problems.

52 **Topic:** Electrical/Electronic Systems

Standard: Repair wiring harnesses and connectors.

53 **Topic:** Electrical/Electronic Systems

Standard: Perform the solder repair of electrical wiring.

54

Topic: Electrical/Electronic Systems

Standard: Perform a starter circuit voltage drop test; determine necessary action.

55

Topic: Electrical/Electronic Systems

Standard: Inspect and test starter relays and solenoids; replace as needed.

56

Topic: Electrical/Electronic Systems

Standard: Remove and install a starter.

57

Topic: Electrical/Electronic Systems

Standard: Diagnose a charging system for the cause of undercharge, no-charge, and overcharge conditions.

58

Topic: Electrical/Electronic Systems

Standard: Remove, inspect, and install a generator (alternator).

59

Topic: Electrical/Electronic Systems

Standard: Perform charging circuit voltage drop tests; determine necessary action.

60

Topic: Electrical/Electronic Systems

Standard: Inspect, replace, and aim headlights and bulbs.

61

Topic: Engine Performance

Standard: Perform a cylinder compression test; determine necessary action.

62

Topic: Engine Performance

Standard: Retrieve and record stored OBD I diagnostic trouble codes; clear codes.

63

Topic: Engine Performance

Standard: Retrieve and record OBD II diagnostic trouble codes; clear codes.

64

Topic: Engine Performance

Standard: Inspect and test power and ground circuits and connections; service or replace as needed.

65

Topic: Engine Performance

Standard: Practice recommended precautions when handling static-sensitive devices.

66

Topic: Engine Performance

Standard: Inspect and test ignition primary circuit wiring and components; perform necessary action.

67

Topic: Engine Performance

Standard: Inspect and test a distributor; perform necessary action.

68

Topic: Engine Performance

Standard: Inspect and test ignition coil(s); perform necessary action.

69

Topic: Engine Performance

Standard: Inspect and test mechanical and electrical fuel pumps and pump control P-2 systems; perform necessary action.

70

Topic: Engine Performance

Standard: Diagnose oil leaks, emissions, and driveability problems resulting from failure of the positive crankcase ventilation (PCV) system; determine necessary action.

71

Topic: Engine Performance

Standard: Inspect and test a positive crankcase ventilation (PCV) filter/breather cap, value, tubes, orifices, and hoses; perform necessary action.

72

Topic: Engine Performance

Standard: Perform cooling system pressure tests; check coolant condition; inspect and test a radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

73 **Topic:** Engine Performance

Standard: Inspect and test a thermostat, by-pass, and housing; perform necessary action.

74 **Topic:** Engine Performance

Standard: Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.

Course: AST: 47.57300 Intermediate Automotive Service Technology

35 **Topic:** Suspension And Steering

Standard: Disable and enable a supplemental restraint system (SRS) in accordance with the P-1 manufacturer's procedures.

36 **Topic:** Suspension And Steering

Standard: Remove and replace a steering wheel; center/time a supplemental restraint system (SRS) coil in accordance with the manufacturer's procedures.

37 **Topic:** Suspension And Steering

Standard: Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action.

38 **Topic:** Suspension And Steering

Standard: Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action.

39 **Topic:** Suspension And Steering

Standard: Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action.

40 **Topic:** Suspension And Steering

Standard: Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action.

41 **Topic:** Suspension And Steering

Standard: Adjust manual or power non-rack and pinion worm bearing preload and sector lash.

42 **Topic:** Suspension And Steering

Standard: Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets.

43 **Topic:** Suspension And Steering

Standard: Disassemble, inspect, perform necessary action, and reassemble rack and pinion steering gear.

44 **Topic:** Suspension And Steering

Standard: Adjust manual or power rack and pinion steering gear.

45 **Topic:** Suspension And Steering

Standard: Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.

46 **Topic:** Suspension And Steering

Standard: Inspect and replace a pitman arm, relay (centerlink /intermediate) rod, idler arm and mountings, and steering linkage damper.

47 **Topic:** Suspension And Steering

Standard: Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.

48 **Topic:** Suspension And Steering

Standard: Diagnose and adjust components of electronically controlled steering systems; determine necessary action.

49

Topic: Suspension And Steering

Standard: Diagnose short and long arm suspension system noises, body sway, and uneven riding height concerns; determine necessary action.

50

Topic: Suspension And Steering

Standard: Remove, inspect, and install upper and lower control anus, bushings, shafts, and rebound bumpers.

51

Topic: Suspension And Steering

Standard: Remove, inspect, install, and adjust strut (compression/tension) rods and bushings.

52

Topic: Suspension And Steering

Standard: Remove, inspect, and install upper and lower ball joints on short and long arm suspension systems.

53

Topic: Suspension And Steering

Standard: Remove, inspect, and install steering knuckle assemblies.

54

Topic: Suspension And Steering

Standard: Remove, inspect, and install short and long arm suspension system coil springs and spring insulators.

55

Topic: Suspension And Steering

Standard: Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts.

56

Topic: Suspension And Steering

Standard: Remove, inspect, and install stabilizer bar bushings, brackets, and links.

57

Topic: Suspension And Steering

Standard: Remove, inspect, and install coil springs and spring insulators.

58

Topic: Suspension And Steering

Standard: Remove, inspect, and install transverse links, control arms, bushings, and mounts.

59

Topic: Suspension And Steering

Standard: Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts.

60

Topic: Suspension And Steering

Standard: Diagnose, inspect, adjust, repair, or replace components of electronically controlled suspension systems.

61

Topic: Brakes

Standard: Check a master cylinder for internal and external leaks and proper operation; determine necessary action.

62

Topic: Brakes

Standard: Remove, bench bleed, and reinstall a master cylinder.

63

Topic: Brakes

Standard: Diagnose poor stopping, pulling, or dragging concerns caused by problems in the hydraulic system; determine necessary action.

64

Topic: Brakes

Standard: Inspect, test, and replace the components of a brake warning light system.

65

Topic: Brakes

Standard: Bleed a (manual, pressure, vacuum, or surge) brake system.

66

Topic: Brakes

Standard: Flush a hydraulic system.

67

Topic: Brakes

Standard: Diagnose poor stopping, noise, pulling, grabbing, dragging, or pedal pulsation concerns; determine necessary action.

68

Topic: Brakes

Standard: Mount a brake drum on a lathe; machine the braking surface.

69

Topic: Brakes

Standard: Diagnose poor stopping, noise, pulling, grabbing, dragging, or pedal pulsation concerns; determine necessary action.

70

Topic: Brakes

Standard: Refinish a rotor according to the manufacturer's recommendations.

71

Topic: Brakes

Standard: Adjust the calipers with an integrated parking brake system.

72

Topic: Brakes

Standard: Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action.

73

Topic: Brakes

Standard: Inspect and test a hydro-boost system and accumulator for leaks and proper operation; determine necessary action.

74

Topic: Electrical/Electronic Systems

Standard: Measure and diagnose the cause(s) of abnormal key off drain: determine necessary action.

75

Topic: Electrical/Electronic Systems

Standard: Inspect and test the switches, connectors, relays, and wires of electrical/electronic circuits; perform necessary action.

76

Topic: Electrical/Electronic Systems

Standard: Perform starter bench tests; determine necessary action.

77

Topic: Electrical/Electronic Systems

Standard: Inspect and test the switches, connectors, and wires of starter control circuits; perform necessary action.

78

Topic: Electrical/Electronic Systems

Standard: Disassemble, clean, inspect, and test starter components; replace as needed.

79

Topic: Electrical/Electronic Systems

Standard: Inspect and test a voltage regulator/regulating circuit; perform necessary action.

80

Topic: Electrical/Electronic Systems

Standard: Disassemble a generator (alternator) and clean, inspect, and test components; determine necessary action.

81

Topic: Electrical/Electronic Systems

Standard: Perform charging circuit voltage drop tests; determine necessary action.

82

Topic: Electrical/Electronic Systems

Standard: Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.

83

Topic: Electrical/Electronic Systems

Standard: Diagnose incorrect horn operation; perform necessary action.

84

Topic: Engine Performance

Standard: Perform a cylinder power balance test; determine necessary action.

85

Topic: Engine Performance

Standard: Perform a cylinder leakage test; determine necessary action.

86

Topic: Engine Performance

Standard: Inspect and test computerized engine control system sensors, the power train control module (PCM), actuators, and circuits; perform necessary action.

87 **Topic:** Engine Performance

Standard: Inspect and test an ignition system pick-up sensor or triggering devices; perform necessary action.

88 **Topic:** Engine Performance

Standard: Inspect and test an ignition control module; perform necessary action.

89 **Topic:** Engine Performance

Standard: Inspect and test a fuel pressure regulation system and components of injection- type fuel systems; perform necessary action.

90 **Topic:** Engine Performance

Standard: Inspect and test a cold enrichment system and components; perform necessary P-3 action.

91 **Topic:** Engine Performance

Standard: Inspect throttle body mounting plates, air induction and filtration system, intake manifold, and gaskets; perform necessary action.

92 **Topic:** Engine Performance

Standard: Check idle speed and fuel mixture.

93 **Topic:** Engine Performance

Standard: Adjust idle speed and fuel mixture.

94 **Topic:** Engine Performance

Standard: Inspect exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.

95 **Topic:** Engine Performance

Standard: Perform an exhaust system back-pressure test; determine necessary action.

96 **Topic:** Engine Performance

Standard: Inspect and test the mechanical components of secondary air injection systems; perform necessary action.

97 **Topic:** Engine Performance

Standard: Inspect and test the electrical/electronically-operated components and circuits of air injection systems; perform necessary action.

98 **Topic:** Engine Performance

Standard: Inspect and test the components of catalytic converter systems; perform necessary action.

99 **Topic:** Engine Performance

Standard: Adjust the valves on engines with mechanical or hydraulic lifters.

100 **Topic:** Engine Performance

Standard: Verify correct camshaft timing; determine necessary action.

Course: AST: 47.57400 Advanced Automotive Service Technology

35 **Topic:** Suspension And Steering

Standard: Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary, action.

36 **Topic:** Suspension And Steering

Standard: Perform a prealignment inspection; perform necessary action.

37 **Topic:** Suspension And Steering

Standard: Measure vehicle riding height; determine necessary action.

38 **Topic:** Suspension And Steering

Standard: Check and adjust the front and rear wheel camber; perform necessary action.

39

Topic: Suspension And Steering

Standard: Check and adjust a caster; perform necessary action.

40

Topic: Suspension And Steering

Standard: Check and adjust a front wheel toe; adjust as needed.

41

Topic: Suspension And Steering

Standard: Center a steering wheel.

42

Topic: Suspension And Steering

Standard: Check toe-out-on-turns (turning radius); determine necessary action.

43

Topic: Suspension And Steering

Standard: Check the SAI (steering axis inclination) and included angle; determine necessary action.

44

Topic: Suspension And Steering

Standard: Check and adjust the rear wheel toe.

45

Topic: Suspension And Steering

Standard: Check the rear wheel thrust angle; determine necessary action.

46

Topic: Suspension And Steering

Standard: Check for front wheel setback; determine necessary action.

47

Topic: Suspension And Steering

Standard: Check the front cradle (subframe) alignment; determine necessary action.

48

Topic: Brakes

Standard: Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, or wear; tighten loose fittings and supports; determine necessary action.

49

Topic: Brakes

Standard: Fabricate and install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed.

50

Topic: Brakes

Standard: Inspect, test, and replace metering (hold-off), proportioning (balance), pressure differential, and combination valves.

51

Topic: Brakes

Standard: Inspect, test, replace, and adjust the height (load) sensing proportioning valve.

52

Topic: Brakes

Standard: Inspect and test antilock brake system (ABS) components; determine necessary action.

53

Topic: Brakes

Standard: Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise concerns caused by the antilock brake system (ABS); determine necessary action.

54

Topic: Brakes

Standard: Diagnose antilock brake system (ABS) electronic control(s) and components using selfdiagnosis and/or recommended test equipment; determine necessary action.

55

Topic: Brakes

Standard: Depressurize high-pressure components of the antilock brake system (ABS).

56

Topic: Brakes

Standard: Bleed the antilock brake system's (ABS) front and rear hydraulic circuits.

57

Topic: Brakes

Standard: Remove and install the antilock brake system (ABS) electrical/electronic and hydraulic components.

58 **Topic:** Brakes

Standard: Service, test, and adjust antilock brake system (ABS) speed sensors.

59 **Topic:** Brakes

Standard: Diagnose antilock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.).

60 **Topic:** Electrical/Electronic Systems

Standard: Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.

61 **Topic:** Electrical/Electronic Systems

Standard: Inspect and test gauges and gauge sending units for the cause of intermittent, high, low, or no gauge readings; determine necessary action.

62 **Topic:** Electrical/Electronic Systems

Standard: Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action.

63 **Topic:** Electrical/Electronic Systems

Standard: Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action.

64 **Topic:** Electrical/Electronic Systems

Standard: Inspect and test the sensors, connectors, and wires of electronic instrument circuits; determine necessary action.

65 **Topic:** Electrical/Electronic Systems

Standard: Diagnose incorrect wiper operation; diagnose wiper speed control and park P-3 problems; perform necessary action.

66 **Topic:** Electrical/Electronic Systems

Standard: Diagnose incorrect windshield washer operation; perform necessary action.

67 **Topic:** Electrical/Electronic Systems

Standard: Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.

68 **Topic:** Electrical/Electronic Systems

Standard: Diagnose incorrect heated glass operation; determine necessary action.

69 **Topic:** Electrical/Electronic Systems

Standard: Diagnose incorrect electric lock operation; determine necessary action.

70 **Topic:** Electrical/Electronic Systems

Standard: Diagnose incorrect operation of cruise control systems; repair as needed.

71 **Topic:** Electrical/Electronic Systems

Standard: Diagnose supplemental restraint system (SRS) concerns; determine necessary action; follow the manufacturer's safety procedures to prevent accidental deployment.

72 **Topic:** Electrical/Electronic Systems

Standard: Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action.

73 **Topic:** Engine Performance

Standard: Diagnose unusual exhaust color, odor, and sound; determine necessary action.

74 **Topic:** Engine Performance

Standard: Diagnose the causes of emissions or driveability concerns resulting from the failure of computerized engine controls with stored diagnostic trouble codes.

75 **Topic:** Engine Performance

Standard: Diagnose emissions or driveability concerns resulting from the failure of computerized engine controls with no stored diagnostic trouble codes; determine necessary action.

76 **Topic:** Engine Performance

Standard: Diagnose no-starting, driveability, and emissions concerns on vehicles with electronic ignition (EI/DIS) (distributorless) systems; determine necessary action.

77 **Topic:** Engine Performance

Standard: Diagnose no-starting, driveability, and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action.

78 **Topic:** Engine Performance

Standard: Remove, service, and install a throttle body; adjust related linkages.

79 **Topic:** Engine Performance

Standard: Inspect, test, and clean fuel injectors.

80 **Topic:** Engine Performance

Standard: Remove, inspect, and test vacuum and electrical circuits and the components and connections of the fuel system; perform necessary action.

81 **Topic:** Engine Performance

Standard: Inspect and test the valve, valve manifold, and exhaust passages of exhaust gas recirculation (EGR) systems; perform necessary action.

82 **Topic:** Engine Performance

Standard: Inspect and test the vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) systems; perform necessary action.

83 **Topic:** Engine Performance

Standard: Inspect and test the electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.

Course: AST: 47.57500 Automotive Service Technology Internship I

35 **Topic:** Competencies

Standard: Diagnose unusual engine noise or vibration concerns; determine necessary action.

36 **Topic:** Competencies

Standard: Diagnose driveability and emissions problems resulting from failures of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, and similar systems); determine necessary action.

37 **Topic:** Competencies

Standard: Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with carburetor-type fuel systems; determine necessary action.

38 **Topic:** Competencies

Standard: Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems; determine necessary action.

39 **Topic:** Competencies

Standard: Inspect the fuel tank and fuel cap, fuel lines, fittings, and hoses; perform necessary action.

40 **Topic:** Competencies

Standard: Test the operation of turbocharger/supercharger systems; determine necessary action.

41 **Topic:** Competencies

Standard: Diagnose emissions and driveability problems caused by the failure of the exhaust gas recirculation (EGR) system; determine necessary action.

42 **Topic:** Competencies

Standard: Diagnose emissions and driveability problems resulting from the failure of the secondary air injection and catalytic converter systems; determine necessary action.

43 **Topic:** Competenices

Standard: Diagnose emissions and driveability problems resulting from the failure of the intake air temperature control system; determine necessary action.

44 **Topic:** Competencies

Standard: Inspect and test components of the intake air temperature control system; perform necessary action.

45 **Topic:** Competencies

Standard: Diagnose emissions and driveability problems resulting from the failure of the early fuel evaporation control system; determine necessary action.

46 **Topic:** Competencies

Standard: Inspect and test components of the early fuel evaporation control system; perform necessary action.

47 **Topic:** Competencies

Standard: Diagnose emissions and driveability problems resulting from the failure of evaporative emissions control system; determine necessary action.

48 **Topic:** Competencies

Standard: Inspect and test the components and hoses of the evaporative emissions control system; perform necessary action.

Course: Construction/Carpentry: 46.55000 Carpentry I

35 **Topic:** Floor Systems

Standard: Identify the different types of framing systems.

36 **Topic:** Floor Systems

Standard: Read and understand drawings and specifications to determine floor system requirements.

37 **Topic:** Floor Systems

Standard: Identify floor and sill framing and support members.

38 **Topic:** Floor Systems

Standard: Name the methods used to fasten sills to the foundation.

39 **Topic:** Floor Systems

Standard: Given specific floor load and span data, select the proper girder/beam size from a list of available girders/beams.

40 **Topic:** Floor Systems

Standard: List and recognize different types of floor joists.

41 **Topic:** Floor Systems

Standard: Given specific floor load and span data, select the proper joist size from a list of available joists.

42 **Topic:** Floor Systems

Standard: List and recognize different types of bridging.

43 **Topic:** Floor Systems

Standard: List and recognize different types of flooring materials.

44 **Topic:** Floor Systems

Standard: Explain the purposes and subflooring and underlayment.

45 **Topic:** Floor Systems

Standard: Match selected fasteners used in floor framing to their correct uses.

46 **Topic:** Floor Systems

Standard: Estimate the amount of material needed to frame a floor assembly.

47 **Topic:** Floor Systems

Standard: Demonstrate the ability to: · Lay out and construct a floor assembly. · Install bridging. · Install joists for a cantilever floor. · Install a sub-floor using butt-joint plywood/OSB panels. · Install a single floor system using tongue-and-groove plywood/OSB panels.

48 **Topic:** Wall and Ceiling Framing

Standard: Identify the components of a wall and ceiling layout.

49 **Topic:** Wall and Ceiling Framing

Standard: Describe the procedure for laying out a wood frame wall, including plates, corner posts, door and window openings, partition Ts, bracing, and fire-stops.

50 **Topic:** Wall and Ceiling Framing

Standard: Describe the correct procedure for assembling and erecting and exterior wall.

51 **Topic:** Wall and Ceiling Framing

Standard: Describe the common materials and methods used for installing sheathing on walls.

52 **Topic:** Wall and Ceiling Framing

Standard: Lay out, assemble, erect, and brace exterior walls for a frame building.

53 **Topic:** Wall and Ceiling Framing

Standard: Describe wall framing techniques use in masonry construction.

54 **Topic:** Wall and Ceiling Framing

Standard: Explain the use of metal studs in wall framing.

55 **Topic:** Wall and Ceiling Framing

Standard: Describe the correct procedure for laying out a ceiling.

56 **Topic:** Wall and Ceiling Framing

Standard: Cut and install ceiling joists on a wood frame building.

57 **Topic:** Wall and Ceiling Framing

Standard: Estimate the materials required to frame walls and ceilings.

Course: Construction/Carpentry: 46.55100 Residential Carpentry

35 **Topic:** Roof Framing

Standard: Understand the terms associated with roof framing.

36 **Topic:** Roof Framing

Standard: Identify the roof framing members used in gable and hip roofs.

37 **Topic:** Roof Framing

Standard: Identify the methods used to calculate the length of a rafter.

38 **Topic:** Roof Framing

Standard: Identify the various types of trusses used in roof framing.

39 **Topic:** Roof Framing

Standard: Use a rafter framing square, speed square, and calculator in laying out a roof.

40
Topic: Roof Framing
Standard: Identify various types of sheathing use in roof construction.

41
Topic: Roof Framing
Standard: Frame a gable roof with vent openings.

42
Topic: Roof Framing
Standard: Frame a roof opening.

43
Topic: Roof Framing
Standard: Construct a frame roof, including hips, valleys, commons, jack rafters, and sheathing.

44
Topic: Roof Framing
Standard: Erect a gable roof using trusses.

45
Topic: Roof Framing
Standard: Estimate the materials used in framing and sheathing a roof.

46
Topic: Windows and Exterior Doors
Standard: Identify various types of fixed, sliding, and swinging windows.

47
Topic: Windows and Exterior Doors
Standard: Identify the parts of a window installation.

48
Topic: Windows and Exterior Doors
Standard: State the requirements for a proper window installation.

49
Topic: Windows and Exterior Door
Standard: Install a pre-hung window.

50
Topic: Windows and Exterior Doors
Standard: Identify the common types of skylights and roof windows.

51
Topic: Windows and Exterior Doors
Standard: Describe the procedure for properly installing a skylight.

52
Topic: Windows and Exterior Doors
Standard: Identify the common types of exterior doors and explain how they are constructed.

53
Topic: Windows and Exterior Doors
Standard: Identify the parts of a door installation.

54
Topic: Windows and Exterior Doors
Standard: Identify the types of thresholds used with exterior doors.

55
Topic: Windows and Exterior Doors
Standard: Install a threshold on a concrete floor.

56
Topic: Windows and Exterior Doors
Standard: Install a pre-hung exterior door with weatherstripping.

57
Topic: Windows and Exterior Doors
Standard: Identify the various types of lock-sets used on exterior doors and explain how they are installed.

58
Topic: Windows and Exterior Doors
Standard: Explain the correct installation procedure for a rollup garage door.

59
Topic: Windows and Exterior Doors
Standard: Install a lock-set.

35 **Topic:** Reading Plans and Elevations

Standard: Describe the types of drawings usually included in a set of plans and list the information found on each type.

36 **Topic:** Reading Plans and Elevations

Standard: Identify the different types of lines used on construction drawings.

37 **Topic:** Reading Plans and Elevations

Standard: Identify selected architectural symbols commonly used to represent materials on plans.

38 **Topic:** Reading Plans and Elevations

Standard: Identify selected electrical, mechanical, and plumbing symbols commonly used on plans.

39 **Topic:** Reading Plans and Elevations

Standard: Identify selected abbreviations commonly used on plans.

40 **Topic:** Reading Plans and Elevations

Standard: Read plans, elevations, schedules, etc., contained in basic construction drawings.

41 **Topic:** Reading Plans and Elevations

Standard: State the purpose of written specifications.

42 **Topic:** Reading Plans and Elevations

Standard: Understand and identify the parts of a specification.

43 **Topic:** Reading Plans and Elevations

Standard: Demonstrate or describe how to perform a quantity takeoff for materials.

44 **Topic:** Distance Measurement and Leveling

Standard: Describe the major responsibilities of the carpenter relative to site layout.

45 **Topic:** Distance Measurement and Leveling

Standard: Interpret site/plot drawings.

46 **Topic:** Distance Measurement and Leveling

Standard: Convert measurements stated in feet and inches to equivalent measurements stated in decimal feet and vice versa.

47 **Topic:** Distance Measurement and Leveling

Standard: Recognize, use, and properly maintain tools and equipment associated with taping.

48 **Topic:** Distance Measurement and Leveling

Standard: Use taping equipment and procedures to make distance measurements and perform site layout tasks.

49 **Topic:** Distance Measurement and Leveling

Standard: Determine approximate distances by pacing.

50 **Topic:** Distance Measurement and Leveling

Standard: Recognize, use, and properly care for tools and equipment associated with differential leveling.

51 **Topic:** Distance Measurement and Leveling

Standard: Use a builder’s level or transit and differential leveling procedures to determine site and building elevations.

52 **Topic:** Distance Measurement and Leveling

Standard: Record site layout data and information in field notes using accepted practices.

53

Topic: Distance Measurement and Leveling

Standard: Check and/or establish 90° angles using the 3/4/5 rule.

54

Topic: Concrete and Reinforcing Materials

Standard: Identify various types of cement and describe their uses.

55

Topic: Concrete and Reinforcing Materials

Standard: Identify types and sizes of concrete aggregates.

56

Topic: Concrete and Reinforcing Materials

Standard: Identify types of concrete admixtures and describe their uses.

57

Topic: Concrete and Reinforcing Materials

Standard: Identify special types of concrete and describe their uses.

58

Topic: Concrete and Reinforcing Materials

Standard: Identify concrete curing methods and materials.

59

Topic: Concrete and Reinforcing Materials

Standard: Identify concrete testing methods.

60

Topic: Concrete and Reinforcing Materials

Standard: Demonstrate sampling methods used for the testing of concrete.

61

Topic: Concrete and Reinforcing Materials

Standard: Perform slump testing of concrete.

62

Topic: Concrete and Reinforcing Materials

Standard: Perform casting of specimens for strength testing of concrete.

63

Topic: Concrete and Reinforcing Materials

Standard: Perform volume estimates for concrete quantity requirement.

64

Topic: Concrete and Reinforcing Materials

Standard: Identify types of concrete reinforcement bars and describe their uses.

65

Topic: Concrete and Reinforcing Materials

Standard: Identify types of reinforcement bar supports and describe their uses.

66

Topic: Concrete and Reinforcing Materials

Standard: Identify types of welded-wire fabric reinforcement material and describe their uses.

67

Topic: Foundations and Flatwork

Standard: Recognize four kinds of footings: · Continuous or spread · Stepped · Pier · Grade beam

68

Topic: Foundations and Flatwork

Standard: Identify the parts of footing forms and explain their purpose.

69

Topic: Foundations and Flatwork

Standard: Identify the parts of pier forms and explain their purpose.

70

Topic: Foundations and Flatwork

Standard: Demonstrate the ability to lay out and construct selected footing forms, including: · Continuous footing · Pier footing · Pile cap · Grade beam

71

Topic: Foundations and Flatwork

Standard: Strip a pier footing form and prepare it for erection at another location.

72

Topic: Foundations and Flatwork

Standard: Recognize types of concrete pours that require the construction of edge forms: · Slabs with or without a foundation · Parking lots · Driveways and streets · Sidewalks · Approaches

73 **Topic:** Foundations and Flatwork

Standard: Identify the parts of edge forms and explain their purpose.

74 **Topic:** Foundations and Flatwork

Standard: Demonstrate the ability to construct and disassemble edge forms for: · A slab-on-grade with an existing foundation. · A slab-on-grade with an integral foundation.

75 **Topic:** Foundations and Flatwork

Standard: Explain the purpose of a screed and identify the different types of screeds.

76 **Topic:** Foundations and Flatwork

Standard: Demonstrate the ability to set screeds on grade.

Course: Construction/Carpentry: 46.55300 Commercial Carpentry

35 **Topic:** Concrete Forms

Standard: Identify the various types of concrete forms.

36 **Topic:** Concrete Forms

Standard: Identify the components of each type of form.

37 **Topic:** Concrete Forms

Standard: Explain the safety procedures associated with using concrete forms.

38 **Topic:** Concrete Forms

Standard: Construct wall, column, beam, and stair forms.

39 **Topic:** Reinforcing Concrete

Standard: Describe the applications of reinforcing bars, the uses of reinforced structural concrete, and the basic processes involved in placing reinforcing bars.

40 **Topic:** Reinforcing Concrete

Standard: Recognize and identify the bar bends standardized by the American Concrete Institute.

41 **Topic:** Reinforcing Concrete

Standard: Read and interpret bar lists and describe the information found on a bar list.

42 **Topic:** Reinforcing Concrete

Standard: List the types of ties used in securing reinforcing bars.

43 **Topic:** Reinforcing Concrete

Standard: State the tolerances allowed in the fabrication of reinforcing bars.

44 **Topic:** Reinforcing Concrete

Standard: Demonstrate the use of common ties for reinforcing bars.

45 **Topic:** Reinforcing Concrete

Standard: Describe methods by which reinforcing bars may be cut and bent in the field.

46 **Topic:** Reinforcing Concrete

Standard: Identify the tools and equipment needed for installing reinforcing bars.

47 **Topic:** Reinforcing Concrete`

Standard: Demonstrate the ability to safely use selected tools and equipment to cut, bend, and install reinforcing materials.

48 **Topic:** Reinforcing Concrete

Standard: Explain the necessity of concrete cover in placing reinforcing bars.

49

Topic: Reinforcing Concrete

Standard: Explain and demonstrate how to place bars in walls, columns, beams, girders, joists, and slabs.

50

Topic: Reinforcing Concrete

Standard: Identify lapped and welded splices.

51

Topic: Handling and Placing Concrete

Standard: Identify and state the purpose of different types of concrete joints.

52

Topic: Handling and Placing Concrete

Standard: Recognize the various equipment used to transport and place concrete.

53

Topic: Handling and Placing Concrete

Standard: Describe the factors that contribute to the quality of concrete placement.

54

Topic: Handling and Placing Concrete

Standard: Demonstrate and/or describe the correct methods for placing and consolidating concrete into forms.

55

Topic: Handling and Placing Concrete

Standard: Demonstrate and/or describe how to use a screed to strike off and level concrete to the proper grade in a form.

56

Topic: Handling and Placing Concrete

Standard: Demonstrate and/or describe how to use a bullfloat and /or darby to level and smooth concrete.

57

Topic: Handling and Placing Concrete

Standard: Determine when conditions permit the concrete finishing operation to start.

58

Topic: Handling and Placing Concrete

Standard: Demonstrate and/or describe how to use a hand float and finishing trowel.

59

Topic: Handling and Placing Concrete

Standard: Demonstrate and/or describe how to use an edger.

60

Topic: Handling and Placing Concrete

Standard: Demonstrate and/or describe how to use a jointer.

61

Topic: Handling and Placing Concrete

Standard: Name the factors that affect the curing of concrete and describe the methods used to achieve proper curing.

62

Topic: Handling and Placing Concrete

Standard: Properly care for and safely use the hand and power tools used when working with concrete.

63

Topic: Patented Forms

Standard: Recognize various types of patented forms.

64

Topic: Patented Forms

Standard: Identify the components of patented wall-forming systems.

65

Topic: Patented Forms

Standard: State the differences in construction and use for different types of forms.

66

Topic: Patented Forms

Standard: Describe how a flying form system is moved.

67

Topic: Patented Forms

Standard: Erect, plumb, and brace a patented wall form.

68

Topic: Patented Forms

Standard: Use a patented hardware system to erect forms of lumber and sheathing.

69 **Topic:** Patented Forms
Standard: Erect, plumb, and brace a patented column form.

70 **Topic:** Tilt-up Wall Systems
Standard: Describe the history of tilt-up construction.

71 **Topic:** Tilt-up Wall Systems
Standard: Explain the advantages and disadvantages of tilt-up construction.

72 **Topic:** Tilt-up Wall Systems
Standard: Explain how aggregates are used to obtain the desired appearance in tilt-up wall panels.

73 **Topic:** Tilt-up Wall Systems
Standard: Explain and/or demonstrate the correct method for preparing a floor slab to be used in forming tilt-up panels.

74 **Topic:** Tilt-up Wall Systems
Standard: Explain and/or demonstrate the correct procedure for forming and finishing a tilt-up wall panel.

75 **Topic:** Tilt-up Wall Systems
Standard: Explain and/or demonstrate the correct procedure for preparing footings to receive tilt-up wall panels.

76 **Topic:** Tilt-up Wall Systems
Standard: Explain and/or demonstrate the correct procedure for safely lifting and joining wall panels.

77 **Topic:** Tilt-up Wall Systems
Standard: Select and properly place lifting and bracing insers.

Course: Construction/Electrical: 46.56000 Electrical I

35 **Topic:** Electrical Theory
Standard: Recognize what atoms are and how they are constructed.

36 **Topic:** Electrical Theory
Standard: Define voltage and identify the ways in which it can be produced.

37 **Topic:** Electrical Theory
Standard: Explain the difference between conductors and insulators.

38 **Topic:** Electrical Theory
Standard: Define the units of measurement that are used to measure the properties of electricity.

39 **Topic:** Electrical Theory
Standard: Explain how voltage, current, and resistance are related to each other.

40 **Topic:** Electrical Theory
Standard: Using the formula for Ohm’s Law, calculate an unknown valve.

41 **Topic:** Electrical Theory
Standard: Explain the different types of meters used to measure voltage, current, and resistance.

42 **Topic:** Electrical Theory
Standard: Using the power formula, calculate the amount of power used by a circuit.

43 **Topic:** Introduction To The National Electrical Code
Standard: Explain the purpose and history of the National Electrical Code (NEC).

44 **Topic:** Introduction To The National Electrical Code
Standard: Describe the layout of the NEC.

45 **Topic:** Introduction To The National Electrical Code
Standard: Explain how to navigate the NEC.

46 **Topic:** Introduction To The National Electrical Code

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

47 **Topic:** Introduction To The National Electrical Code

Standard: Explain the role of testing laboratories.

48 **Topic:** Electrical Test Equipment

Standard: Explain the operation of and describe the following pieces of test equipment; · Ammeter · Voltmeter · Ohmmeter · Volt-ohm-milliammeter · Wattmeter · Megohmmeter · Frequency meter · Power factor meter · Continuity tester · Voltage tester · Recording instruments · Cable-length meters

49 **Topic:** Electrical Test Equipment

Standard: Explain how to read and convert from one scale to another using the above test equipment.

50 **Topic:** Electrical Test Equipment

Standard: Explain the importance of proper meter polarity.

51 **Topic:** Electrical Test Equipment

Standard: Define frequency and explain the use of a frequency meter.

52 **Topic:** Electrical Test Equipment

Standard: Explain the difference between digital and analog meter.

53 **Topic:** Raceways, Boxes, and Fittings

Standard: Describe various types of cable trays and raceways.

54 **Topic:** Raceways, Boxes, and Fittings

Standard: Identify and select various types and sizes of raceways.

55 **Topic:** Raceways, Boxes, and Fittings

Standard: Identify and select various types and sizes of cable trays.

56 **Topic:** Raceways, Boxes, and Fittings

Standard: Identify and select various types of raceway fittings.

57 **Topic:** Raceways, Boxes, and Fittings

Standard: Identify various methods used to install raceways.

58 **Topic:** Raceways, Boxes, and Fittings

Standard: Demonstrate knowledge of NEC raceway requirements.

59 **Topic:** Raceways, Boxes, and Fittings

Standard: Describe procedures for installing raceways and boxes: · On masonry surfaces. · On concrete surfaces. · In a metal stud environment. · In a wood frame environment. · On drywall surfaces.

60 **Topic:** Raceways, Boxes, and Fittings

Standard: Recognize safety precautions that must be followed when working with boxes and raceways.

61 **Topic:** Wiring: Residential

Standard: Describe how to determine electric service requirements for dwellings.

62 **Topic:** Wiring: Residential

Standard: Explain the grounding requirements of a residential electric service.

63 **Topic:** Wiring: Residential

Standard: Calculate and select service-entrance equipment.

64 **Topic:** Wiring: Residential

Standard: Select the proper wiring methods for various types of residences.

65 **Topic:** Wiring: Residential

Standard: Explain the role of the NEC in residential wiring.

66 **Topic:** Wiring: Residential
Standard: Compute branch circuit loads and explain their installation requirements.

67 **Topic:** Wiring: Residential
Standard: Explain the types and purposed of equipment grounding conductors.

68 **Topic:** Wiring: Residential
Standard: Explain the purpose of ground fault circuit interrupters and tell where they must be installed.

69 **Topic:** Wiring: Residential
Standard: Size outlet boxes and select the proper type for different wiring methods.

70 **Topic:** Wiring: Residential
Standard: Describe rules for installing electric space heating and HVAC equipment.

71 **Topic:** Wiring: Residential
Standard: Describe the installation rules for electrical systems around swimming pools, spas, and hot tubs.

72 **Topic:** Wiring: Residential
Standard: Explain how wiring devices are selected and installed.

73 **Topic:** Wiring: Residential
Standard: Describe the installation and control of lighting fixtures.

Course: Construction/Electrical: 46.56100 Electrical II

35 **Topic:** Electrical Theory Applications
Standard: Explain the basic characteristics of a series circuit.

36 **Topic:** Electrical Theory Applications
Standard: Explain the basic characteristics of a parallel circuit.

37 **Topic:** Electrical Theory Applications
Standard: Explain the basic characteristics of a series-parallel circuit.

38 **Topic:** Electrical Theory Applications
Standard: Calculate, using Kirchhoff's Voltage Law, the voltage drop in series, parallel, and series-parallel circuits.

39 **Topic:** Electrical Theory Applications
Standard: Calculate, using Kirchhoff's Current Law, the total current in parallel and series-parallel circuits.

40 **Topic:** Electrical Theory Applications
Standard: Find the total amount of resistance in a series circuit.

41 **Topic:** Electrical Theory Applications
Standard: Find the total amount of resistance in a parallel circuit.

42 **Topic:** Electrical Theory Applications
Standard: Find the total amount of resistance in a series-parallel circuit.

43 **Topic:** Hand Bending
Standard: Identify the methods of hand bending conduit.

44 **Topic:** Hand Bending
Standard: Identify the various methods used to install conduit.

45 **Topic:** Hand Bending
Standard: Use math formulas to determine conduit bends.

46 **Topic:** Hand Bending
Standard: Make 90° bends, back-to-back bends, offsets, kicks, and saddle bends using a hand bender.

47 **Topic:** Hand Bending
Standard: Cut, ream, and thread conduit.

48 **Topic:** Fasteners and Anchors
Standard: Identify and explain the use of: · Threaded fasteners · Nonthreaded fasteners · Anchors

49 **Topic:** Fasteners and Anchors
Standard: Demonstrate the correct applications for fasteners and anchors.

50 **Topic:** Fasteners and Anchors
Standard: Install fasteners and anchors.

51 **Topic:** Introduction to Electrical Blueprints
Standard: Explain the basic layout of a blueprint.

52 **Topic:** Introduction to Electrical Blueprints
Standard: Describe the information included in the title block of a blueprint.

53 **Topic:** Introduction to Electrical Blueprints
Standard: Identify the types of lines used on blueprints.

54 **Topic:** Introduction to Electrical Blueprints
Standard: Identify common symbols used on blueprints.

55 **Topic:** Introduction to Electrical Blueprints
Standard: Understand the use of architect and engineer’s scales.

56 **Topic:** Introduction to Electrical Blueprints
Standard: Interpret electrical drawings, including site plans, floor plans, and detail drawings.

57 **Topic:** Introduction to Electrical Blueprints
Standard: Read equipment schedules found on electrical blueprints.

58 **Topic:** Introduction to Electrical Blueprints
Standard: Describe the type of information included in electrical specifications.

59 **Topic:** Wiring: Commercial Industrial
Standard: Identify and state the functions and ratings of single-pole, double-pole, three-way, four-way, dimmer, special, and safety switches.

60 **Topic:** Wiring: Commercial and Industrial
Standard: Explain NEMA classifications as they relate to switches and enclosures.

61 **Topic:** Wiring: Commercial and Industrial
Standard: Explain the NEC requirements concerning wiring devices.

62 **Topic:** Wiring: Commercial and Industrial
Standard: Identify and state the functions and ratings of straight blade, twist lock, and pin and sleeve receptacles.

63 **Topic:** Wiring: Commercial and Industrial
Standard: Identify and define receptacle terminals and disconnects.

64 **Topic:** Wiring: Commercial and Industrial
Standard: Identify and define ground fault circuit interrupters.

65 **Topic:** Wiring: Commercial and Industrial
Standard: Explain the box mounting requirements in the NEC.

66 **Topic:** Wiring: Commercial and Industrial

Standard: Use a wire stripper to strip insulation from a wire.

67 **Topic:** Wiring: Commercial and Industrial

Standard: Use a solderless connector to splice wires together.

68 **Topic:** Wiring: Commercial and Industrial

Standard: Identify and state the functions of limit switches and relays.

69 **Topic:** Wiring: Commercial and Industrial

Standard: Identify and state the function of switchgear.

Course: Construction/Electrical: 46.56200 Commercial Wiring I

35 **Topic:** Alternating Current

Standard: Calculate the peak and effective voltage or current values for an AC waveform.

36 **Topic:** Alternating Current

Standard: Calculate the phase relationship between two AC waveforms.

37 **Topic:** Alternating Current

Standard: Describe the voltage and current phase relationship in a resistive AC circuit.

38 **Topic:** Alternating Current

Standard: Describe the voltage and current transients that occur in an inductive circuit.

39 **Topic:** Alternating Current

Standard: Define inductive reactance and state how it is affected by frequency.

40 **Topic:** Alternating Current

Standard: Describe the voltage and current transients that occur in a capacitive circuit.

41 **Topic:** Alternating Current

Standard: Define capacitive reactance and state how it is affected by frequency.

42 **Topic:** Alternating Current

Standard: Explain the relationship between voltage and current in the following types of AC circuits: · RL circuit · RC circuit · LC circuit · RLC circuit

43 **Topic:** Alternating Current

Standard: Describe the effect that resonant frequency has on impedance and current flow in a series or parallel resonant circuit.

44 **Topic:** Alternating Current

Standard: Define bandwidth and describe how it is affected by resistance in a series or parallel resonant circuit.

45 **Topic:** Alternating Current

Standard: Explain the following terms as they relate to AC circuits: · True power · Apparent power · Reactive power · Power factor

46 **Topic:** Alternating Current

Standard: Explain basic transformer action.

47 **Topic:** Motors: Theory and Application

Standard: Define the following terms: · Ampacity · Branch circuit · Circuit breaker · Controller · Duty · Equipment · Full-load amps · Ground fault circuit interrupter · Interrupting rating · Motor circuit switch · NEMA design letter · Nonautomatic · Overcurrent · Overload · Power factor · Rated full-load speed · Rated horsepower · Remote control circuit · Service factor · Thermal cutout · Thermal protector

48 **Topic:** Motors: Theory and Application

Standard: Describe the various types of motor enclosures.

49 **Topic:** Motors: Theory and Application

Standard: Describe how the rated voltage of a motor differs from the system voltage.

50 **Topic:** Motors: Theory and Application

Standard: Describe the basic construction and components of a three-phase squirrel cage induction motor.

51 **Topic:** Motors: Theory and Application

Standard: Explain the relationships among speed, frequency, and the number of poles in a three-phase induction motor.

52 **Topic:** Motors: Theory and Application

Standard: Describe how torque is developed in an induction motor.

53 **Topic:** Motors: Theory and Application

Standard: Explain how and why torque varies with rotor reactance and slip.

54 **Topic:** Motors: Theory and Application

Standard: Define percent slip and speed regulation.

55 **Topic:** Motors: Theory and Application

Standard: Explain how the direction of a three-phase motor is reversed.

56 **Topic:** Motors: Theory and Application

Standard: Describe the component parts and operating characteristics of a three-phase wound rotor induction motor.

57 **Topic:** Motors: Theory and Application

Standard: Describe the component parts and operating characteristics of a three-phase synchronous motor.

58 **Topic:** Motors: Theory and Application

Standard: Define torque, starting current, and armature reaction as they apply to DC motors.

59 **Topic:** Motors: Theory and Application

Standard: Explain how the direction of rotation of a DC motor is changed.

60 **Topic:** Motors: Theory and Application

Standard: Describe the design and characteristics of a DC shunt, series, and compound motor.

61 **Topic:** Motors: Theory and Application

Standard: Describe dual-voltage motors and their applications.

62 **Topic:** Motors: Theory and Application

Standard: Describe the methods for determining various motor connections.

63 **Topic:** Motors: Theory and Application

Standard: Describe general motor protection requirements as delineated in the NEC.

64 **Topic:** Grounding

Standard: Explain the purpose of grounding and the scope of NEC Article 250.

65 **Topic:** Grounding

Standard: Distinguish between a short circuit and a ground fault.

66 **Topic:** Grounding

Standard: Define the NEC ground-related terms.

67 **Topic:** Grounding

Standard: Distinguish between system grounding and equipment grounding.

68

Topic: Grounding

Standard: Use NEC Table 250-66 to size the grounding electrode conductor for various AC systems.

69

Topic: Grounding

Standard: Explain the NEC requirements for the installation and physical protection of grounding electrode conductors.

70

Topic: Grounding

Standard: Explain the function of the grounding electrode system and determine which grounding electrodes must be used.

71

Topic: Grounding

Standard: Define made electrodes and explain the resistance requirements for made electrodes using NEC Section 250-52.

72

Topic: Grounding

Standard: Use NEC Table 250-122 to size the equipment-grounding conductor for raceways and equipment.

73

Topic: Grounding

Standard: Explain the function of the main bonding jumper in the grounding system and size the main bonding jumper for various applications.

74

Topic: Grounding

Standard: Size the main bonding jumper for a service utilizing multiple service disconnecting means.

75

Topic: Grounding

Standard: Explain the NEC requirements for bonding of enclosures and equipment.

76

Topic: Grounding

Standard: Explain the NEC requirements for grounding of enclosures and equipment.

77

Topic: Grounding

Standard: Explain effectively grounded and its importance in clearing ground faults and short circuits.

78

Topic: Grounding

Standard: Explain the purposes of the grounded conductor (neutral) in the operation of overcurrent devices.

79

Topic: Grounding

Standard: Explain the NEC requirements for grounding separately derived systems, including transformers and generators.

80

Topic: Grounding

Standard: Explain the NEC requirements for grounding at more than one building.

81

Topic: Grounding

Standard: Explain the NEC grounding requirements for systems over 600 volts.

82

Topic: Conduit Bending

Standard: Describe the process of conduit bending using power tools.

83

Topic: Conduit Bending

Standard: Identify all parts of popular electric and hydraulic benders.

84

Topic: Conduit Bending

Standard: Avoid excessive waste when working with conduit systems.

85

Topic: Conduit Bending

Standard: Bend offsets, kicks, saddles, segmented, and parallel bends.

86

Topic: Conduit Bending

Standard: Explain the requirements of the NEC for bending conduits.

87 **Topic:** Conduit Bending
Standard: Compute the radius, degrees in bend, developed length, and gain for conduit up to six inches.

88 **Topic:** Conduit Bending
Standard: Explain how to correct damaged conduit and modify existing bends.

89 **Topic:** Boxes and Fittings
Standard: Describe the different types of nonmetallic and metallic boxes.

90 **Topic:** Boxes and Fittings
Standard: Understand the NEC requirements for box fill.

91 **Topic:** Boxes and Fittings
Standard: Calculate the required box size for any number and size of conductors.

92 **Topic:** Boxes and Fittings
Standard: Explain the NEC regulations for volume required per conductor in outlet boxes.

93 **Topic:** Boxes and Fittings
Standard: Properly locate, install, and support boxes of all types.

94 **Topic:** Boxes and Fittings
Standard: Describe the NEC regulations governing pull and junction boxes.

95 **Topic:** Boxes and Fittings
Standard: Explain the radius rule when installing conductors in pull boxes.

96 **Topic:** Boxes and Fittings
Standard: Understand the NEC requirements for boxes supporting lighting fixtures.

97 **Topic:** Boxes and Fittings
Standard: Describe the purpose of conduit boxes and Type FS boxes.

98 **Topic:** Boxes and Fittings
Standard: Install the different types of fittings used in conjunction with boxes.

99 **Topic:** Boxes and Fittings
Standard: Describe the installation rules for installing boxes and fittings in hazardous areas.

100 **Topic:** Boxes and Fittings
Standard: Explain how boxes and fittings are selected and installed.

101 **Topic:** Boxes and Fittings
Standard: Describe the various types of box supports.

102 **Topic:** Conductor Installations
Standard: Describe the various methods of installing conductors in conduit.

103 **Topic:** Conductor Installations
Standard: Plan and set up for a cable pull.

104 **Topic:** Conductor Installations
Standard: Understand the importance of selecting the proper location for cable pulls.

105 **Topic:** Conductor Installations
Standard: Describe how cable reels are transported to the pulling site.

106 **Topic:** Conductor Installations
Standard: Set up reel stands and spindles for a wire-pulling installation.

107 **Topic:** Conductor Installations
Standard: Explain how mandrels, swabs, and brushes are used to prepare conduit for conductors.

108 **Topic:** Conductor Installations
Standard: Properly install a pull line for a cable-pulling operation.

109 **Topic:** Conductor Installations
Standard: Explain the operation of power fish tape systems.

110 **Topic:** Conductor Installations
Standard: Prepare the ends of conductors for pulling.

111 **Topic:** Conductor Installations
Standard: Describe the types of cable pullers.

112 **Topic:** Conductor Installations
Standard: Describe the process of high-force cable pulling.

113 **Topic:** Conductor Installations
Standard: Explain how to support conductors in vertical conduit runs.

114 **Topic:** Conductor Installations
Standard: Describe the installation of cables in cable trays.

115 **Topic:** Conductor Installations
Standard: Explain the importance of communication during a cable-pulling operation.

116 **Topic:** Conductor Installations
Standard: Calculate the probable stress or tension in cable pulls.

Course: Construction/Electrical: 46.56300 Commercial Wiring II

35 **Topic:** Cable Tray
Standard: Describe the components that make up a cable tray assembly.

36 **Topic:** Cable Tray
Standard: Explain the methods used to hang and secure cable tray.

37 **Topic:** Cable Tray
Standard: Describe how cable enters and exits cable tray.

38 **Topic:** Cable Tray
Standard: Select the proper cable tray fitting for the situation.

39 **Topic:** Cable Tray
Standard: Explain the NEMA standards for cable tray installations.

40 **Topic:** Cable Tray
Standard: Explain the NEC requirements for cable tray installations.

41 **Topic:** Cable Tray
Standard: Select the required fitting to ensure equipment-grounding continuity in cable tray systems.

42 **Topic:** Cable Tray
Standard: Interpret electrical working drawings showing cable tray fittings.

43 **Topic:** Cable Tray
Standard: Size cable tray for the number and type of conductors contained in the system.

44 **Topic:** Cable Tray
Standard: Select rollers and sheaves for pulling cable in specific cable tray situations.

45 **Topic:** Cable Tray
Standard: Designate the required locations of rollers and sheaves for a specific cable pull.

46 **Topic:** Cable Tray
Standard: Fabricate an offset for a cable tray.

47 **Topic:** Conductor Terminations and Splices
Standard: Describe how to make a good conductor termination.

48 **Topic:** Conductor Terminations and Splices
Standard: Prepare cable ends for terminations and splices.

49 **Topic:** Conductor Terminations and Splices
Standard: Install lugs and connectors onto conductors.

50 **Topic:** Conductor Terminations and Splices
Standard: Train cable at termination points.

51 **Topic:** Conductor Terminations and Splices
Standard: Explain the role of the NEC in making cable terminations and splices.

52 **Topic:** Conductor Terminations and Splices
Standard: Explain why mechanical stress should be avoided at cable termination points.

53 **Topic:** Conductor Terminations and Splices
Standard: Describe the importance of using proper bolt torque when bolting lugs onto busbars.

54 **Topic:** Conductor Terminations and Splices
Standard: Describe crimping techniques.

55 **Topic:** Conductor Terminations and Splices
Standard: Select the proper lug or connector for the job.

56 **Topic:** Conductor Terminations and Splices
Standard: Describe splicing techniques.

57 **Topic:** Conductor Terminations and Splices
Standard: Describe the installation rules for parallel conductors.

58 **Topic:** Conductor Terminations and Splices
Standard: Explain how to use hand and power crimping tools.

59 **Topic:** Installation of Electric Services
Standard: Describe various types of electric services for commercial and industrial installations.

60 **Topic:** Installation of Electric Services
Standard: Read electrical blueprints and diagrams describing service installations.

61 **Topic:** Installation of Electric Services
Standard: Calculate and select service-entrance equipment.

62 **Topic:** Installation of Electric Services
Standard: Explain the role of the NEC in service installations.

63 **Topic:** Installation of Electric Services
Standard: Install main disconnect switches, panelboards, and overcurrent protection devices.

64 **Topic:** Installation of Electric Services
Standard: Identify the circuit loads, number of circuits required, and installation requirements for distribution panels.

65 **Topic:** Installation of Electric Services
Standard: Explain the types and purposes of service grounding.

66 **Topic:** Installation of Electric Services
Standard: Explain the purpose of ground fault circuit interrupters and where they must be installed.

67 **Topic:** Installation of Electric Services
Standard: Describe single-phase service connections.

68 **Topic:** Installation of Electric Services
Standard: Describe both wye-connected and delta-connected three-phase services.

69 **Topic:** Circuit Breakers and Fuses
Standard: Explain the necessity of overcurrent protection devices in electrical circuits.

70 **Topic:** Circuit Breakers and Fuses
Standard: Define the terms associated with fuses and circuit breakers.

71 **Topic:** Circuit Breakers and Fuses
Standard: Describe the operation of a circuit breaker.

72 **Topic:** Circuit Breakers and Fuses
Standard: Select the most suitable overcurrent device for the application.

73 **Topic:** Circuit Breakers and Fuses
Standard: Explain the role of the NEC in specifying overcurrent devices.

74 **Topic:** Circuit Breakers and Fuses
Standard: Describe the operation of single-element and time-delay fuses.

75 **Topic:** Circuit Breakers and Fuses
Standard: Explain how ground fault circuit interrupters (GFCIs) can save lives.

76 **Topic:** Circuit Breakers and Fuses
Standard: Replace a renewable fuse link.

77 **Topic:** Circuit Breakers and Fuses
Standard: Calculate short circuit currents.

78 **Topic:** Circuit Breakers and Fuses
Standard: Describe troubleshooting and maintenance techniques for overcurrent devices.

79 **Topic:** Contactors and Relays
Standard: Describe the operating principles of contactors and relays.

80 **Topic:** Contactors and Relays
Standard: Select contactors and relays for use in specific electrical systems.

81 **Topic:** Contactors and Relays
Standard: Explain how mechanical contactors operate.

82 **Topic:** Contactors and Relays
Standard: Explain how solid-state contactors operate.

83 **Topic:** Contactors and Relays
Standard: Install contactors and relays according to the NEC requirements.

84 **Topic:** Contactors and Relays

Standard: Select and install contactors and relays for lighting control.

85 **Topic:** Contactors and Relays

Standard: Read wiring diagrams involving contactors and relays.

86 **Topic:** Contactors and Relays

Standard: Describe how overload relays operate.

87 **Topic:** Contactors and Relays

Standard: Connect a simple control circuit.

88 **Topic:** Contactors and Relays

Standard: Test control circuits.

89 **Topic:** Electric Lighting

Standard: Explain how the human eye works.

90 **Topic:** Electric Lighting

Standard: Describe the characteristics of light.

91 **Topic:** Electric Lighting

Standard: Recognize the different kinds of lamps and explain the advantages and disadvantages of each type: · Incandescent · Halogen · Fluorescent · High-intensity discharge (HID)

92 **Topic:** Electric Lighting

Standard: Properly select and install lamps into lighting fixtures.

93 **Topic:** Electric Lighting

Standard: Recognize and install various types of lighting fixtures: · Surface-mounted · Recessed · Suspended · Track-mounted

Course: Construction/Masonry: 46.57000 Masonry I

35 **Topic:** Safety Requirements

Standard: Describe safety precautions and general housekeeping practices that should be followed at a typical work site.

36 **Topic:** Safety Requirements

Standard: Describe the safety precautions that should be followed when working in special areas such as trenches, excavations, confined spaces, scaffolding, and limited access zones.

37 **Topic:** Safety Requirements

Standard: Describe the proper procedures for handling and maintaining masonry tools safely.

38 **Topic:** Safety Requirements

Standard: Explain the importance of safety meetings and what they involve.

39 **Topic:** Safety Requirements

Standard: Identify and discuss the purpose of federal safety designation colors.

40 **Topic:** Safety Requirements

Standard: Demonstrate setting up ladders according to OSHA (Occupational Safety and Health Administration) safety regulations under the supervision of a qualified person.

41 **Topic:** Safety Requirements

Standard: Discuss the uses of and demonstrate proper procedures for putting on eye protection, respiratory protection, and a safety harness.

42 **Topic:** Safety Requirements
Standard: Demonstrate correct safety procedures for fueling and starting a gas-fueled power tool.

43 **Topic:** Mathematics, Drawings, and Specifications
Standard: Understand and work with denominate numbers.

44 **Topic:** Mathematics, Drawings, and Specifications
Standard: Read a mason's measure.

45 **Topic:** Mathematics, Drawings, and Specifications
Standard: Convert measurements in the U.S. common system into their metric equivalents.

46 **Topic:** Mathematics, Drawings, and Specifications
Standard: Recognize, identify, and calculate areas, circumferences, and volumes of basic geometric shapes.

47 **Topic:** Mathematics, Drawings, and Specifications
Standard: Identify the basic parts of a set of drawings.

48 **Topic:** Mathematics, Drawings, and Specifications
Standard: Discuss the different types of specifications used in the building industry and the sections that pertain to masonry.

49 **Topic:** Masonry Units and Installation Techniques
Standard: Describe the most common types of masonry units.

50 **Topic:** Masonry Units and Installation Techniques
Standard: Describe and demonstrate setting up a wall.

51 **Topic:** Masonry Units and Installation Techniques
Standard: Lay a dry bond.

52 **Topic:** Masonry Units and Installation Techniques
Standard: Spread furrowed bed joint and butter masonry units.

53 **Topic:** Masonry Units and Installation Techniques
Standard: Describe the different types of masonry bonds.

54 **Topic:** Masonry Units and Installation Techniques
Standard: Cut brick and block accurately.

55 **Topic:** Masonry Units and Installation Techniques
Standard: Lay masonry units in a true course.

56 **Topic:** Masonry Units and Installation Techniques
Standard: Design and build a: · Pyramid wall · Corner using 3/4/5 rule · Column

Course: Construction/Masonry: 46.57100 Residential Masonry

35 **Topic:** Residential Plans and Drawing Interpretation
Standard: Understand the organization of residential plans and drawings.

36 **Topic:** Residential Plans and Drawing Interpretation
Standard: Interpret dimensions and scales on drawings.

37 **Topic:** Residential Plans and Drawing Interpretation
Standard: Interpret information on residential plans.

38 **Topic:** Residential Plans and Drawing Interpretation
Standard: Estimate materials quantities from plans and drawings.

39 **Topic:** Residential Masonry
Standard: Understand the requirements for construction of various types of residential foundations.

40 **Topic:** Residential Masonry
Standard: Identify and explain the characteristics, uses, and installation techniques for brick pavers.

41 **Topic:** Residential Masonry
Standard: Lay out and construct steps, patios, and decks made from masonry units.

42 **Topic:** Residential Masonry
Standard: Lay out and construct chimneys and fireplaces.

43 **Topic:** Grout and Other Reinforcement
Standard: Name and describe the primary ingredients in grout and their properties.

44 **Topic:** Grout and Other Reinforcement
Standard: Identify the different types of grout used in masonry work.

45 **Topic:** Grout and Other Reinforcement
Standard: Describe the common admixtures and their uses.

46 **Topic:** Grout and Other Reinforcement
Standard: Describe the use of steel bar reinforcement in masonry construction.

47 **Topic:** Grout and Other Reinforcement
Standard: Use the proper techniques to apply grout in low and high lifts.

48 **Topic:** Metal Work in Masonry
Standard: Describe the uses and installation of vertical reinforcement.

49 **Topic:** Metal Work in Masonry
Standard: Describe the uses and installation of different types of horizontal joint reinforcements and ties.

50 **Topic:** Metal Work in Masonry
Standard: Describe the uses and installation of different anchors, fasteners, and embedded items.

51 **Topic:** Metal Work in Masonry
Standard: Describe the installation of hollow metal frames.

52 **Topic:** Metal Work in Masonry
Standard: Describe the functions and installations of sills and lintels.

Course: Construction/Masonry: 46.57200 Design Masonry

35 **Topic:** Advanced Laying Techniques
Standard: Recognize the structural principles and fundamental uses of basic types of walls.

36 **Topic:** Advanced Laying Techniques
Standard: Recognize the requirement for, and function of, control joints and expansion joints.

37 **Topic:** Advanced Laying Techniques
Standard: Construct various types of walls using proper reinforcement, jointing, and bonding techniques.

38 **Topic:** Advanced Laying Techniques
Standard: Construct specialty structures such as manholes, segmented block walls, and screens.

39 **Topic:** Advanced Laying Techniques
Standard: Identify and explain the different types of masonry arches used today.

40 **Topic:** Advanced Laying Techniques

Standard: Construct a semicircular and jack arch.

41 **Topic:** Construction Techniques and Moisture Control

Standard: Explain and demonstrate techniques for constructing masonry around windows, doors, and other openings.

42 **Topic:** Construction Techniques and Moisture Control

Standard: Explain the requirements for wall bracing and demonstrate the techniques used to construct pilasters and other types of bracing.

43 **Topic:** Construction Techniques and Moisture Control

Standard: Identify the various types of insulation used in conjunction with masonry construction and explain installation techniques.

44 **Topic:** Construction Techniques and Moisture Control

Standard: Identify the need for moisture control in various types of masonry construction and demonstrate the techniques used to eliminate moisture problems.

45 **Topic:** Elevated Work

Standard: Describe the appropriate steps necessary for setting up and maintaining elevated workstations.

46 **Topic:** Elevated Work

Standard: Properly operate material handling and hoisting equipment.

47 **Topic:** Elevated Work

Standard: Describe the safety requirements and guidelines employed in elevated and high-rise construction.

48 **Topic:** Elevated Work

Standard: Describe basic activities that can be used on the job to prevent elevated workstation accidents.

49 **Topic:** Elevated Work

Standard: Understand scaffolding positioning and how it affects laying technique.

Course: Construction/Masonry: 46.57300 Commercial Masonry

35 **Topic:** Construction Inspection and Quality Control

Standard: Discuss industry standards for quality control.

36 **Topic:** Construction Inspection and Quality Control

Standard: Build masonry sample panels and prisms.

37 **Topic:** Construction Inspection and Quality Control

Standard: Perform field test on mortar.

38 **Topic:** Construction Inspection and Quality Control

Standard: Discuss and perform field inspections.

39 **Topic:** Commercial Drawings

Standard: Recognize the difference between commercial and residential construction drawings.

40 **Topic:** Commercial Drawings

Standard: Identify the basic keys, abbreviations, and other references contained in a set of commercial drawings.

41 **Topic:** Commercial Drawings

Standard: Accurately read a set of commercial drawings.

42 **Topic:** Commercial Drawings

Standard: Explain basic construction details and concepts employed in commercial construction.

43 **Topic:** Estimating

Standard: Understand and apply basic materials estimating procedures for concrete block construction and brick construction.

44 **Topic:** Estimating

Standard: Understand and apply basic estimating procedures for reinforcements, ties, and other materials.

45 **Topic:** Estimating

Standard: Understand and apply procedures for quantities of mortar and mortar materials.

46 **Topic:** Project Planning and Supervision

Standard: Describe the general duties and responsibilities of masonry foremen and supervisors.

47 **Topic:** Project Planning and Supervision

Standard: Describe the basic activities required to organize project resources.

48 **Topic:** Project Planning and Supervision

Standard: Operate and effectively use basic surveying equipment to lay out foundations, walls, and other structural components.

49 **Topic:** Project Planning and Supervision

Standard: Understand and apply inspection procedures normally used on a project.

Course: Construction/Plumbing: 46.58000 Plumbing I

35 **Topic:** Introduction to Plumbing Blueprint Reading

Standard: Discuss the various ways in which drawings can be reproduced, including blue lines, black lines, sepias, and CAD (computer aided design).

36 **Topic:** Introduction to Plumbing Blueprint Reading

Standard: Identify orthographic, oblique, and isometric drawings.

37 **Topic:** Introduction to Plumbing Blueprint Reading

Standard: Discuss how orthographic views are used to depict information about objects.

38 **Topic:** Introduction to Plumbing Blueprint Reading

Standard: Explain how scale and dimensions are used to convey information on orthographic drawings.

39 **Topic:** Introduction to Plumbing Blueprint Reading

Standard: Identify the basic symbols used in schematic drawings of pipe assemblies.

40 **Topic:** Introduction to Plumbing Blueprint Reading

Standard: Discuss the characteristics of isometric drawings.

41 **Topic:** Introduction to Plumbing Blueprint Reading

Standard: Discuss procedures used to make piping isometrics.

42 **Topic:** Reading Residential Plumbing Drawings

Standard: List the types of drawings that may be included in a set of residential plans.

43 **Topic:** Reading Residential Plumbing Drawings

Standard: Distinguish between plans and specifications.

44 **Topic:** Reading Residential Plumbing Drawings

Standard: Interpret plumbing related information from a set of residential plans.

45 **Topic:** Reading Residential Plumbing Drawings
Standard: Understand the relationships that exist among the various drawings.

46 **Topic:** Reading Residential Plumbing Drawings
Standard: Apply the local code requirements to given drawings.

47 **Topic:** Math for Plumbers
Standard: Name the basic elements of a fitting.

48 **Topic:** Math for Plumbers
Standard: Discuss various methods of measuring pipe.

49 **Topic:** Math for Plumbers
Standard: Use tables to find fitting allowances for various sizes and types of fittings.

50 **Topic:** Math for Plumbers
Standard: Define the term offset as it is used in piping applications.

51 **Topic:** Math for Plumbers
Standard: Name the principal parts of a piping offset.

52 **Topic:** Joining Cast-Iron Pipe and Fittings
Standard: Identify cast-iron pipe.

53 **Topic:** Joining Cast-Iron Pipe and Fittings
Standard: Cut cast-iron pipe to proper lengths.

54 **Topic:** Joining Cast-Iron Pipe and Fittings
Standard: Install cast-iron pipe and fittings.

55 **Topic:** Joining Cast-Iron Pipe and Fittings
Standard: Join cast-iron pipe and fittings.

Course: Construction/Plumbing: 46.58100 Residential Plumbing

35 **Topic:** Making Flared and Compression Joints with Copper Tubing
Standard: Identify fittings and soft copper tubing.

36 **Topic:** Making Flared and Compression Joints with Copper Tubing
Standard: Discuss the advantages of flared and compression joints.

37 **Topic:** Installing Traps and Interceptors
Standard: Describe the different types of traps and how they work.

38 **Topic:** Installing Traps and Interceptors
Standard: Explain the local code requirements for trap installation.

39 **Topic:** Installing Traps and Interceptors
Standard: Identify the critical dimensions in trap installation.

40 **Topic:** Fitting and Cleanout Requirements for DWV Piping
Standard: Recognize the different types of DWV (drain, waste, and ventilation) fittings.

41 **Topic:** Fitting and Cleanout Requirements for DMV Piping
Standard: Understand the application of the various kinds of DWV fittings used within the plumbing design.

42 **Topic:** Fitting and Cleanout Requirements for DMV Piping
Standard: Understand the application of the various kinds of DWV fittings in reference to code requirements.

43 **Topic:** Fitting and Cleanout Requirements for DMV Piping
Standard: Understand the use of clean-outs in the DWV piping system.

44 **Topic:** Fitting and Cleanout Requirements for DMV Piping
Standard: Become familiar with the code requirements for the size, direction, and location of clean-outs.

45 **Topic:** Fitting and Cleanout Requirements for DMV Piping
Standard: Understand the placement of clean-outs on stacks, junctions, and traps.

46 **Topic:** Fitting and Cleanout Requirements for DMV Piping
Standard: Understand the requirements for clean-out accessibility and clearance.

47 **Topic:** Fitting and Cleanout Requirements for DMV Piping
Standard: Understand the code requirements for manholes.

48 **Topic:** Installing Natural Gas Piping Systems
Standard: Understand how the code affects natural gas piping systems.

49 **Topic:** Installing Natural Gas Piping Systems
Standard: Recognize the different types of natural gas distribution materials.

50 **Topic:** Installing Natural Gas Piping Systems
Standard: Interpret plumbing drawings or blueprints to determine natural gas piping layouts.

51 **Topic:** Installing Natural Gas Piping Systems
Standard: Recognize the parts of a gas system.

52 **Topic:** Installing Natural Gas Piping Systems
Standard: Know testing and purging procedures.

53 **Topic:** Installing Natural Gas Piping Systems
Standard: Understand appliance installation.

54 **Topic:** Installing LPG Piping Systems
Standard: Understand how the code affects LPG (liquid propane gas) piping systems.

55 **Topic:** Installing LPG Piping Systems
Standard: Recognize the different materials used in LPG piping systems.

56 **Topic:** Installing LPG Piping Systems
Standard: Recognize different types of storage containers.

57 **Topic:** Installing LPG Piping Systems
Standard: Interpret plumbing plans to determine layouts.

58 **Topic:** Installing LPG Piping Systems
Standard: Recognize the parts of a LPG system.

59 **Topic:** Installing LPG Piping Systems
Standard: Understand testing procedures for LPG systems.

60 **Topic:** Installing LPG Piping Systems
Standard: Install LPG appliances.

61 **Topic:** Installing Fuel Oil Piping Systems
Standard: Understand how code affects fuel oil piping systems.

62 **Topic:** Installing Fuel Oil Piping Systems
Standard: Recognize the different types of fuel oil distribution materials.

63 **Topic:** Installing Fuel Oil Piping Systems
Standard: Interpret plumbing drawings or blueprints to determine fuel oil system layouts.

64 **Topic:** Installing Fuel Oil Piping Systems
Standard: Recognize the parts of a fuel oil system.

65 **Topic:** Installing Fuel Oil Piping Systems
Standard: Understand testing and bleeding procedures.

66 **Topic:** Installing Fuel Oil Piping Systems
Standard: Understand appliance installation.

Course: Construction/Plumbing: 46.58200 Commercial Plumbing I

35 **Topic:** Reading Commercial Plumbing Drawings Part I
Standard: Interpret information from given Site Plans.

36 **Topic:** Reading Commercial Plumbing Drawings Part I
Standard: Verify dimensions shown on drawings and generate a Request for Information (RFI) when discrepancies are found.

37 **Topic:** Reading Commercial Plumbing Drawings Part I
Standard: Locate plumbing entry points, walls, and chases.

38 **Topic:** Reading Commercial Plumbing Drawings Part I
Standard: Determine the sizes of drains, lines, and other plumbing requirements.

39 **Topic:** Reading Commercial Plumbing Drawings Part I
Standard: Do a material takeoff for DWV and water supply systems from information shown on drawings.

40 **Topic:** Reading Commercial Plumbing Drawings Part I
Standard: Develop a bill of materials.

41 **Topic:** Intermediate Math For Plumbers
Standard: Calculate 11-1/4, 22-1/2, 60, and 72-degree simple offsets.

42 **Topic:** Intermediate Math For Plumbers
Standard: Calculate 11-1/4, 22-1/2, 60, and 72-degree parallel offsets.

43 **Topic:** Intermediate Math For Plumbers
Standard: Calculate the area of a triangle, circle, and square.

44 **Topic:** Intermediate Math For Plumbers
Standard: Calculate the volume of rectangular solids and cylinders.

45 **Topic:** Intermediate Math For Plumbers
Standard: Calculate the capacity of tanks in gallons.

46 **Topic:** Intermediate Math For Plumbers
Standard: Calculate the weight of water in a tank, given the volume.

47 **Topic:** Installing Pipe In Trenches
Standard: Understand the process of installing pipe in trenches.

48 **Topic:** Installing Pipe In Trenches
Standard: Recognize the various tools and machines used to lay out and dig trenches.

49 **Topic:** Installing Pipe In Trenches
Standard: Understand the need to follow prescribed safety rules when trenching.

50 **Topic:** Installing Pipe In Trenches
Standard: Size a trench for a line of pipe.

51 **Topic:** Installing Pipe In Trenches
Standard: Layout a trench for a line of pipe.

52 **Topic:** Grade For Drain and Waste Piping
Standard: Interpret grade requirements from plumbing codes.

53 **Topic:** Grade For Drain and Waste Piping
Standard: Calculate grade, fall, run, and percent of grade.

54 **Topic:** Grade For Drain and Waste Piping
Standard: Measure grade using spirit levels.

55 **Topic:** Grade For Drain and Waste Piping
Standard: Measure grade using lasers.

56 **Topic:** Grade For Drain and Waste Piping
Standard: Measure grade using optical instruments.

57 **Topic:** Joining Clay and Concrete Pipe
Standard: Understand the applications of clay and concrete pipe.

58 **Topic:** Joining Clay and Concrete Pipe
Standard: Understand how clay and concrete pipe and fittings are made.

59 **Topic:** Joining Clay and Concrete Pipe
Standard: Cut clay and concrete pipe.

60 **Topic:** Joining Clay and Concrete Pipe
Standard: Join clay and concrete pipe.

61 **Topic:** Connecting To The Sewer Main
Standard: Know where to make connections to sewer mains.

62 **Topic:** Connecting To The Sewer Main
Standard: Name the agency responsible for making connections.

63 **Topic:** Connecting To The Sewer Main
Standard: Identify the proper place to tap a sewer pipe.

64 **Topic:** Connecting To The Sewer Main
Standard: Know about the ways to cut holes to tap sewer mains.

65 **Topic:** Connecting To The Sewer Main
Standard: Know the fittings available for sewer main branch joints.

66 **Topic:** Connecting To The Sewer Main
Standard: List the processes for installing sewer main branch joints.

67 **Topic:** Installing Roof, Floor, and Area Drains
Standard: Obtain the needed information from drawings and specifications to locate drains.

68 **Topic:** Installing Roof, Floor, and Area Drains
Standard: Install a roof drain.

69 **Topic:** Installing Roof, Floor, and Area Drains
Standard: Install waterproof membranes and flashing.

70 **Topic:** Installing Roof, Floor, and Area Drains
Standard: Use a surveyors level or transit to measure the elevation of a floor drain.

71 **Topic:** Installing Pipe Hangers and Supports
Standard: Identify basic problems encountered when supporting plastic DWV pipe.

72 **Topic:** Installing Pipe Hangers and Supports
Standard: Identify the three basic components of supports and hangers.

73 **Topic:** Installing Pipe Hangers and Supports
Standard: Identify service for different types of pipe attachments and connectors.

74 **Topic:** Installing Pipe Hangers and Supports
Standard: Identify service for different types of spring hangers and pipe rollers.

75 **Topic:** Installing Pipe Hangers and Supports
Standard: Construct field-made alignment guides.

76 **Topic:** Installing Pipe Hangers and Supports
Standard: Protect pipe insulation from being crushed in the hanger or support.

77 **Topic:** Installing Pipe Hangers and Supports
Standard: Properly support: · Vertical pipe · Horizontal pipe · Closet bends · Stack bases · Multiple side by side runs of pipe

78 **Topic:** Installing Pipe Hangers and Supports
Standard: Discuss the proper use of powder actuated fastening systems to secure common pipe attachments.

79 **Topic:** Installing DWV Piping Systems
Standard: Develop a material takeoff from a given set of plans.

80 **Topic:** Installing DWV Piping Systems
Standard: Use plans to determine the route of the plumbing and the locations of the fixtures.

81 **Topic:** Installing DWV Piping Systems
Standard: Locate plumbing fixtures using roughing-in measurements.

82 **Topic:** Installing DWV Piping Systems
Standard: Center the stack within the structure.

83 **Topic:** Installing DWV Piping Systems
Standard: Install a building drain.

84 **Topic:** Installing DWV Piping Systems
Standard: Install a main stack.

85 **Topic:** Installing DWV Piping Systems
Standard: Install a secondary stack.

86 **Topic:** Installing DWV Piping Systems
Standard: Modify structural members without weakening the structure.

87 **Topic:** Testing DWV Piping
Standard: Understand some of the reasons for testing DWV piping.

88 **Topic:** Testing DWV Piping
Standard: Understand what the plumber’s responsibilities are for testing.

89 **Topic:** Testing DWV Piping
Standard: Conduct an air test.

90 **Topic:** Testing DWV Piping
Standard: Conduct a water test.

91 **Topic:** Testing DWV Piping
Standard: Conduct a smoke test.

92 **Topic:** Testing DWV Piping
Standard: Conduct an odor test.

Course: Construction/Plumbing: 46.58300 Commercial Plumbing II

35 **Topic:** Connecting to the Water Main
Standard: Make connections to the water main.

36 **Topic:** Connecting to the Water Main
Standard: Correctly layout pipes and valves for a water connection to a building.

37 **Topic:** Connecting to the Water Main
Standard: Install a curb box.

38 **Topic:** Testing Water Supply Piping
Standard: Conduct an air test.

39 **Topic:** Testing Water Supply Piping
Standard: Conduct a hydrostatic test.

40 **Topic:** Types of Faucets
Standard: Identify and install the most commonly-used faucets.

41 **Topic:** Types of Faucets
Standard: Identify various application for utility faucets.

42 **Topic:** Types of Faucets
Standard: Understand basic functions for utility faucets.

43 **Topic:** Types of Faucets
Standard: Install utility faucets.

44 **Topic:** Types of Faucets
Standard: Identify various types of valve assemblies for kitchen and bathroom faucets.

45 **Topic:** Types of Faucets
Standard: Install common bathroom and kitchen faucets.

46 **Topic:** Types of Faucets
Standard: Identify and install various types of combination shower and bath fittings.

47 **Topic:** Types of Valves
Standard: Understand the differences in pressure ratings for valves.

48 **Topic:** Types of Valves
Standard: Identify basic types of valves.

49 **Topic:** Types of Valves
Standard: Understand the common service applications for common types of valves.

50 **Topic:** Types of Valves
Standard: Understand the common service applications for pressure regulator valves, pressure safety valves, and pressure relief valves.

51 **Topic:** Types of Valves
Standard: Disassemble and assemble valves.

52 **Topic:** Installing and Servicing Valves and Faucets
Standard: Identify components and tools used in threaded valve and faucet installations.

53 **Topic:** Installing and Servicing Valves and Faucets
Standard: Install threaded valves and faucets.

54 **Topic:** Installing and Servicing Valves and Faucets
Standard: Identify components and tools used in soldered valve and faucet installations.

55 **Topic:** Installing and Servicing Valves and Faucets
Standard: Install soldered faucets and valves.

56 **Topic:** Installing and Servicing Valves and Faucets
Standard: Install CPVC faucets and valves.

57 **Topic:** Installing and Servicing Valves and Faucets
Standard: Identify the components of sink and lavatory faucets and shut-off valves.

58 **Topic:** Installing and Servicing Valves and Faucets
Standard: Install freeze-proof lawn faucets and shut-off valves.

59 **Topic:** Installing and Servicing Valves and Faucets
Standard: Identify the components of freeze-proof lawn faucets, self-piercing, and standard needle valves.

60 **Topic:** Installing and Servicing Valves and Faucets
Standard: Install self-piercing and standard needle valves.

61 **Topic:** Installing and Servicing Valves and Faucets
Standard: Identify the potential difficulties and problems associated with valve and faucet installation.

62 **Topic:** Installing and Servicing Valves and Faucets
Standard: Install and test a temperature valve, pressure relief valve, and check valve.

63 **Topic:** Installing and Servicing Valves and Faucets
Standard: Install float valves and flush valves.

64 **Topic:** Installing and Servicing Valves and Faucets
Standard: Adjust float and flush valves for proper functioning.

65 **Topic:** Installing and Servicing Valves and Faucets
Standard: Properly install gas cocks and gas valves.

66 **Topic:** Installing Water Heaters
Standard: Describe the basic operation of water heaters.

67 **Topic:** Installing Water Heaters
Standard: Identify common types of water heaters.

68 **Topic:** Installing Water Heaters
Standard: Identify the basic components of water heaters.

69 **Topic:** Installing Water Heaters
Standard: Install water heaters.

70 **Topic:** Water Meters
Standard: Identify why water meters are installed.

71 **Topic:** Water Meters
Standard: Identify locations for water meter installation.

72 **Topic:** Water Meters

Standard: Identify the three major types of water meters.

73 **Topic:** Water Meters

Standard: Describe the basic working principles of a disk type meter, a turbine meter, and a compound meter.

74 **Topic:** Water Meters

Standard: Identify several types of water meter yokes and their applications.

75 **Topic:** Types of Fixtures

Standard: Identify materials use in the manufacture of plumbing fixtures.

76 **Topic:** Types of Fixtures

Standard: Identify dfu (drain flow unit) ratings for given types of plumbing fixtures.

77 **Topic:** Types of Fixtures

Standard: 1. Discuss common types of: · Sinks and lavatories · Bathtubs and bath-shower modules · Shower stalls and shower baths · Water closets · Urinals · Bidets · Drinking fountains and water coolers · Laundry trays · Service sinks and mop basins · Garbage disposals · Dishwashers

78 **Topic:** Setting Fixtures

Standard: Identify the general installation considerations which should be followed before installing any fixture.

79 **Topic:** Setting Fixtures

Standard: Identify the general process for installing bathtubs and shower stalls.

80 **Topic:** Setting Fixtures

Standard: Describe the basic procedures for installing lavatories and sinks.

81 **Topic:** Setting Fixtures

Standard: Differentiate the procedures for installing built-in and wall-hung sinks and lavatories.

82 **Topic:** Setting Fixtures

Standard: Describe the process for installing water closets.

83 **Topic:** Setting Fixtures

Standard: Describe how installed water closets can be protected.

84 **Topic:** Setting Fixtures

Standard: Describe the process of installing urinals.

85 **Topic:** Setting Fixtures

Standard: Relate the installation of urinals to water closets and sinks.

Course: Construction: 46.54500 Fundamentals of Construction (Required for ALL Clusters)

35 **Topic:** Basic Safety

Standard: Identify the responsibilities and personal characteristics of a professional craftsperson.

36 **Topic:** Basic Safety

Standard: Explain the role that safety plays in the construction crafts.

37 **Topic:** Basic Safety

Standard: Describe what job-site safety means.

38 **Topic:** Basic Safety

Standard: Explain the appropriate safety precautions around common job-site hazards.

39

Topic: Basic Safety

Standard: Demonstrate the use and care of appropriate personal protective equipment.

40

Topic: Basic Safety

Standard: Follow safe procedures for lifting heavy objects.

41

Topic: Basic Safety

Standard: Describe safe behavior on and around ladders and scaffolds.

42

Topic: Basic Safety

Standard: Explain the importance of the HazCom (Hazard Communication Standard) Requirement and MSDSs (Material Safety Data Sheets).

43

Topic: Basic Safety

Standard: Describe fire prevention and fire fighting techniques.

44

Topic: Basic Safety

Standard: Define safe work procedures around electrical hazards.

45

Topic: Introduction to Construction Math

Standard: Explain what the metric system is and how it is important in the construction trade.

46

Topic: Introduction to Construction Math

Standard: Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

47

Topic: Introduction to Construction Math

Standard: Apply mathematical skills to interpret blueprints and meet safety requirements in construction.

48

Topic: Introduction to Hand Tools

Standard: Recognize and identify some of the basic hand tools used in the construction trade.

49

Topic: Introduction to Hand Tools

Standard: Use these tools safely.

50

Topic: Introduction to Hand Tools

Standard: Describe the basic procedures for taking care of these tools.

51

Topic: Introduction to Power Tools

Standard: Identify commonly used power tools of the construction trade.

52

Topic: Introduction to Power Tools

Standard: Use power tools safely.

53

Topic: Introduction to Power Tools

Standard: Explain how to maintain power tools properly.

54

Topic: Introduction to Blueprints

Standard: Recognize and identify basic blueprint terms, components, and symbols.

55

Topic: Introduction to Blueprints

Standard: Relate information on blueprints to actual locations on the print.

56

Topic: Introduction to Blueprints

Standard: Recognize different classifications of drawings.

57

Topic: Introduction to Blueprints

Standard: Interpret and use drawing dimensions.

58

Topic: Basic Rigging

Standard: Identify and describe the use of slings and common rigging hardware.

59 **Topic:** Basic Rigging
Standard: Describe the basic inspection techniques and rejection criteria use for slings and hardware.

60 **Topic:** Basic Rigging
Standard: Describe the basic hitch configurations and their proper connections.

61 **Topic:** Basic Rigging
Standard: Describe basic load-handling safety practices.

62 **Topic:** Basic Rigging
Standard: Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

Course: Construction: 46.54600 Introduction to Building (Required for ALL Clusters)

35 **Topic:** Orientation to the Trade
Standard: Describe the history of the carpentry trade.

36 **Topic:** Orientation to the Trade
Standard: Identify the stages of progress within the carpentry trade.

37 **Topic:** Orientation to the Trade
Standard: Identify the responsibilities of a person working in the construction industry.

38 **Topic:** Orientation to the Trade
Standard: State the personal characteristics of a professional.

39 **Topic:** Orientation to the Trade
Standard: Explain the importance of safety in the construction industry.

40 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: Explain the terms commonly used in discussing wood and lumber.

41 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: State the uses of various types of hardwoods and softwoods.

42 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: Identify various types of imperfections that are found in lumber.

43 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: Explain how lumber is graded.

44 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: Interpret grade markings on lumber and plywood.

45 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: Explain how plywood is manufactured, graded, and used.

46 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: Identify various types of building boards and identify their uses.

47 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: Identify the uses of and safety precautions associated with pressure-treated lumber.

48 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: Describe the proper method of caring for lumber and wood building materials at the job site.

49 **Topic:** Wood Building Materials, Fasteners, and Adhesives
Standard: State the uses of various types of engineered lumber.

50

Topic: Wood Building Materials, Fasteners, and Adhesives

Standard: Calculate the quantities of lumber and wood products using industry-standard methods.

51

Topic: Wood Building Materials, Fasteners, and Adhesives

Standard: List the basic nail and staple types and their uses.

52

Topic: Wood Building Materials, Fasteners, and Adhesives

Standard: List the basic types of screws and their uses.

53

Topic: Wood Building Materials, Fasteners, and Adhesives

Standard: Identify the different types of anchors and their uses.

54

Topic: Wood Building Materials, Fasteners, and Adhesives

Standard: Describe the common types of adhesives used in construction work and explain their uses.

55

Topic: Hand and Power Tools

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

56

Topic: Hand and Power Tools

Standard: Use hand tools in a safe and appropriate manner.

57

Topic: Hand and Power Tools

Standard: Sate the general safety rules for operating all power tools, regardless of type.

58

Topic: Hand and Power Tools

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

59

Topic: Hand and Power Tools

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

60

Topic: Hand and Power Tools

Standard: Use portable power tools in a safe and appropriate manner.

61

Topic: Hand and Power Tools

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

62

Topic: Hand and Power Tools

Standard: Use stationary power tools in a safe and appropriate manner.

63

Topic: Electrical Safety

Standard: Demonstrate safe working procedures in a construction environment.

64

Topic: Electrical Safety

Standard: Explain the purpose of OSHA (Occupational Safety and Health Administration) and how it promotes safety on the job.

65

Topic: Electrical Safety

Standard: Identify electrical hazards and how to avoid or minimize them in the workplace.

66

Topic: Electrical Safety

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

67

Topic: Conductors

Standard: Explain the various sizes and gauges of wire in accordance with American Wire Gauge standards.

68

Topic: Conductors

Standard: Identify insulation and jacket types according to conditions and applications.

69

Topic: Conductors

Standard: Describe voltage ratings of conductors and cables.

70 **Topic:** Conductors
Standard: Read and identify markings on conductors and cables.

71 **Topic:** Conductors
Standard: Use the tables in the NEC (National Electrical Code) to determine the ampacity of a conductor.

72 **Topic:** Conductors
Standard: State the purpose of stranded wire.

73 **Topic:** Conductors
Standard: State the purpose of compressed conductors.

74 **Topic:** Conductors
Standard: Describe the different materials from which conductors are made.

75 **Topic:** Conductors
Standard: Describe the different types of conductor insulation.

76 **Topic:** Conductors
Standard: Describe the color coding of insulation.

77 **Topic:** Conductors
Standard: Describe instrumentation control wiring.

78 **Topic:** Conductors
Standard: Describe the equipment required for pulling wire through conduit.

79 **Topic:** Conductors
Standard: Describe the procedure for pulling wire through conduit.

80 **Topic:** Conductors
Standard: Install conductors in conduit.

81 **Topic:** Conductors
Standard: Pull conductors in a conduit system.

82 **Topic:** Introduction to Masonry
Standard: Review the history of masonry.

83 **Topic:** Introduction to Masonry
Standard: Describe modern masonry materials and methods.

84 **Topic:** Introduction to Masonry
Standard: Understand career ladders and advancement possibilities in masonry work.

85 **Topic:** Introduction to Masonry
Standard: Describe the skills, attitudes, and abilities needed to work as a mason.

86 **Topic:** Tools and Equipment
Standard: Identify and name the tools used in performing masonry work.

87 **Topic:** Tools and Equipment
Standard: Identify and name the equipment used in performing masonry work.

88 **Topic:** Tools and Equipment
Standard: Describe how each tool is used.

89 **Topic:** Tools and Equipment
Standard: Describe how the equipment is used.

90 **Topic:** Tools and Equipment

Standard: Associate trade terms with the appropriate tools and equipment.

91 **Topic:** Tools and Equipment

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

92 **Topic:** Mortar

Standard: Name and describe the primary ingredients in mortar and their properties.

93 **Topic:** Mortar

Standard: Identify the various types of mortar used in masonry work.

94 **Topic:** Mortar

Standard: Describe the common admixtures and their uses.

95 **Topic:** Mortar

Standard: Identify the common problems found in mortar application and their solutions.

96 **Topic:** Mortar

Standard: Properly set up the mortar mixing area.

97 **Topic:** Mortar

Standard: Properly mix mortar by hand.

98 **Topic:** Mortar

Standard: Properly mix mortar with a mechanical mixer.

99 **Topic:** The Plumbing Trade

Standard: Discuss the historical development of the trade.

100 **Topic:** The Plumbing Trade

Standard: Discuss the functions of water supply and sewage treatment systems.

101 **Topic:** The Plumbing Trade

Standard: Discuss the importance of plumbers in modern society.

102 **Topic:** Basic Plumbing Tools

Standard: Discuss safety as it applies to plumbing tools.

103 **Topic:** Basic Plumbing Tools

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

104 **Topic:** Basic Plumbing Tools

Standard: Discuss the proper maintenance procedures to be used for hand and power tools.

105 **Topic:** Copper and Plastic Piping Practices

Standard: State the precautions that must be taken when installing refrigerant piping.

106 **Topic:** Copper and Plastic Piping Practices

Standard: Select the right tubing for a job.

107 **Topic:** Copper and Plastic Piping Practices

Standard: Cut and bend tubing.

108 **Topic:** Copper and Plastic Piping Practices

Standard: Join tubing by using flare and compression fittings.

109 **Topic:** Copper and Plastic Piping Practices

Standard: Determine the kinds of hangers and support needed for refrigerant piping.

110 **Topic:** Copper and Plastic Piping Practices

Standard: Insulate refrigerant piping.

111 **Topic:** Copper and Plastic Piping Practices

Standard: State the basic requirements for pressure-testing a system once it has been installed.

112 **Topic:** Copper and Plastic Piping Practices

Standard: Follow basic safety precautions for the installation, operation, and maintenance of refrigerating and air conditioning equipment.

113 **Topic:** Soldering and Brazing

Standard: Assemble and operate the tools used for soldering.

114 **Topic:** Soldering and Brazing

Standard: Prepare tubing and fittings for soldering.

115 **Topic:** Soldering and Brazing

Standard: Identify the purposes and use of solder and solder fluxes.

116 **Topic:** Soldering and Brazing

Standard: Solder copper tubing and fittings.

117 **Topic:** Soldering and Brazing

Standard: Assemble and operate the tools used for brazing.

118 **Topic:** Soldering and Brazing

Standard: Prepare tubing and fittings for brazing.

119 **Topic:** Soldering and Brazing

Standard: Identify the purposes and use of filler metals and fluxes used for brazing.

120 **Topic:** Soldering and Brazing

Standard: Braze copper tubing and fittings.

121 **Topic:** Soldering and Brazing

Standard: Identify the inert gases that can safely be used to purge tubing when brazing.

122 **Topic:** Cutting and Threading Carbon Steel Pipe

Standard: Discuss the weights and sizes in which steel pipe is available.

123 **Topic:** Cutting and Threading Carbon Steel Pipe

Standard: Discuss the American Standard Pipe Thread.

Course: Cosmetology: Core Skills

1 **Topic:** Basic Skills

Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills

Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills

Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills

Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills

Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills

Standard: Identify problems, alternative solutions, and consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15 **Topic:** Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16 **Topic:** Interpersonal Skills

Standard: Share knowledge and skills with others.

17 **Topic:** Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18 **Topic:** Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19 **Topic:** Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20 **Topic:** Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21 **Topic:** Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22 **Topic:** Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23 **Topic:** Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24 **Topic:** Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25 **Topic:** Technology

Standard: Utilize a variety of technologies.

26 **Topic:** Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27 **Topic:** Business Aspects

Standard: Identify forms of business ownership.

28 **Topic:** Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29 **Topic:** Business Aspects

Standard: Demonstrate understanding of the individual's role, responsibilities, and relationships in the organizational structure of a business.

30 **Topic:** Business Aspects

Standard: Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

31 **Topic:** Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32 **Topic:** Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33 **Topic:** Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34 **Topic:** Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

Course: Cosmetology: 12.54500 Salon Services Core I

35 **Topic:** Career Opportunities and State and Local Laws

Standard: Define cosmetologist, manicurist, and esthetician.

36 **Topic:** Career Opportunities and State and Local Laws

Standard: List the required hours for training, in Georgia, for cosmetologist, manicurist, and esthetician.

37 **Topic:** Career Opportunities and State and Local Laws

Standard: Identify the state board that controls licensure in Georgia.

38 **Topic:** Career Opportunities and State and Local Laws

Standard: List types of registrations/licensure one may possess in Georgia.

39 **Topic:** Career Opportunities and State and Local Laws

Standard: Identify continuing education requirements, once licensed by the board.

40 **Topic:** Career Opportunities and State and Local Laws

Standard: Describe licensure reciprocation process with other states.

41 **Topic:** Career Opportunities and State and Local Laws
Standard: Identify type(s) of local and or state licensure one must possess for opening a salon.

42 **Topic:** Professional Image
Standard: Describe what is meant by the term "Professional Image."

43 **Topic:** Professional Image
Standard: List a minimum of three ways one might project a professional image.

44 **Topic:** Professional Image
Standard: Describe what is considered "Professional Dress" when working in a salon.

45 **Topic:** Professional Image
Standard: Describe the significance of integrity, honesty, and work ethics in the cosmetology profession.

46 **Topic:** Professional Image
Standard: Demonstrate a professional image in appearance and mannerisms while in class and laboratory settings and practice good work ethics.

47 **Topic:** Professional Image
Standard: List "topics of conversation" with clients that are considered professional and those that are unprofessional in the salon.

48 **Topic:** Professional Image
Standard: Summarize and define personal and public hygiene.

49 **Topic:** Bacteriology
Standard: Define bacteriology.

50 **Topic:** Bacteriology
Standard: Describe why the study of bacteriology is important to the cosmetologist.

51 **Topic:** Bacteriology
Standard: List types and classifications of bacteria.

52 **Topic:** Bacteriology
Standard: Identify basic science as it applies to decontamination and infection control.

53 **Topic:** Bacteriology
Standard: Differentiate between the different types of sanitizing agents.

54 **Topic:** Bacteriology
Standard: Define air born and blood born pathogens and explain why this is important to the cosmetologist.

55 **Topic:** Safe, Sanitary, & Efficient Work Practices
Standard: List the steps in sanitizing implements and equipment.

56 **Topic:** Safe, Sanitary, & Efficient Work Practices
Standard: Demonstrate proper sanitation and shop safety rules in all procedures.

57 **Topic:** Safe, Sanitary, & Efficient Work Practices
Standard: Demonstrate first aid procedures for minor cuts and chemical reactions.

58 **Topic:** Safe, Sanitary, & Efficient Work Practices
Standard: List procedures to follow in case of emergency situations involving clients.

59 **Topic:** Safe, Sanitary, & Efficient Work Practices
Standard: Follow procedures for facility evacuation drills.

60 **Topic:** Safe, Sanitary, & Efficient Work Practices
Standard: Demonstrate proper maintenance of electrical and mechanical equipment.

61 **Topic:** Safe, Sanitary, & Efficient Work Practices

Standard: Demonstrate precautionary procedures in the salon and knowledge of appropriate behavior in dealing with blood spills.

62 **Topic:** Safe, Sanitary, & Efficient Work Practices

Standard: Follow OSHA requirements set forth for cosmetologist, esthetician, and nail technician and maintain an MSDS notebook while working in the dispensary.

63 **Topic:** Chemistry Fundamentals

Standard: Describe the importance of studying fundamental chemistry as it relates to cosmetology.

64 **Topic:** Chemistry Fundamentals

Standard: Define organic, inorganic chemistry, matter and composition of elements, compounds, and mixtures.

65 **Topic:** Chemistry Fundamentals

Standard: Define acids and alkalies and be able to chart cosmetic chemicals on PH scale.

66 **Topic:** Chemistry Fundamentals

Standard: List the three layers of hair.

67 **Topic:** Chemistry Fundamentals

Standard: Describe what is meant by hair textures.

68 **Topic:** Chemistry Fundamentals

Standard: Describe the composition of hair before, during, and after chemical treatment.

69 **Topic:** Chemistry Fundamentals

Standard: Describe the physical and chemical classifications of cosmetics.

70 **Topic:** Introduction to Shampooing

Standard: Describe the basic principles of chemistry applied to shampooing, including: emulsions and suspensions, pH scale, and the ability to identify types of shampoos and their chemistry.

71 **Topic:** Introduction to Shampooing

Standard: Demonstrate proper draping of a client, including wet, chemical, and dry hair services.

72 **Topic:** Introduction to Shampooing

Standard: Analyze and recognize hair and scalp condition of client.

73 **Topic:** Introduction to Shampooing

Standard: Identify different type of shampooing procedures, relating to the salon services to be performed.

74 **Topic:** Introduction to Shampooing

Standard: Demonstrate proper scalp massage and rinsing of client, for a basic salon service.

75 **Topic:** Introduction to Shampooing

Standard: Identify safety and infection control procedures while performing shampooing services.

76 **Topic:** Basic Styling Principals

Standard: Identify styling instruments.

77 **Topic:** Basic Styling Principals

Standard: Demonstrate how to properly remove tangles from wet hair.

78 **Topic:** Basic Styling Principals

Standard: Identify supplies and equipment required for finger waving.

79 **Topic:** Basic Styling Principals

Standard: Mold hair in direction of planned pattern and distribute waving lotion.

80 **Topic:** Basic Styling Principals

Standard: Create a horizontal, vertical shadow wave, and ridge wave.

81

Topic: Basic Styling Principals

Standard: Identify supplies and equipment needed for wet hairstyling.

82

Topic: Basic Styling Principals

Standard: Identify the principal parts of a pin curl, including three stem directions.

83

Topic: Basic Styling Principals

Standard: Demonstrate the formation of pin curls in relation to bases, both clockwise and counter-clockwise.

84

Topic: Basic Styling Principals

Standard: Demonstrate the proper procedure for anchoring pin curls.

85

Topic: Basic Styling Principals

Standard: Demonstrate skip waves and skip waving techniques.

86

Topic: Basic Styling Principals

Standard: Demonstrate ridge curls and ridge curl techniques.

87

Topic: Basic Styling Principals

Standard: Identify types and shapes of hair rollers.

88

Topic: Basic Styling Principals

Standard: Identify and explain the function of stem directions used in roller settings.

89

Topic: Basic Styling Principals

Standard: Demonstrate roller placement in relation to bases.

90

Topic: Basic Styling Principals

Standard: Identify implements used in a comb-out.

91

Topic: Basic Styling Principals

Standard: Demonstrate proper brushing, backcombing, and comb out techniques.

92

Topic: Basic Styling Principals

Standard: Demonstrate proper procedures for blow-drying hair, including how to create lift and curl with blowdryer and brush.

93

Topic: Basic Styling Principals

Standard: Identify supplies and equipment required for thermal hairstyling.

94

Topic: Basic Styling Principals

Standard: Demonstrate how to test the heat of thermal irons and curlers.

95

Topic: Basic Styling Principals

Standard: Demonstrate the process for thermal curling short, medium, and long hair.

96

Topic: Basic Styling Principals

Standard: Demonstrate braiding and intertwining techniques utilizing principles of design.

97

Topic: Basic Styling Principals

Standard: Perform a wet set and comb out using a minimum of three principles of design, i.e. hair molding, finger waves, skip waves, pin curls, and/or rollers.

98

Topic: Basic Styling Principals

Standard: Prepare and perform thermal styling using electric rollers, blow dryers, curling irons, crimping irons, thermo-press combing, and air-waving combs utilizing the principles of design.

99

Topic: Basic Styling Principals

Standard: Identify safety and infection control procedures for hair design services.

100

Topic: Introduction to Skin Care

Standard: Explain the structure and function of the human skin.

101 **Topic:** Introduction to Skin Care
Standard: List the various diseases and disorders of the skin.

102 **Topic:** Introduction to Skin Care
Standard: Identify normal, dry, and oily skin.

103 **Topic:** Introduction to Skin Care
Standard: List and identify products and supplies needed to perform plain facial services.

104 **Topic:** Introduction to Skin Care
Standard: Explain the purpose of massage.

105 **Topic:** Introduction to Skin Care
Standard: Demonstrate the basic facial massage movements.

106 **Topic:** Introduction to Skin Care
Standard: Identify supplies needed for a professional make-up application.

107 **Topic:** Introduction to Skin Care
Standard: Demonstrate how to professionally apply make-up.

108 **Topic:** Introduction to Skin Care
Standard: Identify safety and infection control procedures for skin care services.

109 **Topic:** Introduction to Nail Care
Standard: Explain the structure of the nails.

110 **Topic:** Introduction to Nail Care
Standard: Identify diseases of the hands and feet.

111 **Topic:** Introduction to Nail Care
Standard: Identify products, supplies, and implements needed for a manicure and pedicure.

112 **Topic:** Introduction to Nail Care
Standard: Demonstrate proper techniques for giving a plain manicure.

113 **Topic:** Introduction to Nail Care
Standard: Demonstrate proper techniques for giving a plain pedicure.

114 **Topic:** Introduction to Nail Care
Standard: Demonstrate how to properly repair broken or split nails.

115 **Topic:** Introduction to Nail Care
Standard: Identify safety and infection control procedures for nail care services.

Course: Cosmetology: 12.54600 Salon Services Core II

35 **Topic:** Basic Hair and Scalp Treatments
Standard: Identify the layers of hair structure.

36 **Topic:** Basic Hair and Scalp Treatments
Standard: Identify technical terms for head and facial hair and their locations.

37 **Topic:** Basic Hair and Scalp Treatments
Standard: Analyze samples of hair and identify their textures.

38 **Topic:** Basic Hair and Scalp Treatments
Standard: Identify various natural hair growth patterns on live models.

39 **Topic:** Basic Hair and Scalp Treatments
Standard: List the physical and chemical actions that damage hair.

40 **Topic:** Basic Hair and Scalp Treatments
Standard: Perform hair analysis for density, porosity, and elasticity.

41 **Topic:** Basic Hair and Scalp Treatments
Standard: Identify different types of hair reconditioning products

42 **Topic:** Basic Hair and Scalp Treatments
Standard: Demonstrate the application of basic conditioners.

43 **Topic:** Basic Hair and Scalp Treatments
Standard: Identify electrical implements used for hair and scalp treatments.

44 **Topic:** Basic Hair and Scalp Treatments
Standard: Demonstrate corrective scalp treatments.

45 **Topic:** Basic Hair and Scalp Treatments
Standard: Demonstrate corrective hair treatments.

46 **Topic:** Basic Hair and Scalp Treatments
Standard: Demonstrate safety and infection control procedures in hair and scalp treatments.

47 **Topic:** Diseases and Disorders of Skin & Hair
Standard: List the most common diseases of the skin and explain their causes.

48 **Topic:** Diseases and Disorders of Skin & Hair
Standard: List the most common disorders of the scalp and hair, and explain their causes.

49 **Topic:** Diseases and Disorders of Skin & Hair
Standard: Identify corrective treatments for conditions that may be treated in a salon.

50 **Topic:** Diseases and Disorders of Skin & Hair
Standard: Identify the diseases or disorders that must be referred to a medical doctor.

51 **Topic:** Diseases and Disorders of Skin & Hair
Standard: List the steps to be taken to "sterilize" the salon after exposure to a case of pediculosis.

52 **Topic:** Introduction to Hair Cutting
Standard: Identify and describe terminology that applies to haircutting.

53 **Topic:** Introduction to Hair Cutting
Standard: Demonstrate safety and sanitation procedures used in haircutting, for the safety of the cosmetologist and the client.

54 **Topic:** Introduction to Hair Cutting
Standard: Identify haircutting implements and the proper handling of each.

55 **Topic:** Introduction to Hair Cutting
Standard: Demonstrate proper maintenance and sanitary procedures for hair cutting tools.

56 **Topic:** Introduction to Hair Cutting
Standard: Demonstrate sectioning of hair for haircutting.

57 **Topic:** Introduction to Hair Cutting
Standard: Describe the differences caused by various elevations and guidelines.

58 **Topic:** Introduction to Hair Cutting
Standard: Demonstrate the ability to remove bulk (thinning) without disturbing the length.

59

Topic: Introduction to Hair Cutting

Standard: Demonstrate proper procedures for a basic haircut.

60

Topic: Introduction to Hair Cutting

Standard: Demonstrate procedures for shingling and slithering in a haircut.

61

Topic: Introduction to Hair Cutting

Standard: Demonstrate proper technique used in razor haircutting.

62

Topic: Introduction to Hair Cutting

Standard: Demonstrate the proper way to check a basic haircut.

63

Topic: Introduction to Hair Cutting

Standard: Demonstrate safety and infection control procedures in haircutting.

64

Topic: Introduction to Chemical Waving and Relaxing

Standard: Identify and describe terminology that applies to chemical processing of the hair.

65

Topic: Introduction to Chemical Waving and Relaxing

Standard: Explain the differences and/or similarities in the chemistry of processing hair with perms and relaxers and how it relates to the fundamentals of hair chemistry.

66

Topic: Introduction to Chemical Waving and Relaxing

Standard: Explain and demonstrate safety procedures for permanent waving and chemical hair relaxing.

67

Topic: Introduction to Chemical Waving and Relaxing

Standard: Explain the importance of keeping client records for chemical services and list type of information to be recorded.

68

Topic: Introduction to Chemical Waving and Relaxing

Standard: Demonstrate procedure for analyzing the scalp and hair for a chemical process.

69

Topic: Introduction to Chemical Waving and Relaxing

Standard: Demonstrate proper techniques in sectioning, blocking, and wrapping of a permanent wave.

70

Topic: Introduction to Chemical Waving and Relaxing

Standard: Demonstrate proper techniques in sectioning for and applying a chemical relaxer.

71

Topic: Introduction to Chemical Waving and Relaxing

Standard: Demonstrate safety and infection control procedures for permanent waving and relaxing services.

72

Topic: Introduction to Lightening and Hair Coloring

Standard: Describe the basic concepts/laws of color, to include primary, secondary, and tertiary colors.

73

Topic: Introduction to Lightening and Hair Coloring

Standard: Explain the levels of colors.

74

Topic: Introduction to Lightening and Hair Coloring

Standard: Identify how the chemical process of coloring/lightening changes the hair.

75

Topic: Introduction to Lightening and Hair Coloring

Standard: Identify and describe the various classifications of color.

76

Topic: Introduction to Lightening and Hair Coloring

Standard: Demonstrate how to perform a predisposition or patch test.

77

Topic: Introduction to Lightening and Hair Coloring

Standard: Demonstrate how to perform a strand test.

78

Topic: Introduction to Lightening and Hair Coloring

Standard: Explain importance of keeping client records for coloring services and list type of information to be kept, including a liability release form.

79 **Topic:** Introduction to Lightening and Hair Coloring

Standard: Demonstrate how to give a shampoo, color rinse, and semi-permanent tint.

80 **Topic:** Introduction to Lightening and Hair Coloring

Standard: Demonstrate how to block/section for a virgin tint or touch-up application.

81 **Topic:** Introduction to Lightening and Hair Coloring

Standard: Demonstrate how to "mix" an aniline derivative tint.

82 **Topic:** Introduction to Lightening and Hair Coloring

Standard: Demonstrate process of giving a one-step virgin tint and a one-step tint retouch.

83 **Topic:** Introduction to Lightening and Hair Coloring

Standard: Explain the differences and/or similarities in giving a frosting, tipping, streaking, and blonde-on-blonde treatment.

84 **Topic:** Introduction to Lightening and Hair Coloring

Standard: Demonstrate introductory techniques and procedures for giving a frosting, tipping, streaking and blonde-on-blonde treatment.

85 **Topic:** Introduction to Lightening and Hair Coloring

Standard: Demonstrate safety and infection control procedures for lightening and hair coloring services.

86 **Topic:** Intermediate Styling Principals

Standard: Explain the relationship of facial types to styling principles.

87 **Topic:** Intermediate Styling Principals

Standard: List the various facial types.

88 **Topic:** Intermediate Styling Principals

Standard: Identify instruments used in blow drying and thermal techniques.

89 **Topic:** Intermediate Styling Principals

Standard: Demonstrate the proper use and handling of thermal curling irons.

90 **Topic:** Intermediate Styling Principals

Standard: Demonstrate proper maintenance and sanitary procedures for styling tools.

91 **Topic:** Intermediate Styling Principals

Standard: Describe thermal heaters and pressing instruments.

92 **Topic:** Intermediate Styling Principals

Standard: Demonstrate hair pressing techniques.

93 **Topic:** Intermediate Styling Principals

Standard: Demonstrate thermal waving techniques.

94 **Topic:** Intermediate Styling Principals

Standard: Demonstrate procedures for fitting, cleaning, shaping, and styling human hair and synthetic wigs and hairpieces.

95 **Topic:** Intermediate Styling Principals

Standard: Demonstrate safety and infection control procedures for styling services.

Course: Cosmetology: 12.54700 Advanced Styling Principles

35 **Topic:** Advanced Styling Principles

Standard: Demonstrate the proper use of pin curls, skip waves, and roller placement by creating hair designs using all three of these techniques.

36 **Topic:** Advanced Styling Principles

Standard: Demonstrate proper brushing and combing procedures for advanced hair design.

37 **Topic:** Advanced Styling Principles

Standard: Demonstrate creative designs through the use of a blow dryer, brush, and curling iron, taking into consideration facial shape and other styling principles.

38 **Topic:** Advanced Styling Principles

Standard: Demonstrate the proper use of thermal instruments by creating hair designs utilizing pressing, curling, and waving techniques, utilizing principles of design.

39 **Topic:** Advanced Styling Principles

Standard: Demonstrate proper procedures for braiding and intertwining in creating hair designs.

40 **Topic:** Advanced Styling Principles

Standard: Demonstrate safety and infection control procedures for styling services.

41 **Topic:** Anatomy and Physiology

Standard: Explain scientific principles related to the study of organs and tissues relevant to cosmetology.

42 **Topic:** Anatomy and Physiology

Standard: Describe the composition of the skeletal system as it relates to cosmetology.

43 **Topic:** Anatomy and Physiology

Standard: Describe the functions and identify the principle parts of the muscular system as it relates to cosmetology.

44 **Topic:** Anatomy and Physiology

Standard: Describe the functions and identify the principle parts of the nervous system as it relates to cosmetology.

45 **Topic:** Anatomy and Physiology

Standard: Describe the functions and identify the principle parts of the circulatory system as it relates to cosmetology.

46 **Standard:** Contrast the functions of the excretory, endocrine, respiratory, and digestive systems.

Course: Cosmetology: 12.54800 Haircutting

35 **Topic:** Haircutting

Standard: Demonstrate how to conduct a head and body analysis for haircutting.

36 **Topic:** Haircutting

Standard: Describe and demonstrate the geometric lines used in haircutting.

37 **Topic:** Haircutting

Standard: Demonstrate proper hair sectioning and the use of various guidelines.

38 **Topic:** Haircutting

Standard: Demonstrate the effects of "head positioning" in hair cutting.

39 **Topic:** Haircutting

Standard: Demonstrate the proper use of electrical hair clippers, utilizing various guards and edgers.

40 **Topic:** Haircutting

Standard: Explain the role of hair texture when selecting the proper hair cut for a client.

41 **Topic:** Haircutting

Standard: Demonstrate correct procedures for checking a haircut.

42 **Topic:** Haircutting

Standard: Demonstrate safety and infection control procedures for haircutting.

43 **Topic:** Electricity

Standard: Define electricity and why the study is important to the cosmetologist.

44 **Topic:** Electricity

Standard: Name two forms of electricity.

45 **Topic:** Electricity

Standard: List safety precautions that must be followed when using electricity.

46 **Topic:** Electricity

Standard: Explain the benefits derived from four types of current.

47 **Topic:** Electricity

Standard: List electrical equipment used in the salon.

48 **Topic:** Electricity

Standard: Explain light therapy and demonstrate the proper uses.

Course: Cosmetology: 12.54900 Chemical Hair Processing

35 **Topic:** Chemical Waving

Standard: Explain the differences in giving a perm to virgin hair and that has been previously treated with color or lightening products.

36 **Topic:** Chemical Waving

Standard: Demonstrate proper blocking, wrapping, and processing of perms for clients with short, medium, and long hair.

37 **Topic:** Chemical Waving

Standard: Explain how to select proper rod size for desired results.

38 **Topic:** Chemical Waving

Standard: Explain what happens during the neutralizing process of a permanent wave.

39 **Topic:** Chemical Waving

Standard: Identify a minimum of three problems that can occur when giving a permanent wave that would result in an unhappy client and may cause damage to the client's scalp and/or hair.

40 **Topic:** Chemical Waving

Standard: Demonstrate safety and infection control procedures for permanent waving services.

41 **Topic:** Chemical Relaxing

Standard: Differentiate between sodium hydroxide relaxers and ammonium thioglycolate relaxers.

42 **Topic:** Chemical Relaxing

Standard: Demonstrate procedures used for a sodium hydroxide hair relaxing process.

43 **Topic:** Chemical Relaxing

Standard: Demonstrate procedures used for an ammonium thioglycolate hair relaxing process.

44 **Topic:** Chemical Relaxing

Standard: Demonstrate procedures used for a soft curl permanent.

45 **Topic:** Chemical Relaxing

Standard: Explain the differences of giving a chemical relaxing treatment to virgin hair and that has been chemically treated with color.

46 **Topic:** Chemical Relaxing

Standard: Identify a minimum of three problems that can occur when giving a chemical relaxer that would result in an unhappy client and may cause damage to the client's scalp and/or hair.

47 **Topic:** Chemical Relaxing

Standard: Follow all safety precautions and procedures while performing this service.

48 **Topic:** Hair Lightening and Coloring Techniques

Standard: Demonstrate applying hair color with a bottle and with a bowl and brush.

49 **Topic:** Hair Lightening and Coloring Techniques

Standard: Demonstrate the mixing of more than one color in a single step application process.

50 **Topic:** Hair Lightening and Coloring Techniques

Standard: Demonstrate a single and a double-process tint application.

51 **Topic:** Hair Lightening and Coloring Techniques

Standard: List a minimum of three reasons for needing corrective hair coloring treatments.

52 **Topic:** Hair Lightening and Coloring Techniques

Standard: List preventive steps to avoid hair coloring problems.

53 **Topic:** Hair Lightening and Coloring Techniques

Standard: List steps in performing corrective hair coloring procedures.

54 **Topic:** Hair Lightening and Coloring Techniques

Standard: Demonstrate the use of special effects using foil techniques.

55 **Topic:** Hair Lightening and Coloring Techniques

Standard: Demonstrate the use of special effects using cap and hook techniques.

56 **Topic:** Hair Lightening and Coloring Techniques

Standard: Identify a minimum of three problems that can occur when giving a color treatment that result in an unhappy client and may cause damage to the client's scalp and hair.

57 **Topic:** Hair Lightening and Coloring Techniques

Standard: Demonstrate effective consulting and communication skills while discussing hair color services with the client.

58 **Topic:** Hair Lightening and Coloring Techniques

Standard: Demonstrate safety and infection control procedures in lightening and hair coloring services.

Course: Cosmetology: 12.55100 Cosmetology Practicum I

35 **Topic:** Practicum

Standard: Use proper procedures in shampooing.

36 **Topic:** Practicum

Standard: Perform proper procedures in hair and scalp treatments.

38 **Topic:** Practicum

Standard: Give basic haircuts.

39 **Topic:** Practicum

Standard: Demonstrate proper procedures in permanent waving and relaxing.

40 **Topic:** Practicum

Standard: Perform lightening and hair coloring procedures.

41 **Topic:** Practicum
Standard: Demonstrate procedures and techniques in facial and nail care services.

42 **Topic:** Practicum
Standard: Demonstrate skills in operating a dispensary.

43 **Topic:** Practicum
Standard: Demonstrate skills in operating a receptionist desk.

44 **Topic:** Practicum
Standard: Demonstrate skills in salon management.

45 **Topic:** Practicum
Standard: Follow all safety and infection control procedures.

46 **Topic:** Practicum
Standard: Exercise good personal hygiene habits while working in the salon.

47 **Topic:** Practicum
Standard: Demonstrate good communication skills when determining client's request for services.

Course: Cosmetology: 12.55200 Cosmetology Practicum II

35 **Topic:** Practicum
Standard: Demonstrate proper procedures in performing shampoos on clients.

36 **Topic:** Practicum
Standard: Perform hair and scalp treatments according to the need of the client.

37 **Topic:** Practicum
Standard: Give basic haircuts.

38 **Topic:** Practicum
Standard: Give permanent wave to clients.

39 **Topic:** Practicum
Standard: Give chemical relaxer to clients.

40 **Topic:** Practicum
Standard: Demonstrate soft curl perm.

41 **Topic:** Practicum
Standard: Lighten a client's hair.

42 **Topic:** Practicum
Standard: Perform hair coloring services according to client's need.

43 **Topic:** Practicum
Standard: Give facials to clients, based on client's need.

44 **Topic:** Practicum
Standard: Perform eyebrow and lash services.

45 **Topic:** Practicum
Standard: Give basic manicures.

46 **Topic:** Practicum
Standard: Give basic pedicures

47 **Topic:** Practicum
Standard: Follow all safety and infection control procedures.

48 **Topic:** Practicum
Standard: Follow good person hygiene habits in the salon.

49 **Topic:** Practicum
Standard: Demonstrate good communication skills while discussing client's request for services.

Course: Cosmetology: 12.55300 Cosmetology Practicum III

35 **Topic:** Practicum
Standard: Perform receptionist duties.

36 **Topic:** Practicum
Standard: Perform dispensary duties.

37 **Topic:** Practicum
Standard: Demonstrate shampooing, hairdressing, and comb-out skills.

38 **Topic:** Practicum
Standard: Give permanent waves.

39 **Topic:** Practicum
Standard: Give chemical relaxer treatments.

40 **Topic:** Practicum
Standard: Perform hair coloring and lightening services according to client's needs.

41 **Topic:** Practicum
Standard: Perform scalp and hair treatments according to client's needs.

42 **Topic:** Practicum
Standard: Demonstrate facial, make-up, and arching procedures according to clients needs.

43 **Topic:** Practicum
Standard: Give manicures according to clients requests and needs.

44 **Topic:** Practicum
Standard: Give pedicures according to client requests and needs.

45 **Topic:** Practicum
Standard: Follow all safety and infection control procedures.

46 **Topic:** Practicum
Standard: Follow good personal hygiene habits.

47 **Topic:** Practicum
Standard: Demonstrate good communication skills when discussing clients request for services.

Course: Cosmetology: 12.55400 Salon Management

35 **Topic:** State and Local Laws
Standard: List state agencies governing the opening of a beauty salon business in Georgia.

36 **Topic:** State and Local Laws
Standard: List requirements for obtaining a license as a cosmetologist, esthetician, and nail technician in Georgia.

37

Topic: State and Local Laws

Standard: List local agencies and their requirements that govern the opening of a salon in Georgia.

38

Topic: Human Rescources

Standard: Describe various pay structures for personnel working in a salon, specifically the "commission" structure and "booth rental" structure for the cosmetologist.

39

Topic: Human Rescources

Standard: Describe advantages and disadvantages of various pay structures for the salon owner.

40

Topic: Human Rescources

Standard: Identify key types of people to call for potential employee reference checks.

41

Topic: Human Rescources

Standard: Demonstrate how to develop a proper resume and job application for a cosmetologist.

42

Topic: Human Rescources

Standard: Identify key times and days that are most productive for personnel in a salon.

43

Topic: Human Rescources

Standard: Identify fringe benefit packages that normally are offered to employees.

44

Topic: Salon Ownership and Planning

Standard: List areas in which a person must be knowledgeable to plan a salon.

45

Topic: Salon Ownership and Planning

Standard: List items to be considered when selecting the location for a salon.

46

Topic: Salon Ownership and Planning

Standard: Illustrate a layout for an open and a closed operator salon.

47

Topic: Salon Ownership and Planning

Standard: Identify characteristics of a proper ventilation system for a salon.

48

Topic: Salon Ownership and Planning

Standard: List advantages and disadvantages of owning versus leasing of a facility.

49

Topic: Management

Standard: Identity various types of ownership.

50

Topic: Management

Standard: Explain salon operations for a normal week of work.

51

Topic: Management

Standard: Identify sources of income and expenditures.

52

Topic: Management

Standard: Describe salon supplies and retail supplies inventory systems.

53

Topic: Management

Standard: Maintain necessary records for tax compliance.

54

Topic: Retailing

Standard: Explain the benefits of retailing.

55

Topic: Retailing

Standard: List areas in which a person must be knowledge to retail successfully.

56

Topic: Retailing

Standard: Organize a retail area for the salon.

57 **Topic:** Retailing
Standard: Demonstrate educating a client on services and products.

58 **Topic:** Marketing
Standard: Identify a minimum of three ways to market a salon.

59 **Topic:** Marketing
Standard: Describe a marketing plan for the opening of a salon.

60 **Topic:** Marketing
Standard: Prepare an advertisement for a salon.

61 **Topic:** Marketing
Standard: Identify ways to evaluate marketing of the salon.

62 **Topic:** Receptionist Duties
Standard: Demonstrate appropriate welcome for clients entering salon.

63 **Topic:** Receptionist Duties
Standard: Demonstrate proper procedures for answering the telephone.

64 **Topic:** Receptionist Duties
Standard: Demonstrate proper operations of a receptionist desk.

65 **Topic:** Receptionist Duties
Standard: Resolve customer complaints.

66 **Topic:** Receptionist Duties
Standard: Demonstrate use of a manual and computerized system for operating a receptionist desk.

67 **Topic:** Receptionist Duties
Standard: Demonstrate proper procedures for financial transactions.

68 **Topic:** Client Retention
Standard: List three reasons why a client might stop utilizing the services of a salon.

69 **Topic:** Client Retention
Standard: Identify types of information to be kept on a client card or computer file.

70 **Topic:** Client Retention
Standard: Demonstrate effective communication between client and cosmetologist while performing salon services.

Course: Cosmetology: 12.55500 Advanced Skin & Nail Care

35 **Topic:** Hair Removal
Standard: Identify ways to remove unwanted facial hair.

36 **Topic:** Hair Removal
Standard: Identify three methods of temporary hair removal.

37 **Topic:** Hair Removal
Standard: Identify methods for permanently removing hair.

38 **Topic:** Hair Removal
Standard: Demonstrate safety and infection control for hair removal services.

39 **Topic:** Corrective Makeup Applications
Standard: Identify situations where corrective make-up applications may be desired.

40 **Topic:** Corrective Makeup Applications
Standard: List various products and supplies needed for corrective make-up applications.

41 **Topic:** Corrective Makeup Applications
Standard: Demonstrate how to minimize facial flaws with make-up.

42 **Topic:** Lash and Brow Procedures
Standard: Demonstrate proper procedures for tinting the lash and brow.

43 **Topic:** Lash and Brow Procedures
Standard: Demonstrate the application and removal of artificial eyelashes.

44 **Topic:** Lash and Brow Procedures
Standard: Demonstrate procedure for tweezing eyebrows.

45 **Topic:** Lash and Brow Procedures
Standard: Demonstrate procedures for waxing eyebrows, using hot and cold method of waxing.

46 **Topic:** Lash and Brow Procedures
Standard: Demonstrate safety and infection control procedures for lash and brow procedures.

47 **Topic:** Cosmetic Surgery
Standard: Identify various types of cosmetic surgery.

48 **Topic:** Cosmetic Surgery
Standard: List a minimum of three reasons why a client may elect to have cosmetic surgery.

49 **Topic:** Facials
Standard: Demonstrate the basic procedures in a plain facial.

50 **Topic:** Facials
Standard: Demonstrate procedures for applying a mask.

51 **Topic:** Facials
Standard: Demonstrate advanced fundamentals of facial treatments, including facial steamers, gauze masks, packs, and toners.

52 **Topic:** Facials
Standard: Identify skin disorders which may be handled in the salon and which should be referred to a physician.

53 **Topic:** Facials
Standard: Demonstrate safety and infection control procedures for facial services.

54 **Topic:** Manicures and Artificial Nails
Standard: Demonstrate procedures for a plain and oil manicure.

55 **Topic:** Manicures and Artificial Nails
Standard: Demonstrate proper hand and arm massage techniques.

56 **Topic:** Manicures and Artificial Nails
Standard: Explain the importance of good ventilation when working with artificial nails.

57 **Topic:** Manicures and Artificial Nails
Standard: Demonstrate procedures for applying acrylic nails, wraps, and tips.

58 **Topic:** Manicures and Artificial Nails
Standard: Demonstrate professional techniques for nail polish applications.

59 **Topic:** Manicures and Artificial Nails
Standard: Demonstrate safety and infection control procedures for manicures and artificial nails.

Course: Cosmetology: 12.55600 Cosmetology Practicum IV

35 **Topic:** Practicum
Standard: Perform shampooing and styling services.

36 **Topic:** Practicum
Standard: Give hair and scalp treatments.

37 **Topic:** Practicum
Standard: Demonstrate hair cutting techniques and procedures.

38 **Topic:** Practicum
Standard: Perform chemical waving and relaxing services.

39 **Topic:** Practicum
Standard: Perform lightening and hair coloring services.

40 **Topic:** Practicum
Standard: Demonstrate skin care services.

41 **Topic:** Practicum
Standard: Demonstrate nail care services.

42 **Topic:** Practicum
Standard: Perform receptionist duties.

43 **Topic:** Practicum
Standard: Perform dispensary duties.

44 **Topic:** Practicum
Standard: Follow safety and infection control procedures.

45 **Topic:** Practicum
Standard: Follow good personal hygiene habits.

46 **Topic:** Practicum
Standard: Demonstrate effective communication skills with clients and co-workers.

47 **Topic:** Practicum
Standard: Practice good work ethics.

Course: Cosmetology: 12.55700 Cosmetology Practicum V

35 **Topic:** Practicum
Standard: Perform shampooing and styling services.

36 **Topic:** Practicum
Standard: Give haircuts.

37 **Topic:** Practicum
Standard: Demonstrate chemical waving procedures.

38 **Topic:** Practicum
Standard: Demonstrate chemical relaxing procedures.

39 **Topic:** Practicum
Standard: Perform lightening and hair coloring services.

40 **Topic:** Practicum
Standard: Demonstrate skin care services.

41 **Topic:** Practicum
Standard: Demonstrate nail care services.

42 **Topic:** Practicum
Standard: Perform salon management duties.

43 **Topic:** Practicum
Standard: Follow safety and infection control procedures.

44 **Topic:** Practicum
Standard: Follow good personal hygiene habits.

45 **Topic:** Practicum
Standard: Demonstrate effective communication skills between clients and co-workers.

Course: Cosmetology: 12.55800 Cosmetology Practicum VI

35 **Topic:** Practicum
Standard: Perform shampooing and styling services.

36 **Topic:** Practicum
Standard: Perform hair and scalp treatments.

37 **Topic:** Practicum
Standard: Give haircuts.

38 **Topic:** Practicum
Standard: Demonstrate chemical waving procedures.

39 **Topic:** Practicum
Standard: Demonstrate chemical relaxing procedures.

40 **Topic:** Practicum
Standard: Perform lightening and hair color services.

41 **Topic:** Practicum
Standard: Demonstrate skin care services.

42 **Topic:** Practicum
Standard: Demonstrate nail care services.

43 **Topic:** Practicum
Standard: Practice salon management techniques.

44 **Topic:** Practicum
Standard: Practice good personal hygiene.

45 **Topic:** Practicum
Standard: Follow safety and infection control procedures.

Course: DRAFT - Graphic Communications: Core Skills

1 **Topic:** Basic Skills

Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills

Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills

Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills

Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills

Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills

Standard: Identify problems, alternative solutions, and consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15 **Topic:** Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16 **Topic:** Interpersonal Skills

Standard: Share knowledge and skills with others.

17 **Topic:** Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18

Topic: Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19

Topic: Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20

Topic: Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21

Topic: Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22

Topic: Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23

Topic: Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24

Topic: Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25

Topic: Technology

Standard: Utilize a variety of technologies.

26

Topic: Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27

Topic: Business Aspects

Standard: Identify forms of business ownership.

28

Topic: Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29

Topic: Business Aspects

Standard: Demonstrate understanding of the individual's role, responsibilities, and relationships in the organizational structure of a business.

30

Topic: Business Aspects

Standard: Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

31

Topic: Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32

Topic: Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33

Topic: Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34

Topic: Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

35 **Topic:** Digital File Preparation
Standard: Define preflighting.

36 **Topic:** Digital File Preparation
Standard: Preflight a document using application preflight software.

37 **Topic:** Digital File Preparation
Standard: Define CTP.

38 **Topic:** Digital File Preparation
Standard: Explain the difference between True Type, Type 1, and Open Type Fonts.

39 **Topic:** Digital File Preparation
Standard: Demonstrate the proper use of loading, displaying, and organizing fonts using a font management software application.

40 **Topic:** Digital File Preparation
Standard: Demonstrate the use of page layout software.

41 **Topic:** Digital File Preparation
Standard: Demonstrate the use of photo manipulation software.

42 **Topic:** Digital File Preparation
Standard: Demonstrate the use of illustration software.

43 **Topic:** Digital File Preparation
Standard: Create a two-sided, three-panel brochure using graphics and text.

44 **Topic:** Digital File Preparation
Standard: Create a four-page newsletter using windows, blocks, text, graphics, frames, and headings.

45 **Topic:** Digital File Preparation
Standard: Create a two-page newsletter using drop caps for paragraph openings, wrap-a-rounds (run-a-rounds), and graphics.

46 **Topic:** Digital File Preparation
Standard: Explain the basic principles of dot gain and its impact on printed materials.

47 **Topic:** Digital File Output
Standard: Read and interpret production information from job jacket/ticket.

48 **Topic:** Digital File Output
Standard: Identify safety considerations in film imagesetting.

49 **Topic:** Digital File Output
Standard: Read and explain material safety data sheets (MSDS).

50 **Topic:** Digital File Output
Standard: Demonstrate the proper waste disposal methods for used chemistry.

51 **Topic:** Digital File Output
Standard: Define preflighting and file repair.

52 **Topic:** Digital File Output
Standard: Identify common digital file problems.

53 **Topic:** Digital File Output
Standard: Repair a digital file.

54 **Topic:** Digital File Output
Standard: Define trapping as it relates to prepress.

55 **Topic:** Digital File Output
Standard: Describe the various options for creating digital traps.

56 **Topic:** Digital File Output
Standard: Trap a page digitally using page layout, illustration, and/or trapping software.

57 **Topic:** Digital File Output
Standard: Define various imposition systems such as work & turn, work & tumble (or flop), perfecting, high-folio, and nesting.

58 **Topic:** Digital File Output
Standard: Create a folding dummy of a 16-page job with proper pagination, folds, and guides.

59 **Topic:** Digital File Output
Standard: Using digital imposition software, impose a document.

60 **Topic:** Digital File Output
Standard: Identify basic parts of a film imagesetter.

61 **Topic:** Digital File Output
Standard: Output a multicolor digital file to a film imagesetter.

62 **Topic:** Digital File Output
Standard: Identify film processor chemicals and methods.

63 **Topic:** Digital File Output
Standard: Run control checks on a film processor.

64 **Topic:** Digital File Output
Standard: Identify basic parts of analog platemaker.

65 **Topic:** Digital File Output
Standard: Identify analog plate materials and plate types.

66 **Topic:** Digital File Output
Standard: List the considerations in selecting the correct plate material (paper, polyester, metal) for a given job.

67 **Topic:** Digital File Output
Standard: Identify plate processor chemicals and methods.

68 **Topic:** Digital File Output
Standard: Identify platemaking procedures for metal plates.

69 **Topic:** Digital File Output
Standard: Determine exposure time for metal plates using transparent step scale.

70 **Topic:** Digital File Output
Standard: Explain the purpose of pin registration systems.

71 **Topic:** Digital File Output
Standard: Prepare analog plates (expose, process, inspect, and store).

72 **Topic:** Digital File Output
Standard: Make additions, deletions, and repairs to an offset plate.

73 **Topic:** Digital File Output
Standard: Identify basic parts of a digital proofing system.

74 **Topic:** Digital File Output
Standard: List the advantages and disadvantages of different color proofing systems.

75 **Topic:** Digital File Output
Standard: Identify digital proofing materials.

76 **Topic:** Digital File Output
Standard: Define CTP technology.

77 **Topic:** Digital File Output
Standard: Identify digital plate materials and plate types.

78 **Topic:** Digital File Output
Standard: Describe the various laser technologies found in computer-to-plate system.

79 **Topic:** Digital File Output
Standard: Prepare digital plates (image, process, inspect, and store).

80 **Topic:** Digital File Output
Standard: List the considerations in imaging related to the characteristics of paper and other printing substrates (foil, plastic).

81 **Topic:** Digital File Output
Standard: Describe the effect of dot gain or loss on the reproduction system.

82 **Topic:** Digital File Output
Standard: Describe the differences between undercolor removal (UCR) and gray component replacement (GCR).

83 **Topic:** Digital File Output
Standard: Explain the differences between a densitometer, plate reader, and spectrophotometer.

84 **Topic:** Digital File Output
Standard: Describe process control procedures necessary for successful digital file output.

85 **Topic:** Digital File Output
Standard: Identify and describe direct imaging technologies on press.

86 **Topic:** Digital File Output
Standard: Describe the use of plate scanning and ink key presetting technologies.

87 **Topic:** Digital File Output
Standard: Explain the CIP4 protocol and how it is used in the printing plant.

88 **Topic:** Digital File Output
Standard: Observe analog and digital platemaking operations at a commercial printer.

89 **Topic:** Digital File Output
Standard: Explain the importance of and demonstrate the proper use of anti-virus software.

Course: DRAFT - Graphic Communications: 48.56200 Fundamentals of Graphic Communications

35 **Topic:** Image Capture
Standard: Read and interpret production information from job ticket/jacket.

36
Topic: Image Capture
Standard: Identify basic scanning hardware.

37
Topic: Image Capture
Standard: Identify basic digital camera hardware.

38
Topic: Image Capture
Standard: Explain the difference between line art and continuous tone originals.

39
Topic: Image Capture
Standard: Using a digital camera or scanner, capture a digital image.

40
Topic: Image Capture
Standard: Identify the difference between continuous images and halftone images

41
Topic: Image Capture
Standard: Identify basic scanner uses and limitations.

42
Topic: Image Capture
Standard: Identify basic scanner software, its uses, and limitations.

43
Topic: Image Capture
Standard: Demonstrate appropriate scanner/program operations for line artwork.

44
Topic: Image Capture
Standard: Demonstrate saving scanned images into an appropriate file format.

45
Topic: Image Capture
Standard: Identify high/low resolution images.

46
Topic: Image Capture
Standard: Demonstrate importing scanned digital images into page layout software.

47
Topic: Image Capture
Standard: Explain the various components and operations of a digital camera.

48
Topic: Image Capture
Standard: Demonstrate appropriate digital camera operations for image capture.

49
Topic: Image Capture
Standard: Import digital images from a digital camera into the computer.

50
Topic: Digital File Output
Standard: Identify traps on a print press sheet.

51
Topic: Digital File Output
Standard: Explain the purpose of a folding dummy.

52
Topic: Digital File Output
Standard: Define imposition.

53
Topic: Digital File Output
Standard: Identify a film imagesetter and processor.

54
Topic: Digital File Output
Standard: Identify analog/digital platemaking equipment and tools for offset plates.

55
Topic: Digital File Output
Standard: Produce an analog/digital plate for offset printing.

56

Topic: Digital File Output

Standard: Identify and discuss various analog and digital proofing systems.

57

Topic: Illustration

Standard: Demonstrate a functional knowledge of keyboard shortcuts/menus and procedures for their use.

58

Topic: Illustration

Standard: Draw a design appropriate for a given job using a graphics program.

59

Topic: Illustration

Standard: Create a design using tints and fills for a given job using a graphics program.

60

Topic: Illustration

Standard: Create a design using manipulated type (rotated, circled, extended, etc.) for a publication.

61

Topic: Illustration

Standard: Trace a drawing/photograph using a graphics program.

62

Topic: Illustration

Standard: Create a design/publication using electronic clip art.

63

Topic: Page Layout

Standard: Create a printed piece using tints, reverses, and manipulating type for effect.

64

Topic: Page Layout

Standard: Produce a multicolor flyer by outputting individual spot colors.

65

Topic: Page Layout

Standard: Demonstrate knowledge of available page layout programs capabilities, advantages, and disadvantages.

66

Topic: Page Layout

Standard: Demonstrate the proper procedures on printing a proof to a monochrome laser printer and/or inkjet printer using page layout software.

67

Topic: Page Layout

Standard: Create a two-sided, three-panel brochure using graphics and text.

68

Topic: Press Operations

Standard: Read and interpret production information from job ticket/jacket.

69

Topic: Press Operations

Standard: Identify safety considerations for platemaking.

70

Topic: Press Operations

Standard: Practice safe work habits in platemaking operations.

71

Topic: Press Operations

Standard: Identify basic parts of the platemaker.

72

Topic: Press Operations

Standard: Identify plate materials and plate types.

73

Topic: Press Operations

Standard: Identify and explain the difference between positive and negative working plates.

74

Topic: Press Operations

Standard: Identify platemaking procedures.

75

Topic: Press Operations

Standard: Make additions, deletions, and repairs to an offset plate.

76

Topic: Press Operations

Standard: Practice safe work habits in press operations.

77

Topic: Press Operations

Standard: Identify basic parts and systems of a press.

78

Topic: Press Operations

Standard: Identify basic press operation procedures.

79

Topic: Press Operations

Standard: Identify basic paper types and sizes.

80

Topic: Press Operations

Standard: Determine grain direction of paper.

81

Topic: Press Operations

Standard: Handle and jog paper stock (wire/felt, watermarks, carbonless sequence).

82

Topic: Press Operations

Standard: Identify paper weight, coating, and sizes.

83

Topic: Press Operations

Standard: Identify mixed fountain solution testing material, equipment, and procedures.

84

Topic: Press Operations

Standard: Mix fountain solutions using appropriate ratios.

85

Topic: Press Operations

Standard: Perform makeready steps for paper: sheet size, impression cylinder pressure, etc..

86

Topic: Press Operations

Standard: Perform makeready of the inking system.

87

Topic: Press Operations

Standard: Print a single-color, one-sided job using a metal plate.

88

Topic: Press Operations

Standard: Print a single-color job using photo direct and/or electrostatic masters.

89

Topic: Press Operations

Standard: Practice safe handling of chemicals, fountain wash, blanket wash, and other chemicals, and wear appropriate protective gear.

90

Topic: Press Operations

Standard: Identify how press waste and material cost affects a company.

91

Topic: Press Operations

Standard: Identify the characteristics and applications of different inks, i.e. solvent inks, water base inks, UV inks, and rubber base inks.

92

Topic: Job Application and Interpersonal Skills

Standard: Demonstrate proper work ethic/habits.

93

Topic: Job Application and Interpersonal Skills

Standard: Demonstrate how to locate job listings through a variety of sources (Internet, associations, newspapers, agencies, etc.).

94

Topic: Job Application and Interpersonal Skills

Standard: Read and explain various want ads.

95

Topic: Job Application and Interpersonal Skills

Standard: Write a personal resume.

96 **Topic:** Job Application and Interpersonal Skills
Standard: Write a cover letter for obtaining a printing and art design job.

97 **Topic:** Job Application and Interpersonal Skills
Standard: Read and complete an employment application form.

98 **Topic:** Job Application and Interpersonal Skills
Standard: Practice job interview skills with proper appearance.

99 **Topic:** Job Application and Interpersonal Skills
Standard: Complete a telephone job interview.

100 **Topic:** Job Application and Interpersonal Skills
Standard: Write a follow up letter.

101 **Topic:** Job Application and Interpersonal Skills
Standard: Make a follow-up telephone call.

102 **Topic:** Job Application and Interpersonal Skills
Standard: Evaluate benefit package for employment.

103 **Topic:** Job Application and Interpersonal Skills
Standard: Compare job opportunities.

104 **Topic:** Job Application and Interpersonal Skills
Standard: Observe a commercial printing operation.

Course: DRAFT - Graphic Communications: 48.56300 Practicum A, Press Operations

35 **Topic:** Press Operations
Standard: Identify safety considerations for press operations.

36 **Topic:** Press Operations
Standard: Practice safe work habits in press operations.

37 **Topic:** Press Operations
Standard: Identify paper problems that can occur prior to running on the press (i.e., tight edges and wavy paper).

38 **Topic:** Press Operations
Standard: Identify offset ink types and uses.

39 **Topic:** Press Operations
Standard: Identify ink additives.

40 **Topic:** Press Operations
Standard: Identify ink problems.

41 **Topic:** Press Operations
Standard: Identify problems associated with ink and water balance.

42 **Topic:** Press Operations
Standard: Describe a procedure to set up, mix, and test ink for printing using ink color chart for mixing requirements.

43 **Topic:** Press Operations
Standard: Identify fountain solutions and additives.

44 **Topic:** Two Color Printing
Standard: Print a two-color job without register marks.

45 **Topic:** Two Color Printing
Standard: Print a two-color job with register marks.

46 **Topic:** Two Color Printing
Standard: Print a two-color job with color bars.

47 **Topic:** Two Color Printing
Standard: Print a two-color, two-sided job.

48 **Topic:** Two Color Printing
Standard: Perform a major press cleanup and roller treatment (deglazing).

49 **Topic:** Two Color Printing
Standard: Make needed pressure settings on a press.

50 **Topic:** Two Color Printing
Standard: Install and set a blanket.

51 **Topic:** Two Color Printing
Standard: Demonstrate proper wash-up techniques for inking system, dampening system, and cylinders.

52 **Topic:** Two Color Printing
Standard: Evaluate print quality and make needed adjustments to improve a printed piece.

53 **Topic:** Two Color Printing
Standard: Print close register color work.

54 **Topic:** Two Color Printing
Standard: Print heavy solid work making needed adjustments to improve quality.

55 **Topic:** Two Color Printing
Standard: Observe the press operation of a commercial printer.

Course: DRAFT - Graphic Communications: 48.56500 Practicum C-Binding and Finishing

35 **Topic:** Binding and Finishing
Standard: Read and comprehend production information from a job ticket/jacket.

36 **Topic:** Binding and Finishing
Standard: Demonstrate a working knowledge of pagination.

37 **Topic:** Binding and Finishing
Standard: Identify safety considerations in bindery operations.

38 **Topic:** Binding and Finishing
Standard: Practice safe work habits in bindery operations.

39 **Topic:** Binding and Finishing
Standard: Identify basic hand tools, equipment, and materials in bindery operations.

40 **Topic:** Binding and Finishing
Standard: Demonstrate proper procedures in using folding equipment.

41 **Topic:** Binding and Finishing
Standard: Describe and identify in-line finishing systems.

42 **Topic:** Binding and Finishing
Standard: Describe how to use and set up programmable cutters.

43 **Topic:** Binding and Finishing
Standard: Describe how to change the blade on an automatic paper cutter.

44 **Topic:** Binding and Finishing
Standard: Select and identify the most commonly used types of paper.

45 **Topic:** Binding and Finishing
Standard: Demonstrate knowledge of paper types related to their cutting, folding, and binding characteristics.

46 **Topic:** Binding and Finishing
Standard: Describe and identify off-line finishing systems.

47 **Topic:** Binding and Finishing
Standard: Describe the fundamentals and applications of saddle stitching and perfect binding.

48 **Topic:** Binding and Finishing
Standard: Identify packaging and shrink-wrap equipment and materials.

49 **Topic:** Binding and Finishing
Standard: Demonstrate knowledge of mail class rates (bulk, pre-sorted).

50 **Topic:** Binding and Finishing
Standard: List the operational procedures for foil stamping and embossing.

51 **Topic:** Binding and Finishing
Standard: Identify foil stamping and embossing equipment.

52 **Topic:** Binding and Finishing
Standard: List the common problems encountered in foil stamping and embossing.

53 **Topic:** Binding and Finishing
Standard: Identify the components of a case bound book.

54 **Topic:** Binding and Finishing
Standard: Describe the fundamentals of modern case binding.

55 **Topic:** Binding and Finishing
Standard: Describe the various paper inventory and storage techniques.

56 **Topic:** Binding and Finishing
Standard: Demonstrate proper paper handling procedures.

57 **Topic:** Binding and Finishing
Standard: Describe and identify various coating and laminating techniques.

58 **Topic:** Binding and Finishing
Standard: List the advantages and disadvantages of various coating and laminating techniques.

59 **Topic:** Binding and Finishing
Standard: Estimate the cost of materials and production for performing various bindery operations.

60 **Topic:** Binding and Finishing
Standard: Describe waste removal and disposal in the bindery.

61 **Topic:** Binding and Finishing
Standard: Identify spiral binding and wire binding equipment and products.

62 **Topic:** Binding and Finishing
Standard: Describe tipping-in procedures.

63 **Topic:** Binding and Finishing

Standard: Demonstrate how to check the squareness of stock.

64 **Topic:** Binding and Finishing

Standard: Identify common production problems in the bindery.

65 **Topic:** Binding and Finishing

Standard: Prepare folding dummies for commonly-used impositions.

66 **Topic:** Binding and Finishing

Standard: Set up and operate folder consistent with job specifications.

67 **Topic:** Binding and Finishing

Standard: Describe quality control methods for bound products.

68 **Topic:** Binding and Finishing

Standard: Perform preventative maintenance on a folder.

69 **Topic:** Binding and Finishing

Standard: Perform preventative maintenance on a paper cutter.

70 **Topic:** Binding and Finishing

Standard: Define folding terminology and identify different folding techniques.

71 **Topic:** Binding and Finishing

Standard: Use folding equipment to produce a high-folio lip signature and a low-folio signature and describe the advantages of both.

72 **Topic:** Binding and Finishing

Standard: Identify various ancillary equipment such as gluing, ink jetting, and wet scoring.

73 **Topic:** Binding and Finishing

Standard: Describe the use of brick stacking.

74 **Topic:** Binding and Finishing

Standard: Demonstrate the use of brick stacking.

75 **Topic:** Binding and Finishing

Standard: Set up and use a three-hole drill to produce a drilled job.

76 **Topic:** Binding and Finishing

Standard: Describe the applications of database information in the bindery for ink jet personalization and demographic binding.

77 **Topic:** Binding and Finishing

Standard: Observe a commercial bindery operation.

Course: DRAFT - Graphic Communications: 48.56600 Printing Technology Lab I

35 **Topic:** Safety

Standard: Read and interpret production information from job jacket/ticket.

36 **Topic:** Safety

Standard: Identify safety considerations in production job.

37 **Topic:** Safety

Standard: Read and describe material safety data sheets (MSDS).

38 **Topic:** Safety
Standard: Practice safety precautions in laboratory assignments.

39 **Topic:** Safety
Standard: Demonstrate proper waste disposal methods for used chemistry.

40 **Topic:** DIGITAL FILE PREPARATION
Standard: Define preflighting.

41 **Topic:** Digital File Preparation
Standard: Preflight a document using application preflight software.

42 **Topic:** Digital File Preparation
Standard: Define CTP.

43 **Topic:** Digital File Preparation
Standard: Explain the difference between TrueType, Type 1, and Open Type Fonts.

44 **Topic:** Digital File Preparation
Standard: Demonstrate the use of page layout software.

45 **Topic:** Digital File Preparation
Standard: Demonstrate the use of photo manipulation Software.

46 **Topic:** Digital File Preparation
Standard: Demonstrate the use of illustration software.

47 **Topic:** Digital File Preparation
Standard: Create a two-sided, three-panel brochure using graphics and text.

48 **Topic:** Digital File Preparation
Standard: Create a four-page newsletter using windows, blocks, text, graphics, frames, and headings.

49 **Topic:** Digital File Preparation
Standard: Create a two-page newsletter using drop caps for paragraph openings, wrap-a-round (run-a-rounds), and graphics.

50 **Topic:** Digital File Preparation
Standard: Explain the basic principle of dot gain and its impact on printed materials.

51 **Topic:** Digital File Output
Standard: Define preflighting and file repair.

52 **Topic:** Digital File Output
Standard: Identify common digital file problems.

53 **Topic:** Digital File Output
Standard: Repair a digital file.

54 **Topic:** Digital File Output
Standard: Define trapping as it relates to prepress.

55 **Topic:** Digital File Output
Standard: Describe the various options for creating digital traps.

56 **Topic:** Digital File Output
Standard: Trap a page digitally using page layout, illustration, and/or trapping software.

57 **Topic:** Digital File Output
Standard: Define various imposition systems such as work & turn, work & tumble (or flop), perfecting, high-folio, and nesting.

58
Topic: Digital File Output
Standard: Create a folding dummy of a 16-page job with proper pagination, folds, and guides.

59
Topic: Press Operations
Standard: Identify paper problems that can occur prior to running on the press (i.e., tight edges and wavy paper).

60
Topic: Press Operations
Standard: Identify offset ink types and uses.

61
Topic: Press Operations
Standard: Identify ink problems.

62
Topic: Press Operations
Standard: Describe a procedure to set up, mix, and test ink for printing using ink color chart for mixing requirements.

63
Topic: Press Operations
Standard: Identify fountain solutions and additives.

64
Topic: Press Operations
Standard: Print a two-color job without register marks.

65
Topic: Press Operations
Standard: Print a two-color job with register marks.

66
Topic: Press Operations
Standard: Perform a major press cleanup and roller treatment (deglazing).

67
Topic: Press Operations
Standard: Evaluate print quality and make needed adjustments to improve a printed piece

68
Topic: Finishing and Binding
Standard: Select proper hand tools, equipment, and materials for specified bindery jobs.

69
Topic: Finishing and Binding
Standard: Demonstrate the proper use of folding equipment.

70
Topic: Finishing and Binding
Standard: Describe how to use and set up programmable cutters.

71
Topic: Finishing and Binding
Standard: Describe how to change the blade on an automatic paper cutter.

72
Topic: Finishing and Binding
Standard: Select and identify the most commonly-used types of paper.

73
Topic: Finishing and Binding
Standard: Demonstrate knowledge of paper types related to their cutting, folding and binding characteristics.

74
Topic: Finishing and Binding
Standard: Describe and identify off-line finishing systems.

75
Topic: Finishing and Binding
Standard: Describe the fundamentals and applications of saddle stitching and perfect binding.

76
Topic: Finishing and Binding
Standard: Describe various paper inventory and storage techniques.

77
Topic: Finishing and Binding
Standard: Demonstrate proper paper handling procedures.

78 **Topic:** Finishing and Binding
Standard: Demonstrate how to check the squareness of stock.

79 **Topic:** Finishing and Binding
Standard: Identify common production problems in the bindery.

80 **Topic:** Finishing and Binding
Standard: Prepare folding dummies for commonly used impositions.

81 **Topic:** Finishing and Binding
Standard: Set up and operate folder consistent with job specifications.

82 **Topic:** Finishing and Binding
Standard: Set up and use a three-hole drill to produce a drilled job.

83 **Topic:** Screen Printing
Standard: Identify proper hand tools, equipment, and materials for screen printing.

84 **Topic:** Screen Printing
Standard: Discuss characteristics of fabrics, frames, and screen tension.

85 **Topic:** Screen Printing
Standard: Describe the process of using stencils in screen printing.

86 **Topic:** Screen Printing
Standard: Define and describe squeegees.

87 **Topic:** Screen Printing
Standard: Identify screen printing substrates.

88 **Topic:** Screen Printing
Standard: Identify printing inks.

89 **Topic:** Screen Printing
Standard: Identify printing dryers.

90 **Topic:** Screen Printing
Standard: Prepare and/or select art design for screen printing job.

91 **Topic:** Screen Printing
Standard: Prepare stencil for screen printing.

92 **Topic:** Screen Printing
Standard: Prepare machine for operation.

93 **Topic:** Screen Printing
Standard: Prepare ink and additives.

94 **Topic:** Screen Printing
Standard: Operate and monitor machines.

95 **Topic:** Screen Printing
Standard: Inspect quality against required standards.

96 **Topic:** Screen Printing
Standard: Complete assigned screen printing projects.

35 **Topic:** Safety
Standard: Read and interpret production information on a job jacket/ticket.

36 **Topic:** Safety
Standard: Identify safety considerations for each production job.

37 **Topic:** Safety
Standard: Practice safe work habits in all laboratory situations.

38 **Topic:** Safety
Standard: Read & interpret material data sheets (MSDS) associated with all production jobs.

39 **Topic:** Safety
Standard: Follow approved shop dress code for safe operation including necessary personal safety equipment.

40 **Topic:** Safety
Standard: Demonstrate proper waste removal methods for used chemistry.

41 **Topic:** Digital File Preparation
Standard: Identify basic parts of a film imagesetter.

42 **Topic:** Digital File Preparation
Standard: Output a multicolor digital file to a film imagesetter.

43 **Topic:** Digital File Preparation
Standard: Identify film processor chemicals and methods.

44 **Topic:** Digital File Preparation
Standard: Run control checks on a film processor.

45 **Topic:** Digital File Preparation
Standard: Create an analog color proof.

46 **Topic:** Digital File Preparation
Standard: List the considerations in selecting the correct plate material (paper, polyester, metal) for a given job.

47 **Topic:** Digital File Preparation
Standard: Identify plate processor chemicals and methods.

48 **Topic:** Digital File Preparation
Standard: Identify platemaking procedures for metal plates.

49 **Topic:** Digital File Preparation
Standard: Determine exposure time for metal plates using transparent step scale.

50 **Topic:** Digital File Preparation
Standard: Explain the purpose of pin registration systems.

51 **Topic:** Digital File Preparation
Standard: Prepare analog plates (expose, process, inspect, and store).

52 **Topic:** Digital File Preparation
Standard: Make additions, deletions and repairs to an offset plate.

53 **Topic:** Press Operations
Standard: Print a two-color job with color bars.

54
Topic: Press Operations
Standard: Print a two-color, two-sided job.

55
Topic: Press Operations
Standard: Perform a major press cleanup and roller treatment (deglazing).

56
Topic: Press Operations
Standard: Make needed pressure settings on a press.

57
Topic: Press Operations
Standard: Install and set a blanket.

58
Topic: Press Operations
Standard: Demonstrate proper wash up techniques for inking system, dampening system, and cylinders.

59
Topic: Press Operations
Standard: Evaluate quality and make needed adjustments to improve a printed piece.

60
Topic: Press Operations
Standard: Print close register color work.

61
Topic: Press Operations
Standard: Print heavy solid work making needed adjustments to improve quality.

62
Topic: Press Operations
Standard: Observe the press operation of a commercial printer.

63
Topic: Binding and Finishing
Standard: Identify packaging and shrink-wrap equipment and materials.

64
Topic: Binding and Finishing
Standard: Demonstrate knowledge of mail class rates (bulk, pre-sorted).

65
Topic: Binding and Finishing
Standard: List the operational procedures for foil stamping and embossing.

66
Topic: Binding and Finishing
Standard: Identify foil stamping and embossing equipment.

67
Topic: Binding and Finishing
Standard: List the common problems encountered in foil stamping and embossing.

68
Topic: Binding and Finishing
Standard: Identify the components of a case bound book.

69
Topic: Binding and Finishing
Standard: Describe the fundamentals of a modern case binding.

70
Topic: Binding and Finishing
Standard: Describe and identify various coating and laminating techniques.

71
Topic: Binding and Finishing
Standard: List the advantages and disadvantages of various coating and laminating techniques.

72
Topic: Binding and Finishing
Standard: Estimate the cost of materials and production for performing various bindery operations.

73
Topic: Binding and Finishing
Standard: Describe waste removal and disposal in the bindery.

74 **Topic:** Binding and Finishing
Standard: Identify spiral binding and wire binding equipment and products.

75 **Topic:** Binding and Finishing
Standard: Describe tipping-in procedures.

76 **Topic:** Binding and Finishing
Standard: Observe a commercial bindery in operation.

77 **Topic:** Binding and Finishing
Standard: Demonstrate proficiency in binding by completing required laboratory projects.

78 **Topic:** Screen Printing
Standard: Demonstrate the use of a job ticket in screen printing.

79 **Topic:** Screen Printing
Standard: Select proper tools, equipment, and materials for completing specified screen printing job.

80 **Topic:** Screen Printing
Standard: Perform a screen printing job according to ticket/identified specifications.

81 **Topic:** Screen Printing
Standard: Demonstrate proper clean up procedures.

82 **Topic:** Screen Printing
Standard: Follow safety procedures while performing specified tasks.

83 **Topic:** Screen Printing
Standard: Treat and properly dispose of liquid waste.

Course: DRAFT - Graphic Communications: 48.56800 Printing Technology Lab III

35 **Topic:** Safety
Standard: Read and interpret production information from job ticket/jacket.

36 **Topic:** Safety
Standard: Identify safety considerations in production jobs.

37 **Topic:** Safety
Standard: Practice safe work habits in production assignments.

38 **Topic:** Safety
Standard: Read and describe material safety data sheets (MSDS).

39 **Topic:** Safety
Standard: Follow approved shop dress code for safe operation including necessary personal safety equipment.

40 **Topic:** Safety
Standard: Demonstrate the proper waste disposal methods for used chemistry.

41 **Topic:** Digital File Preparation
Standard: Identify basic parts of a digital proofing system.

42 **Topic:** Digital File Preparation
Standard: List the advantages and disadvantages of different color proofing systems.

43 **Topic:** Digital File Preparation
Standard: Identify digital proofing materials.

44

Topic: Digital File Preparation

Standard: Define CTP technology.

45

Topic: Digital File Preparation

Standard: Identify basic parts of a computer-to-plate system.

46

Topic: Digital File Preparation

Standard: Identify digital plate materials and plate types.

47

Topic: Digital File Preparation

Standard: Describe the various laser technologies found in computer-to-plate systems.

48

Topic: Digital File Preparation

Standard: Prepare digital plates (image, process, inspect, and store).

49

Topic: Digital File Preparation

Standard: List the considerations in imaging related to the characteristics of paper and other printing substrates (foil, plastics).

50

Topic: Digital File Preparation

Standard: Describe the effect of dot gain or loss on the reproduction system.

51

Topic: Digital File Preparation

Standard: Describe the difference between a densitometer, plate reader, and spectrophotometer.

52

Topic: Digital File Preparation

Standard: Describe process control procedures necessary for successful digital file output.

53

Topic: Digital File Preparation

Standard: Identify and describe direct imaging technologies on press.

54

Topic: Digital File Preparation

Standard: Describe the use of plate scanning and ink key presetting technologies.

55

Topic: Digital File Preparation

Standard: Explain the CIP4 protocol and how it is used in the printing plant.

56

Topic: Digital File Preparation

Standard: Observe analog and digital platemaking operations at a commercial printer.

57

Topic: Press Operations

Standard: Print a single-color, one sided job using a metal plate.

58

Topic: Press Operations

Standard: Print a single-color job using photo direct and/or electrostatic masters.

59

Topic: Press Operations

Standard: Print a single-color, 2-sided job.

60

Topic: Press Operations

Standard: Print a single-color job on carbonless stock.

61

Topic: Press Operations

Standard: Print a single color job on envelopes.

62

Topic: Press Operations

Standard: Print a single-color job on heavy stock.

63

Topic: Press Operations

Standard: Print a single-color, 2 sided job using work and tumble.

64

Topic: Press Operations

Standard: Print a single-color, 2 sided job using work and turn.

65

Topic: Press Operations

Standard: Print a two-color job with register marks.

66

Topic: Press Operations

Standard: Print a two-color job with no register marks.

67

Topic: Press Operations

Standard: Print a two-color job with color bars.

68

Topic: Press Operations

Standard: Print a two-color, 2 sided job.

69

Topic: Press Operations

Standard: Perform a major press cleanup and roller treatment (deglazing).

70

Topic: Press Operations

Standard: Evaluate print quality and make needed adjustments to improve a printed piece.

71

Topic: Press Operations

Standard: Demonstrate proper wash up techniques for inking system, dampening system, and cylinders.

72

Topic: Binding and Finishing

Standard: Describe quality control methods for bound products.

73

Topic: Binding and Finishing

Standard: Perform preventative maintenance on a folder.

74

Topic: Binding and Finishing

Standard: Perform preventative maintenance on a cutter.

75

Topic: Binding and Finishing

Standard: Define folding terminology and identify different folding techniques.

76

Topic: Binding and Finishing

Standard: Identify various ancillary equipment such as gluing, ink jetting and wet scoring.

77

Topic: Binding and Finishing

Standard: Describe and identify the uses of right angle folding, knife folding, and combination folding.

78

Topic: Binding and Finishing

Standard: Demonstrate the use of brick stacking.

79

Topic: Binding and Finishing

Standard: Set up and use a 3 hole drill to produce a drilled job.

80

Topic: Binding and Finishing

Standard: Describe the applications of database information in the bindery for ink jet personalization and demographic binding.

81

Topic: Binding and Finishing

Standard: Complete laboratory project in binding and finishing as assigned.

82

Topic: Binding and Finishing

Standard: Observe a commercial bindery operation.

83

Topic: Screen Printing

Standard: Select proper tools, equipment and materials for screen printing job.

84 **Topic:** Screen Printing

Standard: Follow all safety procedures while performing screen printing tasks.

85 **Topic:** Screen Printing

Standard: Demonstrate procedures for completing a screen printing job.

86 **Topic:** Screen Printing

Standard: Demonstrate proper cleanup procedures upon completion of screen printing job.

87 **Topic:** Screen Printing

Standard: Demonstrate proper maintenance procedures for screen printing equipment.

88 **Topic:** Screen Printing

Standard: Properly dispose of liquid waste.

Course: DRAFT - Graphic Communications: 48.56100 Introduction to Graphic Communications

35 **Topic:** Careers in Graphic Communications

Standard: Define the role of graphics in the free enterprise system.

36 **Topic:** Careers in Graphic Communications

Standard: Identify print markets and types of print businesses.

37 **Topic:** Careers in Graphic Communications

Standard: Explain the history of the printing industry and how careers have changed over time.

38 **Topic:** Careers in Graphic Communications

Standard: Identify commercial art design opportunities in the graphic communications industry.

39 **Topic:** Careers in Graphic Communications

Standard: Explain how technological changes affect the graphic communications industry as it relates to printing and commercial art .

40 **Topic:** Careers in Graphic Communications

Standard: Identify and describe the major printing processes (including digital printing).

41 **Topic:** Careers in Graphic Communications

Standard: List the advantages and disadvantages of each major process.

42 **Topic:** Careers in Graphic Communications

Standard: List the products produced by each major process.

43 **Topic:** Careers in Graphic Communications

Standard: List in order the business flow of printing from initial concept to final product.

44 **Topic:** Careers in Graphic Communications

Standard: List in order the technical production flow from idea to finished product.

45 **Topic:** Careers in Graphic Communications

Standard: Identify major occupations in the graphic communications industry and explain the basic training needed for each.

46 **Topic:** Careers in Graphic Communications

Standard: List major responsibilities for each of the major occupations identified.

47 **Topic:** Careers in Graphic Communications

Standard: Identify basic salary/wage expectation ranges for the local area.

48 **Topic:** Careers in Graphic Communications
Standard: Identify and describe basic graphic communication equipment.

49 **Topic:** Safety and First Aid
Standard: Identify locations of fire safety equipment.

50 **Topic:** Safety and First Aid
Standard: Describe proper use of fire safety equipment.

51 **Topic:** Safety and First Aid
Standard: List safety rules involving flammable liquids.

52 **Topic:** Safety and First Aid
Standard: List steps to be taken in case of injury in the lab.

53 **Topic:** Safety and First Aid
Standard: Identify location of first aid kit and eye wash station.

54 **Topic:** Safety and First Aid
Standard: Read and interpret Material Safety Data Sheets (MSDS).

55 **Topic:** Safety and First Aid
Standard: Identify protective safety equipment where needed (gloves, goggles, ear plugs).

56 **Topic:** Safety and First Aid
Standard: Follow proper safety procedures when operating equipment.

57 **Topic:** Safety and First Aid
Standard: Follow approved shop dress code for safe operation including necessary personal safety equipment.

58 **Topic:** Safety and First Aid
Standard: Pass general lab safety test.

59 **Topic:** Safety and First Aid
Standard: Use approved methods to dispose of waste materials.

60 **Topic:** Safety and First Aid
Standard: Read, interpret, and follow instructions on warning labels.

61 **Topic:** Safety and First Aid
Standard: Demonstrate common sense when working with others.

62 **Topic:** Safety and First Aid
Standard: Demonstrate a working knowledge of the safety color code.

63 **Topic:** Safety and First Aid
Standard: Identify OSHAs role in the printing industry.

64 **Topic:** Digital File Preparation
Standard: Identify various prepress applications and uses in printing and commercial art careers.

65 **Topic:** Digital File Preparation
Standard: Design a page with appropriate margins, formatting, guides, trims, and folds.

66 **Topic:** Digital File Preparation
Standard: Flow copy from word processing program to page layout program according to job specifications.

67 **Topic:** Digital File Preparation
Standard: Define the difference between raster and vector.

68

Topic: Digital File Preparation

Standard: Identify various types of removable media.

69

Topic: Digital File Preparation

Standard: Import an image into a page layout program.

70

Topic: Digital File Preparation

Standard: Define postscript.

71

Topic: Digital File Preparation

Standard: Explain the differences between word processing, illustration, image editing, and page layout software.

72

Topic: Digital File Preparation

Standard: Design and produce a single-color document using desired fonts, styles, margins, indents, and tabs.

73

Topic: Digital File Preparation

Standard: Select appropriate software for word processing, illustration, image editing, and page layout.

74

Topic: Digital File Preparation

Standard: Prepare a series of hand-drawn sketches for layouts incorporating appropriate marks (i.e., gutters, register marks, and fold lines, etc.).

75

Topic: Type

Standard: Measure copy/text in points using a line gauge.

76

Topic: Type

Standard: Identify x-height, mean-line, base-line, ascenders, descenders, and their roles in measuring and designing with type.

77

Topic: Type

Standard: Identify caps, lowercase, uppercase, small caps and ligatures.

78

Topic: Type

Standard: Define dingbats, bullets, rules, and symbols and their uses in publications.

79

Topic: Type

Standard: Distinguish between display (headline) type and body (text) type by their point sizes and styles.

80

Topic: Type

Standard: Identify the basic type styles and their uses

81

Topic: Type

Standard: Distinguish between serif and sans serif type styles.

82

Topic: Type

Standard: Explain letter spacing, tracking, and kerning of type characteristics.

83

Topic: Type

Standard: Explain word spacing and the relation of em and en in paragraph spacing.

84

Topic: Type

Standard: Define line spacing and explain the measurement principles for the leading of text.

85

Topic: Type

Standard: Define the type arrangements: flush left-ragged right, flush right-ragged left, centered, and justified.

86

Topic: Page Layout

Standard: Select appropriate page layout software for a given job.

87

Topic: Page Layout

Standard: Demonstrate the use of an electronic dictionary, spell checker, and automatic hyphenation.

88 **Topic:** Page Layout
Standard: Demonstrate a functional knowledge of computer menus and palette for the software in use.

89 **Topic:** Page Layout
Standard: Demonstrate text alignment, element positioning, and rules of page design for printed matter.

90 **Topic:** Page Layout
Standard: Set up column grids for digital page layout according to job specifications.

91 **Topic:** Page Layout
Standard: Proofread manuscript copy and make necessary corrections using basic proofreading marks.

92 **Topic:** Page Layout
Standard: Setup and select appropriate pagination for a given job.

93 **Topic:** Page Layout
Standard: Set text with appropriate margins, formatting, gutters, and proper leading.

94 **Topic:** Page Layout
Standard: Import copy from word processing program to page layout program according to job specifications.

96 **Topic:** Page Layout
Standard: Proofread, edit, and make corrections/adjustments to copy on screen.

97 **Topic:** Page Layout
Standard: Place graphics from an existing file into a publication.

98 **Topic:** Page Layout
Standard: Demonstrate the procedure for cropping digital images.

99 **Topic:** Basic Press Operation
Standard: Identify basic offset press parts and operations.

100 **Topic:** Basic Press Operation
Standard: List the advantages and disadvantages of digital printing vs. offset printing.

101 **Topic:** Basic Press Operation
Standard: Describe the use and applications for digital printing in the printing industry.

102 **Topic:** Basic Press Operation
Standard: Describe the main technologies and equipment used in digital printing.

103 **Topic:** Basic Press Operation
Standard: Describe the importance of Commercial Artist understanding production limitations of offset and digital printers, in the design of successful artwork.

104 **Topic:** Basic Press Operation
Standard: Identify the different applications of web and sheet feed printing.

105 **Topic:** Basic Math for Graphic Communications
Standard: Solve addition of whole number problems two and three digits.

106 **Topic:** Basic Math for Graphic Communications
Standard: Solve addition of fraction problems.

107 **Topic:** Basic Math for Graphic Communications
Standard: Solve addition of decimal problems two and three digits.

108 **Topic:** Basic Math for Graphic Communications
Standard: Solve subtraction of whole number problems two and three digits.

109
Topic: Basic Math for Graphic Communications
Standard: Solve subtraction of fraction problems.

110
Topic: Basic Math for Graphic Communications
Standard: Solve subtraction of decimal problems two and three digits.

111
Topic: Basic Math for Graphic Communications
Standard: Solve multiplication of whole numbers two and three digits.

112
Topic: Basic Math for Graphic Communications
Standard: Solve multiplication of decimal problems two and three digits.

113
Topic: Basic Math for Graphic Communications
Standard: Solve division of whole number problems two and three digits.

114
Topic: Basic Math for Graphic Communications
Standard: Solve division of decimals problems two and three digits.

115
Topic: Basic Math for Graphic Communications
Standard: Solve decimals to percent conversion problems

116
Topic: Basic Math for Graphic Communications
Standard: Solve percent to decimal conversion problems.

117
Topic: Basic Math for Graphic Communications
Standard: Solve basic ratio and proportion problems.

118
Topic: Basic Math for Graphic Communications
Standard: Solve basic linear measurement problems.

119
Topic: Basic Math for Graphic Communications
Standard: Solve basic type calculation problems.

120
Topic: Basic Math for Graphic Communications
Standard: Solve basic liquid measure problems.

121
Topic: Basic Math for Graphic Communications
Standard: Solve basic paper cutting calculations.

122
Topic: Basic Math for Graphic Communications
Standard: Solve inches to points conversion problems.

123
Topic: Basic Math for Graphic Communications
Standard: Solve points to inches conversion problems.

124
Topic: Basic Math for Graphic Communications
Standard: Solve cost calculating problems.

125
Topic: Basic Math for Graphic Communications
Standard: Solve inches to decimal conversion problems.

126
Topic: Measurement in Graphic Communications
Standard: Measure linear dimensions for printing materials in inches & fractions of inches.

127
Topic: Measurement in Graphic Communications
Standard: Measure type and leading in points.

128
Topic: Measurement in Graphic Communications
Standard: Measure volume for mixing chemicals for pressroom operations.

129 **Topic:** Measurement in Graphic Communications

Standard: Measure copy for reduction and enlargement using various methods to determine percentage setting.

Course: DRAFT - Precision Machining Core Skills

1 **Topic:** Basic Skills

Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills

Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills

Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills

Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills

Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills

Standard: Identify problems, alternative solutions, and consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15 **Topic:** Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16 **Topic:** Interpersonal Skills

Standard: Share knowledge and skills with others.

17

Topic: Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18

Topic: Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19

Topic: Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20

Topic: Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21

Topic: Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22

Topic: Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23

Topic: Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24

Topic: Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25

Topic: Technology

Standard: Utilize a variety of technologies.

26

Topic: Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27

Topic: Business Aspects

Standard: Identify forms of business ownership.

28

Topic: Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29

Topic: Business Aspects

Standard: Demonstrate understanding of the individual's role, responsibilities, and relationships in the organizational structure of a business.

30

Topic: Business Aspects

Standard: Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

31

Topic: Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32

Topic: Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33

Topic: Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34

Topic: Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

35 **Topic:** Safety

Standard: List general safety rules for the machining laboratory.

36 **Topic:** Safety

Standard: List the specific safety rules applicable to the CNC Turning Center.

37 **Topic:** Safety

Standard: Identify the location of the following: fire extinguisher(s), eye wash station, first aid kit, emergency electrical shutoff(s).

38 **Topic:** Safety

Standard: Describe the types of fires possible in a machining environment and identify the appropriate fire extinguisher for each type of fire.

39 **Topic:** Safety

Standard: Demonstrate the use of a fire extinguisher.

40 **Topic:** Safety

Standard: Demonstrate basic first aid to stop bleeding and prevent shock.

41 **Topic:** Safety

Standard: Describe the procedure for obtaining outside emergency medical response.

42 **Topic:** Safety

Standard: Demonstrate emergency shutoff procedures.

43 **Topic:** Safety

Standard: Demonstrate shop evacuation procedures.

44 **Topic:** Safety

Standard: Identify location of Material Safety and Data Sheets (MSDS).

45 **Topic:** Safety

Standard: Execute an emergency stop of a CNC lathe.

46 **Topic:** Intermediate Computer Numerical Control (CNC)

Standard: Calculate coordinates and dimensions on a CNC machine.

47 **Topic:** Intermediate Computer Numerical Control (CNC)

Standard: Write a basic CNC lathe program for turning, facing, and corner radii.

48 **Topic:** Intermediate Computer Numerical Control (CNC)

Standard: Edit a CNC program.

49 **Topic:** Intermediate Computer Numerical Control (CNC)

Standard: Describe how computer aided manufacturing (CAM) programs can facilitate CNC production.

50 **Topic:** Career Planning

Standard: Prepare a list of companies that hire CNC machinists.

51 **Topic:** Career Planning

Standard: Write a resume.

52 **Topic:** Career Planning

Standard: Conduct mock job interviews.

53 **Topic:** Career Planning

Standard: Prepare a tentative career path for the next ten years.

Course: DRAFT - Precision Machining: 48.59100 Benchwork and Drillpress

35 **Topic:** Safety

Standard: List general safety rules for the machining laboratory.

36 **Topic:** Safety

Standard: List the specific safety rules applicable to the drill press, pedestal grinder, and band saw.

37 **Topic:** Safety

Standard: Identify the location of the following: fire extinguisher(s), eye wash station, first aid kit, emergency electrical shutoff(s).

38 **Topic:** Safety

Standard: Describe the types of fires possible in a machining environment and identify the appropriate fire extinguisher for each type of fire.

39 **Topic:** Safety

Standard: Demonstrate the use of a fire extinguisher.

40 **Topic:** Safety

Standard: Demonstrate basic first aid to stop bleeding and prevent shock.

41 **Topic:** Safety

Standard: Describe the procedure for obtaining outside emergency medical response.

42 **Topic:** Safety

Standard: Demonstrate emergency shutoff procedures.

43 **Topic:** Safety

Standard: Demonstrate shop evacuation procedures.

44 **Topic:** Safety

Standard: Identify location of Material Safety and Data Sheets (MSDS).

45 **Topic:** BluePrint Reading

Standard: Demonstrate proper sketching techniques.

46 **Topic:** BluePrint Reading

Standard: Sketch the top, front, and side views of simple machined parts.

47 **Topic:** BluePrint Reading

Standard: Sketch the three-dimensional isometric view of simple machined parts.

48 **Topic:** BluePrint Reading

Standard: Differentiate between isometric and oblique drawings.

49 **Topic:** BluePrint Reading

Standard: Illustrate proper dimensioning.

50 **Topic:** Job Planning and Management

Standard: From a blueprint develop a process plan for a part requiring drilling.

51 **Topic:** Job Planning and Management
Standard: Fill out an operations sheet listing the sequence of operations.

52 **Topic:** Job Planning and Management
Standard: Complete a materials list and identify required hand tools, fixtures, and cutting fluids.

53 **Topic:** Heat Treatment
Standard: Describe the types of heat treatment.

54 **Topic:** Heat Treatment
Standard: Describe the types of hardness testing.

55 **Topic:** Heat Treatment
Standard: Demonstrate stress relief using a peening process.

56 **Topic:** Heat Treatment
Standard: Demonstrate the proper operation of a heat treatment furnace.

57 **Topic:** Layout and Benchwork
Standard: Demonstrate proper use of a precision surface plate and height gauge with scribe.

58 **Topic:** Layout and Benchwork
Standard: Conduct layout operations using layout ink, scriber, radius gauges, and templates.

59 **Topic:** Layout and Benchwork
Standard: Perform drilling, cutting, and filling operations using appropriate hand tools.

60 **Topic:** Layout and Benchwork
Standard: Check tolerances with a six inch caliper.

61 **Topic:** Layout and Benchwork
Standard: Complete NIMS Layout Level I project.

62 **Topic:** Layout and Benchwork
Standard: Complete NIMS Benchwork Level I project.

63 **Topic:** Drill Press Operations
Standard: Layout and center punch hole locations.

64 **Topic:** Drill Press Operations
Standard: Perform drilling operations.

65 **Topic:** Drill Press Operations
Standard: Perform reaming operations.

66 **Topic:** Drill Press Operations
Standard: Perform countersinking.

67 **Topic:** Drill Press Operations
Standard: Perform counterboring.

68 **Topic:** Drill Press Operations
Standard: Perform counterdrilling.

69 **Topic:** Drill Press Operations
Standard: Perform spot face operations.

70 **Topic:** Drill Press Operations
Standard: Complete NIMS Drill Press Level I project.

71 **Topic:** Quality Control
Standard: Develop an inspection plan.

72 **Topic:** Quality Control
Standard: Select required measuring instruments.

73 **Topic:** Quality Control
Standard: Inspect a simple part.

74 **Topic:** Quality Control
Standard: Complete a written inspection report to include a decision to accept or reject the part.

75 **Topic:** Quality Control
Standard: Describe inspection procedures, results, and decisions.

76 **Topic:** Machinery Maintenance
Standard: Inspect and change drive pulleys and belts.

77 **Topic:** Machinery Maintenance
Standard: Perform incidental and preventative maintenance on a drill press, a bench grinder, and a band saw.

78 **Topic:** Machinery Maintenance
Standard: Report problems that are beyond the scope of authority.

79 **Topic:** Machinery Maintenance
Standard: Fill out the history form for tracking maintenance.

Course: DRAFT - Precision Machining: 48.59200 Basic Machine Tool Operation

35 **Topic:** Safety
Standard: List general safety rules for the machining laboratory.

36 **Topic:** Safety
Standard: List the specific safety rules applicable to the lathe and milling machine.

37 **Topic:** Safety
Standard: Identify the location of the following: fire extinguisher(s), eye wash station, first aid kit, emergency electrical shutoff(s).

38 **Topic:** Safety
Standard: Describe the types of fires possible in a machining environment and identify the appropriate fire extinguisher for each type of fire.

39 **Topic:** Safety
Standard: Demonstrate the use of a fire extinguisher.

40 **Topic:** Safety
Standard: Demonstrate basic first aid to stop bleeding and prevent shock.

41 **Topic:** Safety
Standard: Describe the procedure for obtaining outside emergency medical response.

42 **Topic:** Safety
Standard: Demonstrate emergency shutoff procedures.

43 **Topic:** Safety
Standard: Demonstrate shop evacuation procedures.

44
Topic: Safety
Standard: Identify location of Material Safety and Data Sheets (MSDS).

45
Topic: BluePrint Reading
Standard: Define and illustrate angular, fractional, and decimal tolerances.

46
Topic: BluePrint Reading
Standard: Define and illustrate bilateral tolerances, unilateral tolerances, and limit dimensioning.

47
Topic: Job Planning and Management
Standard: Develop a process plan and sequence of operations for a part requiring turning.

48
Topic: Job Planning and Management
Standard: Develop a process plan and a sequence of operations for a part requiring milling.

49
Topic: Job Planning and Management
Standard: Complete a materials list and identify required tools, fixtures, and cutting fluids for a machining operation.

50
Topic: Basic Lathe
Standard: Identify the parts of an engine lathe.

51
Topic: Basic Lathe
Standard: Check oil reservoirs and cutting fluid levels.

52
Topic: Basic Lathe
Standard: Calculate feeds and speeds for various materials and material diameters.

53
Topic: Basic Lathe
Standard: Set up a lathe for various feeds and speeds.

54
Topic: Basic Lathe
Standard: Grind lathe cutting tools with a pedestal grinder.

55
Topic: Basic Lathe
Standard: Demonstrate set-up and alignment of the tool post.

56
Topic: Basic Lathe
Standard: Demonstrate set-up of the quick change tool holder.

57
Topic: Basic Lathe
Standard: Demonstrate set-up of the three jaw chuck.

58
Topic: Basic Lathe
Standard: Perform facing operations.

59
Topic: Basic Lathe
Standard: Center drill work piece for turning between centers.

60
Topic: Basic Lathe
Standard: Perform cutting operations to specified tolerances with and without the use of digital readout (DRO).

61
Topic: Basic Lathe
Standard: Perform lathe filing to deburr parts.

62
Topic: Basic Mill
Standard: Identify the parts of a vertical milling machine.

63
Topic: Basic Mill
Standard: Check cutting fluid level.

64 **Topic:** Basic Mill
Standard: Indicate head for X and Y axis alignment.

65 **Topic:** Basic Mill
Standard: Calculate feeds and speeds for various materials.

66 **Topic:** Basic Mill
Standard: Set up milling machine for various feeds and speeds.

67 **Topic:** Basic Mill
Standard: Align milling machine fixtures and attachments.

68 **Topic:** Basic Mill
Standard: Identify milling cutters used in vertical milling.

69 **Topic:** Basic Mill
Standard: Demonstrate drilling operations.

70 **Topic:** Basic Mill
Standard: Demonstrate reaming operations.

71 **Topic:** Basic Mill
Standard: Demonstrate boring operations.

72 **Topic:** Basic Mill
Standard: Demonstrate end milling operations.

73 **Topic:** Basic Mill
Standard: Demonstrate face milling operations.

74 **Topic:** Basic Mill
Standard: Demonstrate fly cutting operations (optional).

75 **Topic:** Basic Mill
Standard: Square a work piece to specified tolerances with and without the use of digital readout (DRO).

76 **Topic:** Quality Control
Standard: Develop an inspection plan.

77 **Topic:** Quality Control
Standard: Select required measuring instruments.

78 **Topic:** Quality Control
Standard: Inspect a part produced on a lathe.

79 **Topic:** Quality Control
Standard: Inspect a part produced on a milling machine.

80 **Topic:** Quality Control
Standard: Complete a written inspection report to include a decision to accept or reject the part.

81 **Topic:** Quality Control
Standard: Describe inspection procedures, results, and decisions.

82 **Topic:** Machinery Maintenance
Standard: Perform incidental and preventative maintenance on a lathe and a milling machine.

83 **Topic:** Machinery Maintenance
Standard: Report problems that are beyond the scope of authority.

84

Topic: Machinery Maintenance

Standard: Fill out the history form for tracking maintenance.

Course: DRAFT - Precision Machining: 48.59300 Intermediate Machine Tool Operations

35

Topic: Safety

Standard: List general safety rules for the machining laboratory.

36

Topic: Safety

Standard: List the specific safety rules applicable to the lathe and milling machine.

37

Topic: Safety

Standard: Identify the location of the following: fire extinguisher(s), eye wash station, first aid kit, emergency electrical shutoff(s).

38

Topic: Safety

Standard: Describe the types of fires possible in a machining environment and identify the appropriate fire extinguisher for each type of fire.

39

Topic: Safety

Standard: Demonstrate the use of a fire extinguisher.

40

Topic: Safety

Standard: Demonstrate basic first aid to stop bleeding and prevent shock.

41

Topic: Safety

Standard: Describe the procedure for obtaining outside emergency medical response.

42

Topic: Safety

Standard: Demonstrate emergency shutoff procedures.

43

Topic: Safety

Standard: Demonstrate shop evacuation procedures.

44

Topic: Safety

Standard: Identify location of Material Safety and Data Sheets (MSDS).

45

Topic: BluePrint Reading

Standard: Sketch sectional views of simple and complex machined parts.

46

Topic: BluePrint Reading

Standard: Sketch a half sectional view of a complex machined part.

47

Topic: Job Planning and Management

Standard: Develop a process plan and sequence of operations for a part requiring turning.

48

Topic: Job Planning and Management

Standard: Develop a process plan and a sequence of operations for a part requiring milling.

49

Topic: Job Planning and Management

Standard: Develop a process plan and a sequence of operations for a part requiring surface grinding.

50

Topic: Job Planning and Management

Standard: Complete a materials list and identify required tools, fixtures, and cutting fluids for a machining operation.

51

Topic: Intermediate Lathe

Standard: Check oil reservoirs and cutting fluid levels.

52 **Topic:** Intermediate Lathe
Standard: Calculate feeds and speeds for various materials and material diameters.

53 **Topic:** Intermediate Lathe
Standard: Set up lathe for various feeds and speeds.

54 **Topic:** Intermediate Lathe
Standard: Knurl parts.

55 **Topic:** Intermediate Lathe
Standard: Demonstrate setup of a draw-in collet chuck.

56 **Topic:** Intermediate Lathe
Standard: Cut taper using taper attachment.

57 **Topic:** Intermediate Lathe
Standard: Cut taper using compound rest.

58 **Topic:** Intermediate Lathe
Standard: Demonstrate parting operations (optional).

59 **Topic:** Intermediate Lathe
Standard: Cut external UNF, UNC, and metric right hand and left hand threads to a specified class of fit.

60 **Topic:** Intermediate Lathe
Standard: Deburr threads with a thread file.

61 **Topic:** Intermediate Lathe
Standard: Rechase external threads.

62 **Topic:** Intermediate Lathe
Standard: Perform boring operations.

63 **Topic:** Intermediate Lathe
Standard: Perform counterboring operations.

64 **Topic:** Intermediate Lathe
Standard: Perform countersinking operations.

65 **Topic:** Intermediate Lathe
Standard: Cut internal tapered surfaces.

66 **Topic:** Intermediate Lathe
Standard: Cut internal UNF, UNC, and metric right and left hand threads to a specified class of fit.

67 **Topic:** Intermediate Lathe
Standard: Rechase internal threads.

68 **Topic:** Intermediate Lathe
Standard: Complete NIMS Turning Between Centers Level I project.

69 **Topic:** Intermediate Lathe
Standard: Complete NIMS Turning-Chucking Level I project.

70 **Topic:** Intermediate Milling Machine
Standard: Check cutting fluid level.

71 **Topic:** Intermediate Milling Machine
Standard: Calculate feeds and speeds for various materials.

72 **Topic:** Intermediate Milling Machine
Standard: Set up milling machine for various feeds and speeds.

73 **Topic:** Intermediate Milling Machine
Standard: Align milling machine fixtures and attachments.

74 **Topic:** Intermediate Milling Machine
Standard: Locate work with center finder, edge finders, and indicators.

75 **Topic:** Intermediate Milling Machine
Standard: Demonstrate proper use of a T-slot cutter.

76 **Topic:** Intermediate Milling Machine
Standard: Demonstrate proper use of a Woodruff keyseat cutter.

77 **Topic:** Intermediate Milling Machine
Standard: Mill a keyway.

78 **Topic:** Intermediate Milling Machine
Standard: Mill a chamfer.

79 **Topic:** Intermediate Milling Machine
Standard: Complete NIMS Milling Level I project.

80 **Topic:** Quality Control
Standard: Develop an inspection plan.

81 **Topic:** Quality Control
Standard: Select required measuring instruments.

82 **Topic:** Quality Control
Standard: Inspect a part produced on a lathe.

83 **Topic:** Quality Control
Standard: Inspect a part produced on a milling machine.

84 **Topic:** Quality Control
Standard: Inspect a part produced on a surface grinder.

85 **Topic:** Quality Control
Standard: Complete a written inspection report to include a decision to accept or reject the parts.

86 **Topic:** Machinery Maintenance
Standard: Perform incidental and preventative maintenance on a lathe and a milling machine.

87 **Topic:** Machinery Maintenance
Standard: Report problems that are beyond the scope of authority.

88 **Topic:** Machinery Maintenance
Standard: Fill out the history form for tracking maintenance.

Course: DRAFT - Precision Machining: 48.59400 Advanced Machine Tool Operations

35 **Topic:** Safety
Standard: List general safety rules for the machining laboratory.

36 **Topic:** Safety
Standard: List the specific safety rules applicable to the lathe, milling machine, and surface grinder.

37

Topic: Safety

Standard: Identify the location of the following: fire extinguisher(s), eye wash station, first aid kit, emergency electrical shutoff(s).

38

Topic: Safety

Standard: Describe the types of fires possible in a machining environment and identify the appropriate fire extinguisher for each type of fire.

39

Topic: Safety

Standard: Demonstrate the use of a fire extinguisher.

40

Topic: Safety

Standard: Demonstrate basic first aid to stop bleeding and prevent shock.

41

Topic: Safety

Standard: Describe the procedure for obtaining outside emergency medical response.

42

Topic: Safety

Standard: Demonstrate emergency shutoff procedures.

43

Topic: Safety

Standard: Demonstrate shop evacuation procedures.

44

Topic: Safety

Standard: Identify location of Material Safety and Data Sheets (MSDS).

45

Topic: Blueprint Reading

Standard: Explain how auxiliary views can help clarify a drawing.

46

Topic: Blueprint Reading

Standard: Sketch a complex machined part showing auxiliary views.

47

Topic: Blueprint Reading

Standard: Identify and correctly interpret surface finish designations on a print.

48

Topic: Job Planning and Management

Standard: Develop a process plan and sequence of operations for a part requiring turning.

49

Topic: Job Planning and Management

Standard: Develop a process plan and a sequence of operations for a part requiring milling.

50

Topic: Job Planning and Management

Standard: Develop a process plan and a sequence of operations for a part requiring surface grinding.

51

Topic: Job Planning and Management

Standard: Complete a materials list and identify required tools, fixtures, and cutting fluids for a machining operation.

52

Topic: Advanced Lathe

Standard: Demonstrate centering work in a four jaw chuck using a dial indicator.

53

Topic: Advanced Lathe

Standard: Demonstrate offset turning with a four jaw chuck.

54

Topic: Advanced Lathe

Standard: Demonstrate steady rest turning and boring.

55

Topic: Advanced Lathe

Standard: Demonstrate follower rest turning.

56

Topic: Advanced Lathe

Standard: Cut internal and external acme threads.

57

Topic: Advanced Lathe

Standard: Cut internal and external square threads.

58

Topic: Advanced Lathe

Standard: Cut internal and external double acme threads.

59

Topic: Advanced Milling Machine

Standard: Demonstrate index milling.

60

Topic: Advanced Milling Machine

Standard: Identify the parts of a horizontal milling machine or a vertical milling machine equipped with a horizontal shaft fixture.

61

Topic: Advanced Milling Machine

Standard: Check cutting fluid level.

62

Topic: Advanced Milling Machine

Standard: Calculate feeds and speeds for various materials.

63

Topic: Advanced Milling Machine

Standard: Set up a milling machine for various feeds and speeds for horizontal milling.

64

Topic: Advanced Milling Machine

Standard: Align milling machine fixtures and attachments.

65

Topic: Advanced Milling Machine

Standard: Identify milling cutters used in horizontal milling.

66

Topic: Surface Grinder

Standard: Identify the parts of a surface grinder.

67

Topic: Surface Grinder

Standard: Inspect and clean a surface grinder.

68

Topic: Surface Grinder

Standard: Visually inspect a grinding wheel.

69

Topic: Surface Grinder

Standard: Conduct a ring test on a grinding wheel.

70

Topic: Surface Grinder

Standard: True, dress, and mount a grinding wheel.

71

Topic: Surface Grinder

Standard: Demonstrate proper use of a magnetic chuck.

72

Topic: Surface Grinder

Standard: Choose the proper wheel for the material to be ground.

73

Topic: Surface Grinder

Standard: Grind flat surfaces and square surfaces using manual feed.

74

Topic: Surface Grinder

Standard: Grind angles and chamfers using manual feed.

75

Topic: Surface Grinder

Standard: Grind slots using manual feed.

76

Topic: Surface Grinder

Standard: Demonstrate proper setup of the sine bar.

77 **Topic:** Surface Grinder

Standard: Demonstrate proper use of a precision angle plate.

78 **Topic:** Surface Grinder

Standard: Complete NIMS Surface Grinder Level I project.

79 **Topic:** Quality Control

Standard: Visit the quality control department of a manufacturing industry and identify steps in the quality control procedure.

80 **Topic:** Career Planning

Standard: Prepare a list of companies that hire machinists.

81 **Topic:** Career Planning

Standard: Write a resume.

82 **Topic:** Career Planning

Standard: Conduct mock job interviews.

83 **Topic:** Career Planning

Standard: Prepare a tentative career path for the next ten years.

Course: DRAFT - Precision Machining: 48.59500 Basic CNC Operations

35 **Topic:** Safety

Standard: List general safety rules for the machining laboratory.

36 **Topic:** Safety

Standard: List the specific safety rules applicable to the CNC Machining Center.

37 **Topic:** Safety

Standard: Identify the location of the following: fire extinguisher(s), eye wash station, first aid kit, emergency electrical shutoff(s).

38 **Topic:** Safety

Standard: Describe the types of fires possible in a machining environment and identify the appropriate fire extinguisher for each type of fire.

39 **Topic:** Safety

Standard: Demonstrate the use of a fire extinguisher.

40 **Topic:** Safety

Standard: Demonstrate basic first aid to stop bleeding and prevent shock.

41 **Topic:** Safety

Standard: Describe the procedure for obtaining outside emergency medical response.

42 **Topic:** Safety

Standard: Demonstrate emergency shutoff procedures.

43 **Topic:** Safety

Standard: Demonstrate shop evacuation procedures.

44 **Topic:** Safety

Standard: Identify location of Material Safety and Data Sheets (MSDS).

45 **Topic:** Safety

Standard: Execute an emergency stop of a CNC milling machine.

46 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Identify the parts of a CNC machine.

47 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Check cutting fluid level.

48 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Set up a CNC machine.

49 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Identify and define G and M codes.

50 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Identify and define speed and feed codes.

51 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Identify and define cutter positioning codes.

52 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Demonstrate offsets.

53 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Calculate coordinates and dimensions on a CNC machine.

54 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Write a basic CNC milling machine program for straight and circular moves.

55 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Edit a CNC program.

56 **Topic:** Basic Computer Numerical Control (CNC)
Standard: Identify attributes of a successful CNC machinist.

Course: Electronics: Core Skills

1 **Topic:** Basic Skills
Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills
Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills
Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills
Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills
Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills
Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills
Standard: Identify problems, alternative solutions, and consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15 **Topic:** Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16 **Topic:** Interpersonal Skills

Standard: Share knowledge and skills with others.

17 **Topic:** Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18 **Topic:** Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19 **Topic:** Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20 **Topic:** Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21 **Topic:** Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22 **Topic:** Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23 **Topic:** Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24 **Topic:** Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25 **Topic:** Technology

Standard: Utilize a variety of technologies.

26 **Topic:** Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27 **Topic:** Business Aspects

Standard: Identify forms of business ownership.

28 **Topic:** Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29 **Topic:** Business Aspects

Standard: Demonstrate understanding of the individual's role, responsibilities, and relationships in the organizational structure of a business.

30 **Topic:** Business Aspects

Standard: Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

31 **Topic:** Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32 **Topic:** Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33 **Topic:** Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34 **Topic:** Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

Course: Electronics: 47.59100 Fundamentals of Electronics

35 **Topic:** Electronics Orientation

Standard: Identify career opportunities in the electronics profession.

36 **Topic:** Electronics Orientation

Standard: List professional associations related to the electronics profession.

37 **Topic:** Electronics Orientation

Standard: Outline the areas of specialization, work techniques, processes, and procedures required in the electronics field.

38 **Topic:** Electronics Orientation

Standard: Define terms associated with general electronics skills.

39 **Topic:** Safety Practices in the Electronics Profession

Standard: Use safety procedures established for all types of circuits, components, and equipment.

40 **Topic:** Safety Practices in the Electronics Profession

Standard: Comply with OSHA standards numbers 1910.331-335 for electrical safety work practices.

41 **Topic:** Safety Practices in the Electronics Profession

Standard: Demonstrate knowledge of the applications of safety grounding systems.

42 **Topic:** Safety Practices in the Electronics Profession

Standard: Describe simple first aid procedures.

43 **Topic:** Safety Practices in the Electronics Profession

Standard: Demonstrate the proper and safe usage of tools.

44 **Topic:** Safety Practices in the Electronics Profession

Standard: Identify usage of different types of fire extinguishers.

45 **Topic:** Basic Skill Requirements in the Electronics Profession

Standard: Utilize data books and cross reference/technical manuals to specify and requisition electronics components.

46 **Topic:** Basic Skill Requirements in the Electronics Profession

Standard: Create and interpret electronic schematics, technical drawing, flow diagrams, and block diagrams.

47 **Topic:** Basic Skill Requirements in the Electronics Profession

Standard: Use test equipment including volt-ohm meter (VOM), digital volt-ohm meter (DVM), oscilloscope, and various generators.

48 **Topic:** Basic Skill Requirements in the Electronics Profession

Standard: Show familiarity with block diagram and wiring diagram and wiring diagram component recognition and signal tracing.

49 **Topic:** Basic Skill Requirements in the Electronics Profession

Standard: Determine expected voltage or signal levels at block diagram or schematic test points.

50 **Topic:** Basic Skill Requirements in the Electronics Profession

Standard: Identify and utilize American Wire Gauge Tables.

51 **Topic:** Basic Soldering and Tools

Standard: Apply acceptable soldering/desoldering techniques in basic laboratory practices.

52 **Topic:** Basic Soldering and Tools

Standard: Make electrical connections involving soldering and assembly of multiconductor cable and coaxial cable connectors.

53 **Topic:** Basic Soldering and Tools

Standard: Identify electrical components and values using established symbols and colors codes.

54 **Topic:** Basic Soldering and Tools

Standard: Solder and desolder components on a PC board.

55 **Topic:** Basic Soldering and Tools

Standard: Demonstrate electrostatic discharge (ESD) safety procedures.

56 **Topic:** Basic Soldering and Tools

Standard: Identify and use hand tools properly.

57 **Topic:** Basic Soldering and Tools

Standard: Identify and use power tools properly.

58 **Topic:** Direct Current (DC) Circuits

Standard: Relate electricity to the nature of matter.

59 **Topic:** Direct Current (DC) Circuits

Standard: Identify sources of electricity.

60 **Topic:** Direct Current (DC) Circuits

Standard: Define voltage, current, resistance, power, and energy.

61 **Topic:** Direct Current (DC) Circuits

Standard: Apply Ohm's law and power formulas.

62 **Topic:** Direct Current (DC) Circuits

Standard: Solve basic DC circuits.

63 **Topic:** Direct Current (DC) Circuits

Standard: Solve problems in electronic units utilizing metric prefixes.

64 **Topic:** Direct Current (DC) Circuits
Standard: Read and interpret color codes and symbols to identify electrical components and values.

65 **Topic:** Direct Current (DC) Circuits
Standard: Compute conductance and compute and measure resistance of conductors and insulators.

66 **Topic:** Direct Current (DC) Circuits
Standard: Discuss established troubleshooting steps.

67 **Topic:** Direct Current (DC) Circuits
Standard: Use Ohm's Law to determine values in series circuits.

68 **Topic:** Direct Current (DC) Circuits
Standard: Use power formulas to determine values in series circuits.

69 **Topic:** Direct Current (DC) Circuits
Standard: Construct and measure the operation of series circuits.

70 **Topic:** Direct Current (DC) Circuits
Standard: Determine if an operating series circuit is faulty.

71 **Topic:** Direct Current (DC) Circuits
Standard: Identify an open, short, and changed value resistor in an operating series circuit.

72 **Topic:** Direct Current (DC) Circuits
Standard: Use Ohm's Law to determine values in parallel circuits.

73 **Topic:** Direct Current (DC) Circuits
Standard: Use power formulas to determine values in parallel circuits.

74 **Topic:** Direct Current (DC) Circuits
Standard: Construct and measure the operation of parallel circuits.

75 **Topic:** Direct Current (DC) Circuits
Standard: Determine if an operating parallel circuit is faulty.

76 **Topic:** Direct Current (DC) Circuits
Standard: Identify an open, short, and changed value resistor in an operating parallel circuit.

77 **Topic:** Direct Current (DC) Circuits
Standard: Use Ohm's Law to determine values in series-parallel circuits.

78 **Topic:** Direct Current (DC) Circuits
Standard: Use power formulas to determine values in series-parallel circuits.

79 **Topic:** Direct Current (DC) Circuits
Standard: Construct and measure the operation of series-parallel circuits.

80 **Topic:** Direct Current (DC) Circuits
Standard: Determine if an operating series-parallel circuit is faulty.

81 **Topic:** Direct Current (DC) Circuits
Standard: Identify an open, short, and changed value resistor in an operating series-parallel circuit.

Course: Electronics: 47.59200 Alternating Current Circuits and Basic Computer Usage

35 **Topic:** Basic Computer Usage
Standard: Demonstrate the use of microcomputer operating systems.

36

Topic: Basic Computer Usage

Standard: Demonstrate the use of high-level computer language.

37

Topic: Basic Computer Usage

Standard: Demonstrate the use of microcomputer application programs (i.e., word processing, database and spread sheet).

38

Topic: Alternating Current (AC) Circuits

Standard: Solve basic trigonometric problems applicable to electronics.

39

Topic: Alternating Current (AC) Circuits

Standard: Describe basic magnetism.

40

Topic: Alternating Current (AC) Circuits

Standard: Define basic generator theory and operation.

41

Topic: Alternating Current (AC) Circuits

Standard: Identify the characteristics of sinusoidal waves.

42

Topic: Alternating Current (AC) Circuits

Standard: Describe magnetic properties of circuits and devices.

43

Topic: Alternating Current (AC) Circuits

Standard: Determine the physical and electrical characteristics of capacitors and inductors.

44

Topic: Alternating Current (AC) Circuits

Standard: Define the characteristics of AC capacitive circuits.

45

Topic: Alternating Current (AC) Circuits

Standard: Construct and measure the operation of AC capacitive circuits.

46

Topic: Alternating Current (AC) Circuits

Standard: Define the characteristics of AC inductive circuits.

47

Topic: Alternating Current (AC) Circuits

Standard: Construct and measure the operation of AC inductive circuits.

48

Topic: Alternating Current (AC) Circuits

Standard: Define and apply the principles of transformers to AC circuits.

49

Topic: Alternating Current (AC) Circuits

Standard: Construct and measure the operation of AC circuits utilizing transformers.

50

Topic: Alternating Current (AC) Circuits

Standard: State the principle of impedance matching.

51

Topic: Alternating Current (AC) Circuits

Standard: Determine resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.

52

Topic: Alternating Current (AC) Circuits

Standard: Construct and measure the operation of differentiators and integrators to determine R-C and R-L time constraints.

53

Topic: Alternating Current (AC) Circuits

Standard: State the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel, and complex.)

54

Topic: Alternating Current (AC) Circuits

Standard: Construct and measure the operation of series and parallel resonant circuits.

35 **Topic:** Discrete Solid State Circuits
Standard: Identify and define properties of semiconductor material.

36 **Topic:** Discrete Solid State Circuits
Standard: Identify and define operating characteristics and applications of junction diodes.

37 **Topic:** Discrete Solid State Circuits
Standard: Identify and define operating characteristics and applications of special diodes.

38 **Topic:** Discrete Solid State Circuits
Standard: Construct and measure diode circuits.

39 **Topic:** Discrete Solid State Circuits
Standard: Identify the different classes of transistors amplifiers.

40 **Topic:** Discrete Solid State Circuits
Standard: Identify and define operating characteristics and applications of bipolar transistors.

41 **Topic:** Discrete Solid State Circuits
Standard: Identify and define operating characteristics and applications of field effect transistors to include MOSFET.

42 **Topic:** Discrete Solid State Circuits
Standard: Identify and define operating characteristics and applications of bipolar single stage amplifiers.

43 **Topic:** Discrete Solid State Circuits
Standard: Identify and define operating characteristics and applications of timing circuits.

44 **Topic:** Discrete Solid State Circuits
Standard: Identify and define operating characteristics and applications of IC operational amplifiers.

45 **Topic:** Discrete Solid State Circuits
Standard: Construct and measure single-stage amplifiers.

46 **Topic:** Discrete Solid State Circuits
Standard: Construct and measure thyristor circuitry.

47 **Topic:** Discrete Solid State Circuits
Standard: Set up and operate power supplies for solid-state devices.

48 **Topic:** Discrete Solid State Circuits
Standard: Set up and operate transistor testers.

49 **Topic:** Analog Circuits
Standard: Identify and define operational characteristics and applications of multistage amplifiers.

50 **Topic:** Analog Circuits
Standard: Construct and measure multistage amplifiers.

51 **Topic:** Analog Circuits
Standard: Identify and define operating characteristics and applications of linear integrated circuits.

52 **Topic:** Analog Circuits
Standard: Identify and define operating characteristics and applications of basic power supplies and filters.

53 **Topic:** Analog Circuits
Standard: Construct basic power supplies and filters.

54 **Topic:** Analog Circuits
Standard: Identify and define operating characteristics and applications of differential and operational amplifiers.

55 **Topic:** Analog Circuits
Standard: Construct and measure differential and operational amplifier circuits.

56 **Topic:** Analog Circuits
Standard: Identify and define operational characteristics and applications of audio amplifiers.

57 **Topic:** Analog Circuits
Standard: Construct and measure audio power amplifiers.

Course: Electronics: 47.59400 Digital Circuits

35 **Topic:** Introduction to Digital Electronics
Standard: Identify developments of digital electronics.

36 **Topic:** Introduction to Digital Electronics
Standard: Describe growth of computing equipment.

37 **Topic:** Introduction to Digital Electronics
Standard: Identify uses of digital electronics.

38 **Topic:** Introduction to Digital Electronics
Standard: Explain the differences between decimal, binary, octal, and hexadecimal numbering system.

39 **Topic:** Introduction to Digital Electronics
Standard: Define and apply numbering systems to codes and arithmetic operations.

40 **Topic:** Introduction to Digital Electronics
Standard: Analyze and minimize logic circuits using Boolean operations.

41 **Topic:** Introduction to Digital Electronics
Standard: Identify types of logic gates and their truth tables.

42 **Topic:** Digital Test Equipment
Standard: Set up and operate logic probes for digital circuits.

43 **Topic:** Digital Test Equipment
Standard: Set up and operate power supplies for digital circuits and solve power distribution and noise problems.

44 **Topic:** Digital Test Equipment
Standard: Set up and operate pulsers for digital circuits.

45 **Topic:** Digital Test Equipment
Standard: Set up and operate oscilloscopes for digital circuits.

46 **Topic:** Digital Test Equipment
Standard: Set up and operate logic analyzers for digital circuits.

47 **Topic:** Digital Test Equipment
Standard: Set up and operate pulse generators for digital circuits.

48 **Topic:** Digital Circuits
Standard: Identify, define, and measure characteristics of integrated circuits (IC) logic families.

49 **Topic:** Digital Circuits
Standard: Construct, measure, and troubleshoot combinational logic circuits using integrated circuits.

50 **Topic:** Digital Circuits
Standard: Analyze types of flip-flops and their truth tables.

51 **Topic:** Digital Circuits
Standard: Construct and troubleshoot flip-flops using integrated circuits.

52 **Topic:** Digital Circuits
Standard: Identify types of registers and counters.

53 **Topic:** Digital Circuits
Standard: Construct and troubleshoot registers and counters using flip-flops and logic gates.

54 **Topic:** Digital Circuits
Standard: Analyze clock and timer circuits.

55 **Topic:** Digital Circuits
Standard: Construct and troubleshoot clock and timer circuits.

56 **Topic:** Digital Circuits
Standard: Identify types of arithmetic-logic circuits.

57 **Topic:** Digital Circuits
Standard: Construct and troubleshoot arithmetic-logic circuits.

Course: Electronics: 47.59500 Advanced Direct Current & Alternating Current Circuits

35 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Solve algebraic problems to include exponentials to DC.

36 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Troubleshoot the operation of series circuits.

37 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Troubleshoot the operation of parallel circuits.

38 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Troubleshoot the operation of series-parallel and bridge circuits.

39 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Identify and define voltage divider circuits (loaded and unloaded).

40 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Construct, measure, and troubleshoot the operation of voltage divider circuits (loaded and unloaded).

41 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Apply maximum power transfer theorem.

42 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Construct and measure the operation of DC circuits that demonstrate the maximum power transfer theory.

43 **Topic:** Advanced Direct Current (DC) Circuits
Standard: Set up and operate power supplies for DC circuits.

44 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: Troubleshoot the operation of AC capacitive circuits.

45 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: Troubleshoot the operation of AC inductive circuits.

46 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: Troubleshoot the operation of AC circuits utilizing transformers.

47 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: Troubleshoot the operations of differentiators and integrators to determine R-C and R-L time constraints.

48 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: Troubleshoot the operation of series and parallel resonant circuits.

49 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: State the characteristics of filter circuits.

50 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: Set up and operate power supplies for AC circuits.

51 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: Analyze and measure power in AC circuits.

52 **Topic:** Advanced Alternating Current (AC) Circuits
Standard: Set up and operate capacitor and inductor analyzers for AC circuits.

53 **Topic:** AC and DC Motors
Standard: Explain the difference between generators and alternators.

54 **Topic:** AC and DC Motors
Standard: Analyze the operation and function of DC motors and controls.

55 **Topic:** AC and DC Motors
Standard: State the characteristics of a three-phase circuit.

56 **Topic:** AC and DC Motors
Standard: Explain the difference between three-phase and single-phase AC motors.

Course: Electronics: 47.59600 Advanced Analog & Digital Circuits

35 **Topic:** Advanced Analog Circuits
Standard: Troubleshoot diode circuits.

36 **Topic:** Advanced Analog Circuits
Standard: Troubleshoot single-stage amplifiers.

37 **Topic:** Advanced Analog Circuits
Standard: Troubleshoot thyristor circuitry.

38 **Topic:** Advanced Analog Circuits
Standard: Troubleshoot multistage amplifiers.

39 **Topic:** Advanced Analog Circuits
Standard: Troubleshoot differential and operational amplifiers.

40 **Topic:** Advanced Analog Circuits
Standard: Troubleshoot audio power amplifiers.

41 **Topic:** Advanced Analog Circuits
Standard: Construct, measure, and troubleshoot power supply regulator circuits.

42 **Topic:** Advanced Analog Circuits
Standard: Identify and state the operational characteristics and applications of active filters.

43 **Topic:** Advanced Analog Circuits
Standard: Construct, measure, and troubleshoot active filter circuits.

44 **Topic:** Advanced Analog Circuits
Standard: Identify and state the operational characteristics and applications of sinusoidal and non-sinusoidal oscillator circuits.

45 **Topic:** Advanced Analog Circuits
Standard: Construct, measure, and troubleshoot oscillator circuits.

46 **Topic:** Advanced Analog Circuits
Standard: Identify and state the operational characteristics and applications of cathode ray tubes.

47 **Topic:** Advanced Analog Circuits
Standard: Identify and state the operational characteristics and applications of optic-electronic devices.

48 **Topic:** Advanced Analog Circuits
Standard: Set up and operate measuring instruments for analog circuits.

49 **Topic:** Advanced Digital Circuits
Standard: Identify types of encoding and decoding devices.

50 **Topic:** Advanced Digital Circuits
Standard: Construct and troubleshoot encoders and decoders.

51 **Topic:** Advanced Digital Circuits
Standard: Identify types of multiplexer and demultiplexer circuits using integrated circuits.

52 **Topic:** Advanced Digital Circuits
Standard: Identify types of memory circuits.

53 **Topic:** Advanced Digital Circuits
Standard: Identify the circuits that would perform digital-to-analog and analog-to-digital conversions.

54 **Topic:** Advanced Digital Circuits
Standard: Construct and troubleshoot digital-to-analog and analog-to digital circuits.

55 **Topic:** Advanced Digital Circuits
Standard: Identify types of digital displays.

56 **Topic:** Advanced Digital Circuits
Standard: Construct and troubleshoot digital displays.

Course: Electronics: 47.59700 Fundamentals of Microprocessors & Transmission Media

35 **Topic:** Microprocessor Fundamentals
Standard: Identify central processing unit (CPU) building blocks and their uses (architecture).

36 **Topic:** Microprocessor Fundamentals
Standard: Analyze bus concept.

37 **Topic:** Microprocessor Fundamentals
Standard: Analyze various memory schemes.

38 **Topic:** Microprocessor Fundamentals
Standard: Use memory devices in circuits.

39

Topic: Microprocessor Fundamentals

Standard: Troubleshoot memory device circuits.

40

Topic: Microprocessor Fundamentals

Standard: Set up and operate oscilloscope for microprocessor systems.

41

Topic: Microprocessor Fundamentals

Standard: Set up and operate logic-data analyzer to troubleshoot microprocessor systems.

42

Topic: Microprocessor Fundamentals

Standard: Identify types of input and output devices and peripherals.

43

Topic: Microprocessor Fundamentals

Standard: Interface input and output ports to peripherals.

44

Topic: Microprocessor Fundamentals

Standard: Analyze and troubleshoot input and output ports.

45

Topic: Microprocessor Fundamentals

Standard: Write a macro processor program in assembly language.

46

Topic: Microprocessor Fundamentals

Standard: Write a macro processor program in machine language.

47

Topic: Microprocessor Fundamentals

Standard: Execute the microprocessor instruction set.

48

Topic: Transmission Media Cabling

Standard: Describe the proper standards for terminating coaxial cable.

49

Topic: Transmission Media Cabling

Standard: Recognize the effects of improper cabling.

50

Topic: Transmission Media Cabling

Standard: Describe cable impedance.

51

Topic: Transmission Media Cabling

Standard: Show how to detect shorted or open cables.

52

Topic: Fiber Optics

Standard: Describe basic fiber optic communications principles.

53

Topic: Fiber Optics

Standard: Explain safety precautions required when working with fiber.

54

Topic: Fiber Optics

Standard: Explain proper usage of standard light sources and light meters.

55

Topic: Satellite, Wireless & Data Communication

Standard: Describe the basic concepts of satellite-wireless-data communication as they apply to audio, video, and data.

56

Topic: Satellite, Wireless & Data Communication

Standard: Draw a block diagram of the interconnections between common consumer satellite reception systems and home entertainment products.

57

Topic: Antenna Theory

Standard: Explain antenna construction and design considerations.

58

Topic: Antenna Theory

Standard: Explain radio wave propagation, electrostatic, and electromagnetic fields.

59 **Topic:** Antenna Theory

Standard: Relate antenna elements length and thickness to frequency and bandwidth.

60 **Topic:** Antenna Theory

Standard: Explain the design of a dipole standard antenna.

61 **Topic:** Antenna Theory

Standard: Recognize the effects of polarization of transmitting and receiving antennas.

Course: Engineering: 48.54100 Introduction to Engineering Drawing

35 **Topic:** Engineering Drawing and Design Career Opportunities

Standard: Identify the professional and/or trade associations related to the engineering drawing and design profession.

36 **Topic:** Engineering Drawing and Design Career Opportunities

Standard: Identify areas of specialization and related occupations within the engineering drawing and design profession.

37 **Topic:** Engineering Drawing and Design Career Opportunities

Standard: Identify the employment opportunities in the engineering drawing and design profession.

38 **Topic:** Engineering Drawing and Design Career Opportunities

Standard: Match engineering drawing and design occupational job titles with qualifications and responsibilities.

39 **Topic:** Engineering Drawing and Design Career Opportunities

Standard: Identify education and training required to work in the various engineering drawing and design careers.

40 **Topic:** Safety Practices

Standard: Follow class and lab rules.

41 **Topic:** Safety Practices

Standard: Identify facility and lab safety equipment.

42 **Topic:** Safety Practices

Standard: Describe emergency procedures.

43 **Topic:** Safety Practices

Standard: Match types of fire extinguishers with their operation and class of fires.

44 **Topic:** Safety Practices

Standard: List two classes of fires that might be encountered in the classroom.

45 **Topic:** Safety Practices

Standard: Maintain workstation and storage area.

46 **Topic:** Tools and Equipment

Standard: Demonstrate the correct operation and maintenance of T-square, parallel bar, or drafting machine.

47 **Topic:** Tools and Equipment

Standard: Identify and demonstrate the use of a compass, irregular curve, circle template, etc., to draw circles and arcs.

48 **Topic:** Tools and Equipment

Standard: Demonstrate the use of pencils, lead selection, pointers, erasers, shields, pens, and ink.

49 **Topic:** Tools and Equipment

Standard: Demonstrate proper care and use of different types of scales.

50 **Topic:** Tools and Equipment

Standard: Identify and demonstrate the use of other drafting tools and equipment in producing a drawing.

51 **Topic:** Media/Supplies

Standard: Demonstrate proper care and use of a drawing reproduction machine.

52 **Topic:** Media/Supplies

Standard: Identify and state the proper use of media, i.e., paper, vellum, film.

53 **Topic:** Media/Supplies

Standard: Use drawing media and related drafting materials.

54 **Topic:** Sketching

Standard: Demonstrate the use of horizontal, vertical, and inclined lines.

55 **Topic:** Sketching

Standard: Demonstrate the use of arcs and circles.

56 **Topic:** Sketching

Standard: Demonstrate the use of the alphabet of lines.

57 **Topic:** Sketching

Standard: Create proportionate and legible technical freehand, orthographic, pictorial, schematic, and diagram sketches.

58 **Topic:** Lettering

Standard: Demonstrate proper vertical lettering.

59 **Topic:** Lettering

Standard: Demonstrate proper inclined lettering.

60 **Topic:** Lettering

Standard: Demonstrate lettering using various devices.

61 **Topic:** Alphabet of LInes

Standard: Demonstrate the recommended thickness of lines.

62 **Topic:** Alphabet of LInes

Standard: Demonstrate the use of the alphabet of lines.

63 **Topic:** Geometric Construction

Standard: Produce geometric shapes such as straight lines, geometric angles, plane figures, circles and arcs, and irregular geometric figures.

64 **Topic:** Geometric Construction

Standard: Apply geometric construction techniques to problems.

65 **Topic:** Geometric Construction

Standard: Draw problems where corners are sharp.

66 **Topic:** Geometric Construction

Standard: Draw problems where tangents are smooth.

67 **Topic:** Geometric Construction

Standard: Draw problems that show construction procedure.

68 **Topic:** Dimensioning and Tolerancing

Standard: Apply dimensioning rules to extension, dimension, and leader lines, using the correct rules as they apply to the appropriate discipline.

69 **Topic:** Dimensioning and Tolerancing

Standard: Apply the proper size and locations of dimension line terminators, e.g. arrowheads, ticks, slashes.

70

Topic: Dimensioning and Tolerancing

Standard: Apply the proper size and location to dimensions of lines, arches, angles, radii, and diameters.

71

Topic: Dimensioning and Tolerancing

Standard: Apply the symmetrical features of a center line to its proper size and location.

72

Topic: Dimensioning and Tolerancing

Standard: Apply the proper size and location of extension lines, dimension lines, and leaders dimensions.

73

Topic: Dimensioning and Tolerancing

Standard: Explain and apply nominal size, basic size, tolerance, unilateral tolerances, bilateral tolerances, fit, actual fit, clearance fit, interference fit, transition fit, allowance, maximum material limit, minimum material limit, basic-whole system, and basic-shaft system.

74

Topic: Fundamentals of CAD

Standard: Identify and use all major components of hardware associated with a CAD system.

75

Topic: Fundamentals of CAD

Standard: Initialize start up and shut down available on a CAD system.

76

Topic: Fundamentals of CAD

Standard: Demonstrate definitions and procedures for file management techniques: copying, deleting, finding, saving, renaming, based on operating/applications systems.

77

Topic: Fundamentals of CAD

Standard: Demonstrate the procedure for the preparation and use of a floppy disk based on operating systems.

78

Topic: Fundamentals of CAD

Standard: Use an online help tutorial based on the application system.

79

Topic: Fundamentals of CAD

Standard: Save drawings on hard drives, floppy disks, CDs, etc. based on the application system.

80

Topic: Fundamentals of CAD

Standard: Demonstrate the ability to open a drawing data file and create a drawing.

81

Topic: Fundamentals of CAD

Standard: Demonstrate the ability to perform a drawing setup, e.g., sheet size, border, title block.

82

Topic: Fundamentals of CAD

Standard: Demonstrate multiple construction techniques, including lines, conics, circles, splinters, and arcs polygons, given size, orientation, and location specifications.

83

Topic: Fundamentals of CAD

Standard: Control entity properties by layer, color, and line type.

84

Topic: Fundamentals of CAD

Standard: Create a drawing using the correct types of lines.

85

Topic: Fundamentals of CAD

Standard: Create appropriate text annotation commands orientation, style, size, placement in CADD, or various means of construction for each item.

86

Topic: Fundamentals of CAD

Standard: Apply entity positioning tools, e.g. snap, grid, construction plane, accurately utilizing various locating specifications and system coordinates.

87

Topic: Fundamentals of CAD

Standard: Demonstrate an accurate and unambiguous representation of an object utilizing the editing commands: mirror, trim, extent, scale, rotate, break, move, stretch, and copy.

88 **Topic:** Fundamentals of CAD

Standard: Demonstrate viewing commands, including dynamic rotation, zooming, panning, change view, view names, multiview-view.

89 **Topic:** Fundamentals of CAD

Standard: Demonstrate plotting procedures, including layout, scale, view, file.

90 **Topic:** Multiview Drawings

Standard: Draw an object that is described with two views.

91 **Topic:** Multiview Drawings

Standard: Draw an object that is described with three views.

92 **Topic:** Multiview Drawings

Standard: Select proper drawing scale, views, and layout.

93 **Topic:** Multiview Drawings

Standard: Draw an object that has an inclined surface.

94 **Topic:** Multiview Drawings

Standard: Draw an object containing circles and arcs.

95 **Topic:** Multiview Drawings

Standard: Create orthographic views utilizing the criteria: necessary views, surface and edge relationships, and hidden lines/surfaces. Incorporate all views- top, bottom, front, right, left, and rear, where applicable.

Course: Engineering: 48.54200 Engineering Concepts and Drawings

35 **Topic:** Dimensioning and Tolerancing

Standard: Apply the proper size and location to spheres, cylinders, tapers, pyramids, irregular objects, and pictorial drawings.

36 **Topic:** Dimensioning and Tolerancing

Standard: Apply the proper size and location in metric & inches to dual dimensioning.

37 **Topic:** Dimensioning and Tolerancing

Standard: Apply the proper size and location to Cartesian, polar, datum, and coordinate dimensioning methods.

38 **Topic:** Dimensioning and Tolerancing

Standard: Apply industry standard symbols: finish, electrical/electronic, welding, GD&T, and machine tool as required on a drawing.

39 **Topic:** Dimensioning and Tolerancing

Standard: Apply the proper size and location to GD&T (tolerancing & datum) symbols.

40 **Topic:** Sections

Standard: Prepare drawings containing full sections and half sections.

41 **Topic:** Sections

Standard: Prepare drawings containing offset sections.

42 **Topic:** Sections

Standard: Prepare drawings containing revolved sections.

43 **Topic:** Sections

Standard: Prepare drawings containing removed sections and broken-out sections.

44 **Topic:** Sections

Standard: Prepare drawings containing auxiliary sections.

45 **Topic:** Sections

Standard: Prepare a sectional assembly drawing applying material symbols.

46 **Topic:** Auxiliary

Standard: Prepare drawings containing primary auxiliary views.

47 **Topic:** Auxiliary

Standard: Prepare drawings containing secondary auxiliary views.

48 **Topic:** Auxiliary

Standard: Prepare drawings containing auxiliary views that contain curved lines.

49 **Topic:** Pictorials

Standard: Create, in detail, isometric and exploded drawings using proper size and angle.

50 **Topic:** Pictorials

Standard: Create cabinet and cavalier oblique drawings, using proper size and angle.

51 **Topic:** Pictorials

Standard: Create 1 and 2-point perspective views.

52 **Topic:** Intersection and Developments

Standard: Develop the lateral surfaces of a prism, pyramid, cylinder, and cone.

53 **Topic:** Intersection and Developments

Standard: Develop the lateral surfaces of a prism and cylinder combination.

54 **Topic:** Intersection and Developments

Standard: Develop the lateral surfaces of cones and transition pieces.

55 **Topic:** Intersection and Developments

Standard: Develop the true surface of a plane by revolution.

56 **Topic:** Intersection and Developments

Standard: Draw the intersection of lines to different solids.

Course: Engineering: 48.54300 Solid Modeling and Design

35 **Topic:** 3-D Drawings

Standard: Apply the correct uses for display commands, including hidden line, no hidden, shading, meshing, sire frame.

36 **Topic:** 3-D Drawings

Standard: Create multiple radii fillets, sculpted surfaces, variable fillets, complex/compound wireframe, or solid 3-D models.

37 **Topic:** 3-D Drawings

Standard: Construct accurate drawing representations of a 3-D assembly model.

38 **Topic:** Wireframes

Standard: Demonstrate skill by using complete and accurate wireframe data to create a 3-D wireframe from a 3-D model.

39 **Topic:** Wireframes

Standard: Identify the purposes and uses of extracting geometric data from surfaces and a wireframe.

40 **Topic:** Wireframes

Standard: Extract valid and usable geometric data from surfaces and a wireframe.

41 **Topic:** Rendering

Standard: Shade a rendered image of a model or object using reflectivity, opacity, and lights cameras.

42 **Topic:** Rendering

Standard: Render an image of the model or object using material properties and finishes.

43 **Topic:** Rendering

Standard: Identify the purposes and uses of extracting geometric data from surfaces and a wireframe.

44 **Topic:** Rendering

Standard: Extract valid and usable geometric data from surfaces and a wireframe.

45 **Topic:** Rendering

Standard: Identify the purposes and uses of rendering a models image as far as its reflectivity, opacity, light source, and material finishes.

46 **Topic:** Solid Modeling

Standard: Demonstrate the ability to visualize and create a three-dimensional solid model.

47 **Topic:** Solid Modeling

Standard: Modify solid objects.

48 **Topic:** Solid Modeling

Standard: Create 2-D geometry from 3-D models.

49 **Topic:** Solid Modeling

Standard: Create a 3-D assembly.

50 **Topic:** Solid Modeling

Standard: Produce models in a 3-D CAD environment.

51 **Topic:** Solid Modeling

Standard: Add materials to a 3-D CAD environment.

52 **Topic:** Solid Modeling

Standard: Add lighting to a 3-D CAD environment.

53 **Topic:** Graphic Presentations

Standard: Create a 3-D presentation.

54 **Topic:** Graphic Presentations

Standard: Create an animated 3-D presentation.

55 **Topic:** Graphic Presentations

Standard: Play back/present a 3-D presentation.

Course: Engineering: 48.54400 Technical Manufacturing Concepts and Drawings

35 **Topic:** Manufacturing Processes

Standard: Describe the casting and foundry processes.

36 **Topic:** Manufacturing Processes

Standard: Describe the basic process of pattern making.

37 **Topic:** Manufacturing Processes

Standard: Identify operations that can be performed with an engine lathe, drill press, mill, shaper, grinder, punch press, EDM, and broach.

38

Topic: Manufacturing Processes

Standard: Identify various types of machined holes.

39

Topic: Manufacturing Processes

Standard: Identify common material stock forms.

40

Topic: Manufacturing Processes

Standard: Describe the purpose of tooling jugs and fixtures.

41

Topic: Manufacturing Processes

Standard: List the common plastic processing and forming techniques.

42

Topic: Manufacturing Processes

Standard: Describe the roll Quality Control (QC) plays in manufacturing.

43

Topic: Manufacturing Processes

Standard: Identify and use precision measuring tools.

44

Topic: Threads and Fasteners

Standard: Draw V-threads using detailed, schematic, and simplified symbols.

45

Topic: Threads and Fasteners

Standard: Draw square threads using detailed, schematic, and simplified symbols.

46

Topic: Threads and Fasteners

Standard: Draw washers, keys, pins, retaining rings, springs, and rivets.

47

Topic: Welding

Standard: Draw T welding joints applying the correct welding symbols.

48

Topic: Welding

Standard: Draw butt welding joints applying the correct welding symbols.

49

Topic: Welding

Standard: Draw corner welding joints applying the correct welding symbols.

50

Topic: Welding

Standard: Draw lap welding joints applying the correct welding symbols.

51

Topic: Welding

Standard: Draw edge welding joints applying the correct welding symbols.

52

Topic: Working Drawings

Standard: Create detail production ready drawings of a machine part.

53

Topic: Working Drawings

Standard: Create orthographic assembly drawings of an end product.

54

Topic: Working Drawings

Standard: Create pictorial assembly drawings of a production part.

55

Topic: Working Drawings

Standard: Use appropriate technical references to create the bill-of-materials required for the assembly of a specific end product.

56

Topic: Electricity/Electronics

Standard: Identify components and symbols.

57

Topic: Electricity/Electronics

Standard: Identify connections.

58 **Topic:** Electricity/Electronics
Standard: Demonstrate spacing requirements from board edges and between components.

59 **Topic:** Electricity/Electronics
Standard: Determine the physical size and location for each component.

60 **Topic:** Electricity/Electronics
Standard: Explain methods of avoiding crossovers.

61 **Topic:** Electricity/Electronics
Standard: Draw and accurately dimension a drill plan for a PC board.

62 **Topic:** Electricity/Electronics
Standard: Draw the printed circuit plan for a PC board.

63 **Topic:** Electricity/Electronics
Standard: Draw a wiring schematic.

64 **Topic:** Fluid Drawings
Standard: Identify, including usage, hydraulic components.

65 **Topic:** Fluid Drawings
Standard: Identify symbols for hydraulic components.

66 **Topic:** Fluid Drawings
Standard: Produce graphic diagrams of hydraulic systems.

67 **Topic:** Fluid Drawings
Standard: Identify including usage, pneumatic components.

68 **Topic:** Fluid Drawings
Standard: Identify symbols for pneumatic components.

69 **Topic:** Fluid Drawings
Standard: Produce graphic diagrams of pneumatic systems.

Course: Engineering: 48.54500 Architectural Drawing and Design I

35 **Topic:** House Design
Standard: Demonstrate an understanding of different house styles.

36 **Topic:** House Design
Standard: Demonstrate skill in interior design.

37 **Topic:** House Design
Standard: Demonstrate skill in exterior design.

38 **Topic:** Floor Plans
Standard: Explain the purpose of a floor plan.

39 **Topic:** Floor Plans
Standard: Demonstrate window and door selection/placement.

40 **Topic:** Floor Plans
Standard: Demonstrate the ability to place and draw plumbing fixtures on a selected residential drawing.

41 **Topic:** Floor Plans
Standard: Demonstrate the ability to place electrical symbols on a selected residential drawing.

42 **Topic:** Floor Plans
Standard: Prepare floor plan drawings with dimensions.

43 **Topic:** Roof Designs
Standard: Demonstrate knowledge of roof systems.

44 **Topic:** Roof Designs
Standard: Demonstrate knowledge of roof styles.

45 **Topic:** Roof Designs
Standard: Demonstrate knowledge of roof pitch.

46 **Topic:** Roof Designs
Standard: Demonstrate knowledge of overhang.

47 **Topic:** Roof Designs
Standard: Demonstrate knowledge of roofing material.

48 **Topic:** Roof Designs
Standard: Draw a roof plan for a selected residential plan.

49 **Topic:** Elevations
Standard: Explain the purpose of elevations.

50 **Topic:** Elevations
Standard: Prepare kitchen elevations for a selected residential drawing.

51 **Topic:** Elevations
Standard: Prepare bath elevations for a selected residential drawing.

52 **Topic:** Elevations
Standard: Prepare fireplace elevation for a selected residential drawing.

53 **Topic:** Elevations
Standard: Prepare exterior elevations for a selected residential drawing.

54 **Topic:** Sections and Details
Standard: Explain the purpose for sections and details.

55 **Topic:** Sections and Details
Standard: Draw a typical wall section for a selected residential drawing.

56 **Topic:** Sections and Details
Standard: Draw a fireplace detail for a selected residential drawing.

57 **Topic:** Foundations
Standard: Explain the purpose of foundation plans.

58 **Topic:** Foundations
Standard: Draw and dimension a foundation plan for a selected residential drawing.

Course: Engineering: 48.54600 Architectural Drawing and Design II

35 **Topic:** Schedules
Standard: Explain the purpose of schedules on a set of residential working drawings.

36 **Topic:** Schedules
Standard: Draw a window schedule for a residential plan.

37 **Topic:** Schedules
Standard: Draw a door schedule for a residential plan.

38 **Topic:** Schedules
Standard: Draw a finish schedule for a residential plan.

39 **Topic:** Plumbing
Standard: Explain the purpose of plumbing plans.

40 **Topic:** Plumbing
Standard: Prepare a plumbing plan, riser diagrams, and schedules.

41 **Topic:** Heating and Air
Standard: Explain the purpose of HVAC plans.

42 **Topic:** Heating and Air
Standard: Prepare HVAC plans and schedules.

43 **Topic:** Presentations
Standard: Demonstrate the purpose of architectural presentations.

44 **Topic:** Presentations
Standard: Create a presentation for a selected residential dwelling (wireframe, solid model, perspective, etc.).

45 **Topic:** Presentations
Standard: Build a presentation model for a selected residential dwelling.

46 **Topic:** Presentations
Standard: Deliver a presentation for a residential dwelling to a selected client.

47 **Topic:** Plot/Site Plans
Standard: Explain the purpose of a residential site plan.

48 **Topic:** Plot/Site Plans
Standard: Draw the site plan for a selected residential dwelling with a given plot of land.

49 **Topic:** Specifications
Standard: State the purpose of specifications.

50 **Topic:** Specifications
Standard: Write a set of construction specifications for a selected residential dwelling.

51 **Topic:** Building Estimation
Standard: Demonstrate knowledge of building estimation.

52 **Topic:** Building Estimation
Standard: Prepare an estimate for a selected residential dwelling.

Course: Engineering: 48.54700 Structural Detailing

35 **Topic:** Shapes
Standard: Identify the classes of structural steel.

36 **Topic:** Shapes
Standard: Identify the types of structural steel shapes.

37 **Topic:** Shapes
Standard: Describe typical uses for WWF, W, M, S, C, MC, WWT, WT, MT, HP, L, and HSS steel shapes.

38 **Topic:** Shapes
Standard: Draw and dimension the framing plan for a steel structure.

39 **Topic:** Beam Reactions
Standard: Describe beam reactions.

40 **Topic:** Beam Reactions
Standard: Explain the influence of beam reactions in structural steel detailing.

41 **Topic:** Connections
Standard: Detail a framed connection.

42 **Topic:** Connections
Standard: Detail a seated connection.

43 **Topic:** Connections
Standard: Detail bolted connections.

44 **Topic:** Connections
Standard: Detail welded connections.

45 **Topic:** Columns, Baseplates, and Splices
Standard: Discuss the advantages and disadvantages of different steel shapes as columns.

46 **Topic:** Columns, Baseplates, and Splices
Standard: State the most common material used for base plates.

47 **Topic:** Columns, Baseplates, and Splices
Standard: State the safety rule for base plate anchor bolt spacing.

48 **Topic:** Columns, Baseplates, and Splices
Standard: Identify types of column to base plate connections.

49 **Topic:** Columns, Baseplates, and Splices
Standard: Detail a base plate for shipment with column.

50 **Topic:** Columns, Baseplates, and Splices
Standard: Detail a base plate for separate shipment.

51 **Topic:** Columns, Baseplates, and Splices
Standard: Explain types of beam splices.

52 **Topic:** Columns, Baseplates, and Splices
Standard: Detail a beam shear splice.

53 **Topic:** Columns, Baseplates, and Splices
Standard: Detail a beam moment splice.

54 **Topic:** Columns, Baseplates, and Splices
Standard: Explain types of column splices.

55 **Topic:** Columns, Baseplates, and Splices
Standard: Detail a column lap splice.

56 **Topic:** Columns, Baseplates, and Splices
Standard: Detail a column butt splice.

35 **Topic:** Types of Surveys
Standard: Describe the contents of a typical loan survey and a boundary survey.

36 **Topic:** Types of Surveys
Standard: Differentiate between a loan survey and a boundary survey.

37 **Topic:** Types of Surveys
Standard: Describe the legal aspects of a loan versus a boundary survey.

38 **Topic:** Types of Surveys
Standard: Given field data, draw a loan survey.

39 **Topic:** Plan and Profile Drawings
Standard: Describe the functions of a plan and profile drawing.

40 **Topic:** Plan and Profile Drawings
Standard: Discuss the fieldwork required to obtain the data for a plan and profile drawing.

41 **Topic:** Plan and Profile Drawings
Standard: Identify all common symbols used on plan and profile drawings.

42 **Topic:** Plan and Profile Drawings
Standard: Given a complete set of field data, plot a plan and choose a profile for the project that appears to balance out in cuts and fills.

43 **Topic:** Cross-Sections
Standard: Describe the four uses for earthwork quantity data.

44 **Topic:** Cross-Sections
Standard: Describe typical scales to which cross sections are plotted.

45 **Topic:** Cross-Sections
Standard: Discuss the relationship between the plan and profile drawing to the cross-sections.

46 **Topic:** Cross-Sections
Standard: Draw cross-sections at 25-50' intervals when given a plan and profile drawings.

47 **Topic:** Earth-Work Determination
Standard: Calculate cross-sectional areas of cut and fill by the "counting squares" method.

48 **Topic:** Earth-Work Determination
Standard: Calculate cross-sectional areas of cut and fill by the geometric figure method.

49 **Topic:** Earth-Work Determination
Standard: Calculate cross-sectional areas of cut and fill by the use of a planimeter.

50 **Topic:** Earth-Work Determination
Standard: Calculate total cut and fill between two stations.

51 **Topic:** Earth-Work Determination
Standard: Given a complete set of cross-sections, compute total cut and/or fill for the project.

52 **Topic:** Grade Determination
Standard: Adjust the plane and grade of the profile of a project so that the earthwork approximately balances out using given data.

53 **Topic:** Mapping

Standard: Explain mapping procedures.

54 **Topic:** Mapping

Standard: Prepare a map using bearings.

55 **Topic:** Mapping

Standard: Prepare a map using coordinates.

Course: HVACR: Core Skills

1 **Topic:** Basic Skills

Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills

Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills

Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills

Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills

Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills

Standard: Identify problems, alternative solutions, and consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15

Topic: Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16

Topic: Interpersonal Skills

Standard: Share knowledge and skills with others.

17

Topic: Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18

Topic: Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19

Topic: Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20

Topic: Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21

Topic: Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22

Topic: Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23

Topic: Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24

Topic: Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25

Topic: Technology

Standard: Utilize a variety of technologies.

26

Topic: Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27

Topic: Business Aspects

Standard: Identify forms of business ownership.

28

Topic: Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29

Topic: Business Aspects

Standard: Demonstrate understanding of the individual’s role, responsibilities, and relationships in the organizational structure of a business.

30

Topic: Business Aspects

Standard: Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

31

Topic: Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32

Topic: Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33

Topic: Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34 **Topic:** Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

Course: HVACR: 47.51100 Foundations of HVACR

35 **Topic:** Introduction to HVACR

Standard: Explain the basic principles of heating, ventilation, and air conditioning.

36 **Topic:** Introduction to HVACR

Standard: Identify career opportunities available to people in the HVACR trade.

37 **Topic:** Introduction to HVACR

Standard: Explain the purpose and objectives of an apprentice training program.

38 **Topic:** Introduction to HVACR

Standard: Describe how certified apprentice training can start in high school.

39 **Topic:** Introduction to HVACR

Standard: Describe what the Clean Air Act means to the HVACR trade.

40 **Topic:** Trade Mathematics

Standard: Solve algebraic equations that relate to the HVACR trade.

41 **Topic:** Trade Mathematics

Standard: Calculate volume, weight, pressure, vacuum, and temperature.

42 **Topic:** Trade Mathematics

Standard: Construct simple geometric figures and solve basic geometry problems that relate to the HVACR trade.

43 **Topic:** Tools of the Trade

Standard: Identify and demonstrate the ability to use the following tools: · Pipe wrenches · Torque wrenches · Tinner's and soft face hammers · Hand cutting snips · Hand and power hacksaws · Drill press · Measuring tools

44 **Topic:** Tools of the Trade

Standard: Describe or demonstrate the general procedures for maintenance of most hand and power tools.

45 **Topic:** Tools of the Trade

Standard: Describe or demonstrate the general safety precautions that must be followed when using most hand and power tools.

46 **Topic:** Copper And Plastic Piping Practices

Standard: State the precautions that must be taken when installing refrigerant piping.

47 **Topic:** Copper And Plastic Piping Practices

Standard: Select the right tubing for a job.

48 **Topic:** Copper And Plastic Piping Practices

Standard: Cut and bend tubing.

49 **Topic:** Copper And Plastic Piping Practices

Standard: Join tubing by using flare and compression fittings.

50 **Topic:** Copper And Plastic Piping Practices

Standard: Determine the kinds of hangers and support needed for refrigerant piping.

51 **Topic:** Copper And Plastic Piping Practices

Standard: Insulate refrigerant piping.

52
Topic: Copper And Plastic Piping Practices
Standard: State the basic requirements for pressure-testing a system once it has been installed.

53
Topic: Copper And Plastic Piping Practices
Standard: Follow basic safety precautions for the installation, operation, and maintenance of refrigerating and air conditioning equipment.

54
Topic: Soldering And Brazing
Standard: Assemble and operate the tools used for soldering.

55
Topic: Soldering And Brazing
Standard: Prepare tubing and fittings for soldering.

56
Topic: Soldering And Brazing
Standard: Identify the purposes and use of solder and solder fluxes.

57
Topic: Soldering And Brazing
Standard: Solder copper tubing and fittings.

58
Topic: Soldering And Brazing
Standard: Assemble and operate the tools used for brazing.

59
Topic: Soldering And Brazing
Standard: Prepare tubing and fittings for brazing.

60
Topic: Soldering And Brazing
Standard: Identify the purposes and use of filler metals and fluxes used for brazing.

61
Topic: Soldering And Brazing
Standard: Braze copper tubing and fittings.

62
Topic: Soldering And Brazing
Standard: Identify the inert gases that can safely be used to purge tubing when brazing.

63
Topic: Ferrous Metal Piping Practices
Standard: Identify the types of ferrous metal pipes.

64
Topic: Ferrous Metal Piping Practices
Standard: Measure the sizes of ferrous metal pipes.

65
Topic: Ferrous Metal Piping Practices
Standard: Identify the common malleable iron fittings.

66
Topic: Ferrous Metal Piping Practices
Standard: Cut, ream, and thread ferrous metal pipe.

67
Topic: Ferrous Metal Piping Practices
Standard: Join lengths and threaded pipe together and install fittings.

68
Standard: Describe the main points to consider when installing pipe runs.

69
Topic: Ferrous Metal Piping Practices
Standard: Describe the method used to join grooved piping.

70
Topic: Basic Electricity
Standard: State how electrical power is generated and distributed.

71
Topic: Basic Electricity
Standard: Describe how voltage, current, resistance, and power are related.

72
Topic: Basic Electricity
Standard: Use Ohm’s Low to calculate the current, voltage, and resistance in a circuit.

73 **Topic:** Basic Electricity

Standard: Use the power formula to calculate how much power a circuit consumes.

74 **Topic:** Basic Electricity

Standard: Describe the differences between series and parallel circuits.

75 **Topic:** Basic Electricity

Standard: Recognize and describe the purpose and operation of the various electrical components used in HVACR equipment.

76 **Topic:** Basic Electricity

Standard: State and demonstrate the safety precautions that must be followed when working on electrical equipment.

77 **Topic:** Basic Electricity

Standard: Make voltage, current, and resistance measurements using electrical test equipment.

Course: HVACR: 47.51200 HVACR Heating and Cooling Basics

35 **Topic:** Introduction To Cooling

Standard: Explain how heat transfer occurs in a cooling system, demonstrating an understanding of the terms and concepts used in the refrigeration cycle.

36 **Topic:** Introduction To Cooling

Standard: Calculate the temperature and pressure relationships at key points in the refrigeration cycle.

37 **Topic:** Introduction to Cooling

Standard: Under supervision, use temperature and pressure measuring instruments to make readings at key points in the refrigeration cycle.

38 **Topic:** Introduction To Cooling

Standard: Identify commonly used refrigerants and demonstrate the procedures for handling these refrigerants.

39 **Topic:** Introduction To Cooling

Standard: Recognize the major components of a cooling system and explain how each type works.

40 **Topic:** Introduction To Cooling

Standard: Recognize the major accessories available with cooling systems and explain how each type works.

41 **Topic:** Introduction To Cooling

Standard: Recognize the control devices used in cooling systems and explain how each type works.

42 **Topic:** Introduction To Cooling

Standard: Under supervision, perform basic power-off maintenance procedures applicable to cooling systems.

43 **Topic:** Introduction To Cooling

Standard: State the correct methods to be used when piping a refrigeration or cooling system.

44 **Topic:** Introduction To Heating

Standard: Explain the three methods by which heat is transferred and give an example of each.

45 **Topic:** Introduction To Heating

Standard: Describe how combustion occurs and identify the by-products of combustion.

46 **Topic:** Introduction To Heating

Standard: Identify the various types of fuels used in heating.

47 **Topic:** Introduction To Heating

Standard: Recognize the major components and accessories of a forced-air furnace and explain the function of each component.

48 **Topic:** Introduction To Heating

Standard: State the factors that must be considered when installing a furnace.

49 **Topic:** Introduction To Heating

Standard: Identify the major components of a gas furnace and describe how each works.

50 **Topic:** Introduction To Heating

Standard: With supervision, use a manometer to measure and adjust manifold pressure on a gas furnace.

51 **Topic:** Introduction To Heating

Standard: Identify the major components of an oil furnace and describe how each works.

52 **Topic:** Introduction To Heating

Standard: Describe how an electric furnace works.

53 **Topic:** Introduction To Heating

Standard: With supervision, perform basic furnace preventive maintenance procedures such as cleaning and filter replacement.

Course: HVACR: 47.51300 Air Flow Systems and Maintenance

35 **Topic:** Air Properties And Distribution

Standard: Explain the gas laws (Dalton, Boyle, and Charles) used when dealing with air and its properties.

36 **Topic:** Air Properties And Distribution

Standard: Explain how the properties of air relate to one another.

37 **Topic:** Air Properties And Distribution

Standard: Use a psychometric chart to evaluate air properties and changes in air properties.

38 **Topic:** Air Properties And Distribution

Standard: Explain the differences between propeller and centrifugal fans and blowers.

39 **Topic:** Air Properties And Distribution

Standard: Recognize the various types of duct systems and explain why and where each type is used.

40 **Topic:** Air Properties And Distribution

Standard: Recognize and demonstrate or explain the installation of metal, fiberboard, and flexible duct.

41 **Topic:** Air Properties And Distribution

Standard: Recognize and demonstrate or explain the installation of fittings and transitions use in duct systems.

42 **Topic:** Air Properties And Distribution

Standard: Recognize and demonstrate or explain the use and installation of diffusers, registers, and grilles used in duct systems.

43 **Topic:** Air Properties And Distribution

Standard: Recognize and demonstrate or explain the use and installation of dampers used in duct systems.

44 **Topic:** Air Properties And Distribution

Standard: Recognize and demonstrate or explain the use and installation of insulation and vapor barriers used in duct systems.

45 **Topic:** Air Properties And Distribution

Standard: Recognize the instruments used to make measurements in air systems and explain the use of each instrument.

46 **Topic:** Air Properties And Distribution

Standard: Make basic temperature, air pressure, and velocity measurements in an air distribution system.

47 **Topic:** Chimneys, Vents, And Flues
Standard: Describe the principles of combustion and explain complete and incomplete combustion.

48 **Topic:** Chimneys, Vents, And Flues
Standard: Describe the content of flue gas and explain how it is vented.

49 **Topic:** Chimneys, Vents, And Flues
Standard: Identify the components of a furnace vent system.

50 **Topic:** Chimneys, Vents, And Flues
Standard: Understand how to select and install a vent system.

51 **Topic:** Chimneys, Vents, And Flues
Standard: Perform the adjustments necessary to achieve proper combustion in a gas furnace.

52 **Topic:** Chimneys, Vents, And Flues
Standard: Describe and demonstrate the techniques for venting different types of furnaces.

53 **Topic:** Chimneys, Vents, And Flues
Standard: Explain the various draft control devices used with natural-draft furnaces.

54 **Topic:** Introduction To Mechanical Maintenance
Standard: Identify the types of threaded and nonthreaded fasteners and explain their uses.

55 **Topic:** Introduction To Mechanical Maintenance
Standard: Install threaded and nonthreaded fasteners.

56 **Topic:** Introduction To Mechanical Maintenance
Standard: Identify the types of gaskets, packings, and seals and explain their uses.

57 **Topic:** Introduction To Mechanical Maintenance
Standard: Remove and install gaskets, packings, and seals.

58 **Topic:** Introduction To Mechanical Maintenance
Standard: Identify the types of lubricants and explain their uses.

59 **Topic:** Introduction To Mechanical Maintenance
Standard: Use lubrication equipment to lubricate motor bearings.

60 **Topic:** Introduction To Mechanical Maintenance
Standard: Identify the types of belt drives and explain their uses.

61 **Topic:** Introduction To Mechanical Maintenance
Standard: Demonstrate and/or explain procedures used to install or adjust a belt drive.

62 **Topic:** Introduction To Mechanical Maintenance
Standard: Identify the types of couplings and explain their uses.

63 **Topic:** Introduction To Mechanical Maintenance
Standard: Demonstrate and/or explain procedures used to remove, install, and align couplings.

64 **Topic:** Introduction To Mechanical Maintenance
Standard: Identify the types of bearings and explain their uses.

65 **Topic:** Introduction To Mechanical Maintenance
Standard: Explain causes of bearing failures.

66 **Topic:** Alternating Current
Standard: Describe the operation of the various types of transformers.

67 **Topic:** Alternating Current
Standard: Explain how alternating current is developed and draw a sine wave.

68 **Topic:** Alternating Current
Standard: Identify single-phase and three-phase wiring arrangements.

69 **Topic:** Alternating Current
Standard: Explain how phase shift occurs in inductors and capacitors.

70 **Topic:** Alternating Current
Standard: Describe the types of capacitors and their application.

71 **Topic:** Alternating Current
Standard: Explain the operation of single-phase and three-phase induction motors.

72 **Topic:** Alternating Current
Standard: Identify the various types of single-phase motors and their applications.

73 **Topic:** Alternating Current
Standard: Use a wattmeter, megger, capacitor analyzer, and chart recorder.

74 **Topic:** Alternating Current
Standard: Test inductors and capacitors using an ohmmeter.

75 **Topic:** Alternating Current
Standard: State and demonstrate the safety precautions that must be followed when working with electrical equipment.

Course: HVACR: 47.51400 HVACR Controls and Operation

35 **Topic:** Basic Electronics
Standard: Explain the basic theory of electronics and semiconductors.

36 **Topic:** Basic Electronics
Standard: Explain how various semiconductor devices such as diodes, LEDs, SCRs, DIACs, and TRIACs work and how they are used in power and control circuits.

37 **Topic:** Basic Electronics
Standard: Identify various types of diodes from their digram symbols.

38 **Topic:** Basic Electronics
Standard: Identify different types of resistors and explain how their resistance values can be determined.

39 **Topic:** Basic Electronics
Standard: Describe the operation and function of thermistors and “cad” cells.

40 **Topic:** Basic Electronics
Standard: Test semiconductor components.

41 **Topic:** Electric Furnaces
Standard: Describe and explain the basic operation of an electric furnace.

42 **Topic:** Electric Furnaces
Standard: Identify and describe the functions of major components of electric furnaces.

43 **Topic:** Electric Furnaces
Standard: Identify and describe the functions of electric furnace controls.

44

Topic: Electric Furnaces

Standard: Measure resistances and check components and controls for operation and safety.

45

Topic: Electric Furnaces

Standard: Determine the CFM from the temperature rise.

46

Topic: HVACR Controls

Standard: Explain the function of a thermostat in an HVACR system.

47

Topic: HVACR Controls

Standard: Describe different types of thermostats and explain how they are used.

48

Topic: HVACR Controls

Standard: Demonstrate the correct installation and adjustment of a thermostat using proper siting and wiring techniques.

49

Topic: HVACR Controls

Standard: Explain the basic principles applicable to all control systems.

50

Topic: HVACR Controls

Standard: Identify the various types of electromechanical, electronic, and pneumatic HVACR controls, and explain their function and operation.

51

Topic: HVACR Controls

Standard: Perform simulated troubleshooting of a typical HVACR control circuit.

52

Topic: Accessories And Optional Equipment

Standard: Explain how heat transfer by conduction, convection, radiation, and evaporation relates to human comfort.

53

Topic: Accessories And Optional Equipment

Standard: Explain why it is important to control humidity in a building.

54

Topic: Accessories And Optional Equipment

Standard: Recognize the various kinds of humidifiers used with HVACR systems and explain why each is used.

55

Topic: Accessories And Optional Equipment

Standard: Demonstrate or describe how to install and service the humidifiers used in HVACR systems.

56

Topic: Accessories And Optional Equipment

Standard: Recognize the various kinds of air filters used with HVACR systems and explain why each is used.

57

Topic: Accessories And Optional Equipment

Standard: Demonstrate or describe how to install and service the filters used in HVAC systems.

58

Topic: Accessories And Optional Equipment

Standard: Use a manometer or differential pressure gauge to measure the friction loss of an air filter.

59

Topic: Accessories And Optional Equipment

Standard: Recognize the various kinds of energy-saving evices used with HVACR systems and explain why each is used.

60

Topic: Compressors

Standard: Identify the different kinds of compressors.

61

Topic: Compressors

Standard: Demonstrate an understanding of the mechanical operation for each type of compressor.

62

Topic: Compressors

Standard: Demonstrate an understanding of compressor lubrication methods.

63

Topic: Compressors

Standard: Demonstrate an understanding of methods used to control compressor capacity.

64 **Topic:** Compressors

Standard: Demonstrate an understanding of how compressor protection devices operate.

65 **Topic:** Compressors

Standard: Demonstrate the common procedures used when field servicing open and semihermetic compressors. · Shaft seal removal and installation · Valve plate removal and installation · Unloader adjustment

66 **Topic:** Compressors

Standard: Demonstrate the procedures used to identify system problems that cause compressor failures.

67 **Topic:** Compressors

Standard: Demonstrate the system checkout procedure to be performed following a compressor failure.

68 **Topic:** Compressors

Standard: Demonstrate or describe the procedures used to remove and install a compressor.

69 **Topic:** Compressors

Standard: Demonstrate or describe the procedures used to clean up a system after a compressor burnout.

Course: HVACR: 47.51500 Heat Pumps, Meter Devices, and Refrigerant Handling

35 **Topic:** Heat Pumps

Standard: Describe the principles of reverse-cycle heating.

36 **Topic:** Heat Pumps

Standard: Identify heat pumps by type and general classification.

37 **Topic:** Heat Pumps

Standard: List the components of heat pump systems.

38 **Topic:** Heat Pumps

Standard: Demonstrate heat pump installation and service procedures.

39 **Topic:** Heat Pumps

Standard: Identify and install refrigerant circuit accessories commonly associated with heat pumps.

40 **Topic:** Heat Pumps

Standard: Analyze a heat pump control circuit.

41 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Identify the common types of leak detectors and explain how each is used.

42 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Demonstrate skill in performing leak detection tests.

43 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Identify the service equipment used for evacuating a system and explain why each item of equipment is used.

44 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Demonstrate skill in performing system evacuation and dehydration.

45 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Identify the service equipment used for recovering refrigerant from a system and for recycling the recovered refrigerant, and explain why each item of equipment is used.

46 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Demonstrate skill in performing refrigerant recovery.

47 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Demonstrate or explain how to use a recycle unit.

48 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Identify the service equipment used for charging refrigerant into a system, and explain why each item of equipment is used.

49 **Topic:** Leak Detection, Evacuation, Recovery, And Charging

Standard: Demonstrate skill in charging refrigerant into a system.

50 **Topic:** Metering Devices

Standard: Explain the function of metering devices.

51 **Topic:** Metering Devices

Standard: Describe the operation of selected metering devices and expansion valve.

52 **Topic:** Metering Devices

Standard: Identify types of thermal expansion valves (TEVs).

53 **Topic:** Metering Devices

Standard: Describe problems associated with replacement TEVs.

54 **Topic:** Metering Devices

Standard: Describe the procedure for installing and adjusting selected TEVs.

Course: HVACR: 47.51600 HVACR Servicing and Troubleshooting I

35 **Topic:** Preventive Maintenance

Standard: Describe preventive maintenance and service procedures required for selected HVACR equipment and components.

36 **Topic:** Preventive Maintenance

Standard: Develop a preventive maintenance and service checklist for selected HVACR equipment and accessories.

37 **Topic:** Preventive Maintenance

Standard: Perform identified service and maintenance tasks on selected HVACR equipment, components, and accessories.

38 **Topic:** Preventive Maintenance

Standard: Identify the tools and materials necessary for performing service and maintenance tasks.

39 **Topic:** Introduction To Troubleshooting

Standard: Describe a systematic approach for electrical troubleshooting of HVACR equipment and components.

40 **Topic:** Introduction To Troubleshooting

Standard: Recognize and use equipment manufacturer’s troubleshooting aids to troubleshoot HVACR equipment.

41 **Topic:** Introduction To Troubleshooting

Standard: Exhibit competence in isolating electrical problems to faulty power distribution, load, or control circuits.

42 **Topic:** Introduction To Troubleshooting

Standard: Identify the service instruments needed to troubleshoot HVACR electrical equipment.

43 **Topic:** Introduction To Troubleshooting

Standard: Make electrical troubleshooting checks and measurements on circuits and components common to all HVACR equipment.

44 **Topic:** Troubleshooting Electronic Controls

Standard: Describe the similarities and differences between electronic controls and conventional controls.

45 **Topic:** Troubleshooting Electronic Controls

Standard: Analyze circuit diagrams and other manufacturer's literature to determine the operating sequence of microprocessor-controlled systems.

46 **Topic:** Troubleshooting Electronic Controls

Standard: Use standard and special test equipment to check out a microprocessor-controlled comfort system.

47 **Topic:** Troubleshooting Electronic Controls

Standard: Isolate and correct malfunctions in a microprocessor-controlled furnace.

48 **Topic:** Troubleshooting Electronic Controls

Standard: Isolate and correct malfunctions in a microprocessor-controlled cooling unit or heat pump.

49 **Topic:** Troubleshooting Gas Heating

Standard: Describe the basic operating sequence for natural-draft and induced-draft gas heating equipment.

50 **Topic:** Troubleshooting Gas Heating

Standard: Demonstrate skill in interpreting control circuit diagrams for gas heating systems.

51 **Topic:** Troubleshooting Gas Heating

Standard: Develop a troubleshooting chart for a gas heating system.

52 **Topic:** Troubleshooting Gas Heating

Standard: Identify the tools and instruments used when troubleshooting gas heating systems.

53 **Topic:** Troubleshooting Gas Heating

Standard: Demonstrate skill in using the tools and instruments required for troubleshooting gas heating systems.

54 **Topic:** Troubleshooting Gas Heating

Standard: Isolate and correct malfunctions in gas heating systems.

Course: HVACR: 47.51700 HVACR Servicing and Troubleshooting II

35 **Topic:** Troubleshooting Electric Heating

Standard: Explain the operating principles of various types of electric heating systems.

36 **Topic:** Troubleshooting Electric Heating

Standard: Describe the ways in which electric heating systems and components are likely to fail.

37 **Topic:** Troubleshooting Electric Heating

Standard: Analyze circuit diagrams to determine the operating sequence of an electric furnace.

38 **Topic:** Troubleshooting Electric Heating

Standard: Determine the operating sequence of an electric heater package for a cooling unit or heat pump.

39 **Topic:** Troubleshooting Electric Heating

Standard: Troubleshoot electric furnaces, accessory heater packages, baseboard heating systems, and duct heaters.

40 **Topic:** Troubleshooting Cooling

Standard: Describe a systematic approach for troubleshooting cooling systems and components.

41 **Topic:** Troubleshooting Cooling

Standard: Exhibit competence in isolating problems involving electrical and/or mechanical functions in cooling systems.

42 **Topic:** Troubleshooting Cooling

Standard: Recognize and use equipment manufacturer's troubleshooting aids to troubleshoot cooling systems.

43 **Topic:** Troubleshooting Cooling

Standard: Identify and properly use service instruments needed to troubleshoot cooling systems.

44 **Topic:** Troubleshooting Cooling

Standard: Successfully troubleshoot selected problems in cooling equipment.

45 **Topic:** Troubleshooting Heat Pumps

Standard: Define the basic operating sequence for an air-to-air heat pump.

46 **Topic:** Troubleshooting Heat Pumps

Standard: Demonstrate skill in interpreting control circuit diagrams for heat pumps.

47 **Topic:** Troubleshooting Heat Pumps

Standard: Develop a troubleshooting chart for a heat pump.

48 **Topic:** Troubleshooting Heat Pumps

Standard: Identify the tools and instruments used in troubleshooting heat pumps.

49 **Topic:** Troubleshooting Heat Pumps

Standard: Demonstrate skill in using the tools and instruments required for troubleshooting heat pumps.

50 **Topic:** Troubleshooting Accessories

Standard: Isolate and correct malfunctions in heat pumps.

51 **Topic:** Troubleshooting Accessories

Standard: Describe a systematic approach for troubleshooting HVACR system accessories.

52 **Topic:** Troubleshooting Accessories

Standard: Exhibit competence in isolating problems involving electrical and/or mechanical functions of HVACR system accessories.

53 **Topic:** Troubleshooting Accessories

Standard: Recognize and use equipment manufacturer's troubleshooting aids to troubleshoot HVACR system accessories.

54 **Topic:** Troubleshooting Accessories

Standard: Identify and use service instruments needed to troubleshoot HVACR system accessories.

55 **Topic:** Troubleshooting Accessories

Standard: Successfully troubleshoot problems in selected HVACR system accessories.

Course: Manufacturing/Engineering Sciences: Core Skills

1 **Topic:** Basic Skills

Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills

Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills

Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills

Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills

Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills

Standard: Identify problems, alternative solutions, and consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15 **Topic:** Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16 **Topic:** Interpersonal Skills

Standard: Share knowledge and skills with others.

17 **Topic:** Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18 **Topic:** Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19 **Topic:** Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20 **Topic:** Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21 **Topic:** Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22 **Topic:** Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23 **Topic:** Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24 **Topic:** Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25 **Topic:** Technology

Standard: Utilize a variety of technologies.

26 **Topic:** Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27 **Topic:** Business Aspects

Standard: Identify forms of business ownership.

28 **Topic:** Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29 **Topic:** Business Aspects

Standard: Demonstrate understanding of the individual's role, responsibilities, and relationships in the organizational structure of a business.

30 **Topic:** Business Aspects

Standard: Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

31 **Topic:** Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32 **Topic:** Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33 **Topic:** Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34 **Topic:** Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

Course: Manufacturing: 49.53100 Introduction to Manufacturing/Engineering Sciences

35 **Topic:** Overview of Manufacturing/Engineering

Standard: Identify and describe types of careers available in manufacturing/engineering.

36 **Topic:** Overview of Manufacturing/Engineering

Standard: Identify educational and work experience required for identified careers.

37 **Topic:** Overview of Manufacturing/Engineering

Standard: List professional organizations available for workers in manufacturing/engineering careers.

38 **Topic:** Overview of Manufacturing/Engineering

Standard: Identify functions of an engineering research and development group.

39 **Topic:** Overview of Manufacturing/Engineering

Standard: Define the concepts and principles of total Quality Management.

40 **Topic:** Overview of Manufacturing/Engineering

Standard: Compare TQM to quality concepts used in manufacturing during the past 30 years.

41 **Topic:** Overview of Manufacturing/Engineering

Standard: Describe how principles of teamwork are carried out in a high performance organization.

42 **Topic:** Overview of Manufacturing/Engineering

Standard: Explain how continuous improvement tools can affect the manufacturing process.

43 **Topic:** Overview of Manufacturing/Engineering

Standard: Identify types of tools, including data acquisition and measuring tools, used in quality control.

44 **Topic:** Overview of Manufacturing/Engineering

Standard: Explain the differences/similarities of quality assurance and quality control.

45 **Topic:** Overview of Manufacturing/Engineering

Standard: Describe how and why the quality assurance process is critical to a manufacturing/engineering organization.

46 **Topic:** Overview of Manufacturing/Engineering

Standard: Describe how information systems interrelate with the job of installation, maintenance, and repair of equipment.

47 **Topic:** Overview of Manufacturing/Engineering

Standard: Identify basic business principles used in a high performance organization.

48 **Topic:** Overview of Manufacturing/Engineering

Standard: Describe the basic processes used in manufacturing, including "lean manufacturing" concepts.

49 **Topic:** Overview of Manufacturing/Engineering

Standard: Describe what is meant by predictive and preventive maintenance practices.

50 **Topic:** Health and Safety

Standard: Identify government agencies concerned with safety issues, including OSHA & EPA.

51 **Topic:** Health and Safety

Standard: Identify responsibilities and personal characteristics of a professional as it relates to health and safety.

52 **Topic:** Health and Safety

Standard: Explain the role that safety plays in this occupation.

53 **Topic:** Health and Safety

Standard: Describe what job-site safety means.

54 **Topic:** Health and Safety

Standard: Explain appropriate safety precautions around common job-site hazards.

55 **Topic:** Health and Safety

Standard: Demonstrate the use and care of appropriate personal protective equipment, including gloves, glasses and breathing apparatus and other identified equipment.

56 **Topic:** Health and Safety

Standard: Follow safe procedures for lifting heavy objects.

57 **Topic:** Health and Safety

Standard: Describe safe behavior on and around ladders and scaffolds.

58 **Topic:** Health and Safety

Standard: Explain the importance of the HazCom (Hazard Communication Standard) requirements and MSDSs (Material Safety Data Sheets).

59 **Topic:** Health and Safety

Standard: Describe fire prevention and fire fighting techniques.

60 **Topic:** Health and Safety

Standard: Define safe work procedures around electrical hazards.

61 **Topic:** Health and Safety
Standard: Describe safety and infection control procedures for protection in case of an emergency situation.

62 **Topic:** Health and Safety
Standard: Describe lock/out tag out procedures.

63 **Topic:** Tools and Equipment
Standard: List the most common hand tools used in the maintenance, installation, and repair of equipment.

64 **Topic:** Tools and Equipment
Standard: Identify commonly used power tools.

65 **Topic:** Tools and Equipment
Standard: Use hand and power tools safely.

66 **Topic:** Tools and Equipment
Standard: Explain how to maintain hand and power tools.

67 **Topic:** Tools and Equipment
Standard: Discuss using the right tool for the right job and ergonomics.

68 **Topic:** Introduction to Blueprints and Design
Standard: Recognize and identify basic blueprint terms, components, and symbols.

69 **Topic:** Introduction to Blueprints and Design
Standard: Relate information on blueprints to actual locations on the print.

70 **Topic:** Introduction to Blueprints and Design
Standard: Recognize different classifications of drawings.

71 **Topic:** Introduction to Blueprints and Design
Standard: Interpret and use drawing dimensions, explaining tolerances and their importance.

72 **Topic:** Introduction to Blueprints and Design
Standard: Explain the concepts of Computer Assisted Drafting used in basic design.

73 **Topic:** Introduction to Blueprints and Design
Standard: Explain the use of engineers and architect scales.

74 **Topic:** Basic Rigging
Standard: Identify and describe the use of slings and common rigging hardware.

75 **Topic:** Basic Rigging
Standard: Describe the basic inspection techniques and rejection criteria used for slings and hardware.

76 **Topic:** Basic Rigging
Standard: Describe the basic hitch configurations and their proper connections.

77 **Topic:** Basic Rigging
Standard: Describe basic load-handling safety practices.

78 **Topic:** Basic Rigging
Standard: Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

79 **Topic:** Basic Rigging
Standard: Describe the use of man lifts/ scissor lifts/scaffolding.

80 **Topic:** Basic Rigging
Standard: Discuss ANSI vs. Metric, European projections vs. American.

81 **Topic:** Basic Rigging

Standard: Identify machine shop equipment & terminology associated with machine shop.

82 **Topic:** Mathematics in Manufacturing

Standard: Apply basic mathematical skills, both standard and metric, using whole numbers, decimals, fractions, and percents with and without a calculator.

83 **Topic:** Mathematics in Manufacturing

Standard: Explain what the metric system is and how it is important in manufacturing.

84 **Topic:** Mathematics in Manufacturing

Standard: Recognize and use metric units of length, weight, volume, and temperature.

85 **Topic:** Mathematics in Manufacturing

Standard: Recognize the basic shapes used in the manufacturing industry and apply basic geometry to calculate unknown values.

86 **Topic:** Mathematics in Manufacturing

Standard: Convert metric to standard measurement and standard measurement to metric.

Course: Manufacturing: 49.53200 Electrical Systems I

35 **Topic:** Electrical Safety

Standard: Demonstrate safe working procedures.

36 **Topic:** Electrical Safety

Standard: Explain the purpose of OSHA and how it promotes safety on the job.

37 **Topic:** Electrical Safety

Standard: Identify electrical hazards and how to avoid or minimize them in the workplace.

38 **Topic:** Electrical Safety

Standard: Explain safety issues concerning lockout/tag out procedures, personal protection. using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection systems.

39 **Topic:** Conduit, Fasteners, and Anchors

Standard: Identify methods of hand bending conduit.

40 **Topic:** Conduit, Fasteners, and Anchors

Standard: Identify various methods used to install conduit.

41 **Topic:** Conduit, Fasteners, and Anchors

Standard: Use math formulas to determine conduit bends.

42 **Topic:** Conduit, Fasteners, and Anchors

Standard: Make 90-degree bends, back-to-back bends, offsets, kicks, and saddle bends using a hand bender.

43 **Topic:** Conduit, Fasteners, and Anchors

Standard: Cut, ream, and thread conduit.

44 **Topic:** Conduit, Fasteners, and Anchors

Standard: Identify and explain the use of threaded fasteners.

45 **Topic:** Conduit, Fasteners, and Anchors

Standard: Identify and explain the use of non-threaded fasteners.

46 **Topic:** Conduit, Fasteners, and Anchors

Standard: Identify and explain the use of anchors.

47

Topic: Conduit, Fasteners, and Anchors

Standard: Demonstrate the correct applications of fasteners and anchors.

48

Topic: Conduit, Fasteners, and Anchors

Standard: Install fasteners and anchors.

49

Topic: Electrical Theory

Standard: Recognize what atoms are and how they are constructed.

50

Topic: Electrical Theory

Standard: Define voltage and identify ways in which it can be produced.

51

Topic: Electrical Theory

Standard: Explain the difference between conductors and insulators.

52

Topic: Electrical Theory

Standard: Define units of measurements used to measure properties of electricity.

53

Topic: Electrical Theory

Standard: Explain how voltage, current, and resistance are related to each other.

54

Topic: Electrical Theory

Standard: Using the formula for Ohm's Law, calculate an unknown value.

55

Topic: Electrical Theory

Standard: Explain the different types of meters used to measure voltage, current, and resistance.

56

Topic: Electrical Theory

Standard: Using the power formula, calculate the amount of power used by a circuit.

57

Topic: Electrical Theory

Standard: Explain the basic characteristics of a series circuit.

58

Topic: Electrical Theory

Standard: Explain the basic characteristics of a parallel circuit.

59

Topic: Electrical Theory

Standard: Explain the basic characteristics of a series-parallel circuit.

60

Topic: Electrical Theory

Standard: Calculate, using Kirchoff's Voltage Law, the total current in parallel and series-parallel circuits.

61

Topic: Electrical Theory

Standard: Find the total amount of resistance in a series circuit, a parallel circuit, and a series-parallel circuit.

62

Topic: Electrical Theory

Standard: Explain the operation of and describe the following pieces of equipment: Ammeter, Voltmeter, Ohmmeter, Volt-ohm-millimeter, Wattmeter, Megommeter, Frequency Meter, Power factor meter, Continuity tester, Recording Instruments, Cable-length meters, Data Logger, Chart Recorders.

63

Topic: Electrical Test Equipment

Standard: Explain how to read and convert from one scale to another using the above test equipment.

64

Topic: Electrical Test Equipment

Standard: Explain the importance of proper meter polarity.

65

Topic: Electrical Test Equipment

Standard: Define frequency and explain the use of a frequency meter.

66

Topic: Electrical Test Equipment

Standard: Explain the difference between digital and analog meters.

67

Topic: Introduction to the NEC

Standard: Explain the purpose and history of the National Electric Code (NEC).

68

Topic: Introduction to the NEC

Standard: Describe the layout of the NEC.

69

Topic: Introduction to the NEC

Standard: Explain how to navigate the NEC.

70

Topic: Introduction to the NEC

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

71

Topic: Introduction to the NEC

Standard: Explain the role of testing laboratories.

72

Topic: Conductors

Standard: Explain the various sizes and gauges of wire in accordance with American Wire Gauge standards.

73

Topic: Conductors

Standard: Identify insulation and jacket types according to conditions and applications.

74

Topic: Conductors

Standard: Describe voltage ratings of conductors and cables.

75

Topic: Conductors

Standard: Read and identify markings on conductors and cables.

76

Topic: Conductors

Standard: Use the tables in the NEC to determine the ampacity of a conductor.

77

Topic: Conductors

Standard: State the purpose of stranded wire.

78

Topic: Conductors

Standard: State the purpose of compressed conductors.

79

Topic: Conductors

Standard: Describe the different materials from which conductors are made.

80

Topic: Conductors

Standard: Describe the different types of conductor insulation.

81

Topic: Conductors

Standard: Describe the color coding of insulation.

82

Topic: Conductors

Standard: Describe the instrumentation control wiring.

83

Topic: Conductors

Standard: Describe the equipment required for pulling wire through conduit.

84

Topic: Conductors

Standard: Describe the procedure for pulling wire through conduit.

85

Topic: Conductors

Standard: Install conductors in conduit.

86

Topic: Conductors

Standard: Pull conductors in a conduit system.

87 **Topic:** Introduction to Electrical Blueprints
Standard: Explain the basic layout of a blueprint.

88 **Topic:** Introduction to Electrical Blueprints
Standard: Describe the information included in the title block of a blueprint.

89 **Topic:** Introduction to Electrical Blueprints
Standard: Identify the types of lines used on blueprints.

90 **Topic:** Introduction to Electrical Blueprints
Standard: Identify common symbols used on blueprints.

91 **Topic:** Introduction to Electrical Blueprints
Standard: Describe the use of an architect scale and an engineer scale.

92 **Topic:** Introduction to Electrical Blueprints
Standard: Interpret electrical drawings, including site plans, floor plans, and detail drawings.

93 **Topic:** Introduction to Electrical Blueprints
Standard: Read equipment schedules found on electrical blueprints.

94 **Topic:** Introduction to Electrical Blueprints
Standard: Describe the type of information included in electrical specifications.

95 **Topic:** Oxyfuel Cutting
Standard: Explain oxyfuel cutting safety.

96 **Topic:** Oxyfuel Cutting
Standard: Identify and explain oxyfuel cutting equipment.

97 **Topic:** Oxyfuel Cutting
Standard: Set up oxyfuel equipment.

98 **Topic:** Oxyfuel Cutting
Standard: Light and adjust an oxyfuel torch.

99 **Topic:** Oxyfuel Cutting
Standard: Shut down oxyfuel cutting equipment.

100 **Topic:** Oxyfuel Cutting
Standard: Disassemble oxyfuel equipment.

101 **Topic:** Oxyfuel Cutting
Standard: Change empty cylinders.

102 **Topic:** Oxyfuel Cutting
Standard: Perform oxyfuel cutting: Straight line and square shapes, piercing and slot cutting, bevels, washing, gouging.

Course: Manufacturing: 49.53300 Electrical Systems II

35 **Topic:** Commercial and Industrial Wiring
Standard: Identify and state the functions and ratings of single-pole, double-pole, three-way, four-way, dimmer, special, and safety switches.

36 **Topic:** Commercial and Industrial Wiring
Standard: Explain NEMA classifications as they relate to switches and enclosures.

37

Topic: Commercial and Industrial Wiring

Standard: Explain the NEC requirements concerning wiring devices.

38

Topic: Commercial and Industrial Wiring

Standard: Identify and state the functions and ratings of straight blade, twist lock, and pin and sleeve receptacles.

39

Topic: Commercial and Industrial Wiring

Standard: Identify and define receptacle terminals and disconnects.

40

Topic: Commercial and Industrial Wiring

Standard: Identify and define ground fault circuit interrupters and arc fault circuit interrupters (AFCI).

41

Topic: Commercial and Industrial Wiring

Standard: Explain the box mounting requirements in the NEC.

42

Topic: Commercial and Industrial Wiring

Standard: Use a wire stripper to strip insulation from a wire.

43

Topic: Commercial and Industrial Wiring

Standard: Use a solder less connector to splice wires together.

44

Topic: Commercial and Industrial Wiring

Standard: Identify and state the functions of limit switches and relays.

45

Topic: Commercial and Industrial Wiring

Standard: Identify and state the functions of switchgear.

46

Topic: Alternating Current

Standard: Calculate the peak and effective voltage or current values for an AC waveform.

47

Topic: Alternating Current

Standard: Calculate the phase relationship between two AC waveforms.

48

Topic: Alternating Current

Standard: Describe the voltage and current phase relationship in a resistive AC circuit.

49

Topic: Alternating Current

Standard: Define inductive reactance and state how it is affected by frequency.

50

Topic: Alternating Current

Standard: Describe the voltage and current transients that occur in a capacitive circuit.

51

Topic: Alternating Current

Standard: Define capacitive reactance and state how it is affected by frequency.

52

Topic: Alternating Current

Standard: Explain the relationship between voltage and current in the following types of AC circuits: RL circuit, RC circuit, LC circuit, RLC circuit.

53

Topic: Alternating Current

Standard: Describe the effect that resonant frequency has on impedance and current flow in a series or parallel resonant circuit.

54

Topic: Alternating Current

Standard: Define bandwidth and describe how it is affected by resistance in a series or parallel resonant circuit.

55

Topic: Alternating Current

Standard: Explain the following terms as they relate to AC circuits: True power, Apparent power, Reactive power, Power factor.

56

Topic: Alternating Current

Standard: Explain basic transformer action.

57

Topic: Alternating Current

Standard: Describe three phase circuits, its application, and how it differs from single phase.

58

Topic: Motor Theory and Application

Standard: Define the following terms: Ampacity, Branch circuit, Circuit breaker, Controller, Duty, Equipment, Full-load amps, Ground fault circuit interrupter, Interrupting rating, Motor circuit switch, Thermal protector, NEMA design letter, Nonautomatic, Overcurrent, Overload, Power factor, Rated full-load speed, Rated horsepower, Service factor, Thermal cutout, Remote Control circuit, AFCI.

59

Topic: Motor Theory and Application

Standard: Describe the various types of motor enclosures and mounting types.

60

Topic: Motor Theory and Application

Standard: Describe how the rated voltage of a motor differs from the system voltage.

61

Topic: Motor Theory and Application

Standard: Describe the basic construction and components of a three-phase squirrel cage induction motor.

62

Topic: Motor Theory and Application

Standard: Explain the relationships among speed, frequency, and the number of poles in a three-phase induction motor.

63

Topic: Motor Theory and Application

Standard: Describe how torque is developed in an induction motor.

64

Topic: Motor Theory and Application

Standard: Explain how and why torque varies with rotor reactance and slip.

65

Topic: Motor Theory and Application

Standard: Define percent slip and speed regulation.

66

Topic: Motor Theory and Application

Standard: Explain how the direction of a three-phase motor is reversed.

67

Topic: Motor Theory and Application

Standard: Describe the component parts and operating characteristics of a three-phase synchronous motor.

68

Topic: Motor Theory and Application

Standard: Define torque, starting current, and armature reaction as they apply to DC motors.

69

Topic: Motor Theory and Application

Standard: Explain how the direction of rotation of a DC motor is changed.

70

Topic: Motor Theory and Application

Standard: Describe the design and characteristics of a DC shunt, series, and compound motor.

71

Topic: Motor Theory and Application

Standard: Describe dual-voltage motors and their applications.

72

Topic: Motor Theory and Application

Standard: Describe the methods for determining various motor connections.

73

Topic: Motor Theory and Application

Standard: Describe general motor protection requirements as delineated in the NEC.

74

Topic: Motor Theory and Application

Standard: Discuss frequency drives and servo motors.

75

Topic: Grounding

Standard: Explain the purpose of grounding and the scope of NEC Article 250.

76 **Topic:** Grounding

Standard: Distinguish between a short circuit and a ground fault.

77 **Topic:** Grounding

Standard: Define the NEC ground-related terms.

78 **Topic:** Grounding

Standard: Distinguish between system grounding and equipment grounding.

79 **Topic:** Grounding

Standard: Use NEC Table 250-66 to size the grounding electrode conductor for various AC systems.

80 **Topic:** Grounding

Standard: Explain the NEC requirements for the installation and physical protection of grounding electrode conductors.

81 **Topic:** Grounding

Standard: Explain the function of the grounding electrode system and determine which grounding electrodes must be used.

82 **Topic:** Grounding

Standard: Define made electrodes and explain the resistance requirements for made electrodes using NEC Section 250-52.

83 **Topic:** Grounding

Standard: Use NEC Table 250-122 to size the equipment-grounding conductor for raceways and equipment.

84 **Topic:** Grounding

Standard: Explain the function of the main bonding jumper in the grounding system and size the main bonding jumper for various applications.

85 **Topic:** Grounding

Standard: Size the main bonding jumper for a service utilizing multiple service disconnecting means.

86 **Topic:** Grounding

Standard: Explain the NEC requirements for bonding of enclosures and equipment.

87 **Topic:** Grounding

Standard: Explain the NEC requirements for grounding of enclosures and equipment.

88 **Topic:** Grounding

Standard: Explain effectively grounded and its importance in clearing ground faults and short circuits.

89 **Topic:** Grounding

Standard: Explain the purpose of the grounded conductor (neutral) in the operation of overcurrent devices.

90 **Topic:** Grounding

Standard: Explain the NEC requirements for grounding separately derived systems, including transformers and generators.

91 **Topic:** Grounding

Standard: Explain the NEC requirements for grounding more than one building.

92 **Topic:** Grounding

Standard: Explain the NEC requirements for systems over 600 volts.

93 **Topic:** Boxes and Fittings

Standard: Describe the different types of nonmetallic and metallic boxes.

94 **Topic:** Boxes and Fittings

Standard: Explain the NEC requirements for box fill.

95 **Topic:** Boxes and Fittings
Standard: Calculate the required box size for any number and size of conductors.

96 **Topic:** Boxes and Fittings
Standard: Explain the NEC regulations for volume required per conductor in outlet boxes.

97 **Topic:** Boxes and Fittings
Standard: Properly locate, install, and support boxes of all types.

98 **Topic:** Boxes and Fittings
Standard: Describe the NEC regulations governing pull and junction boxes.

99 **Topic:** Boxes and Fittings
Standard: Explain the radius rule when installing conductors in pull boxes.

100 **Topic:** Boxes and Fittings
Standard: Explain the NEC requirements for boxes supporting lighting fixtures.

101 **Topic:** Boxes and Fittings
Standard: Describe the purpose of conduit bodies and Type FS boxes.

102 **Topic:** Boxes and Fittings
Standard: Install the different types of fittings used in conjunction with boxes.

103 **Topic:** Boxes and Fittings
Standard: Describe the installation rules for installing boxes and fittings in hazardous areas.

104 **Topic:** Boxes and Fittings
Standard: Explain how boxes and fittings are selected and installed.

105 **Topic:** Boxes and Fittings
Standard: Describe the various types of box supports.

106 **Topic:** Cable Trays
Standard: Describe the components that makeup a cable tray assembly.

107 **Topic:** Cable Trays
Standard: Explain the methods used to hang and secure cable tray.

108 **Topic:** Cable Trays
Standard: Describe how cable enters and exits cable tray.

109 **Topic:** Cable Trays
Standard: Select the proper cable tray fitting for the situation.

110 **Topic:** Cable Trays
Standard: Explain the NEMA standards for cable tray installations.

111 **Topic:** Cable Trays
Standard: Explain the NEC requirements for cable tray installations.

112 **Topic:** Cable Trays
Standard: Select the required fittings to ensure equipment-grounding continuity in cable tray systems.

113 **Topic:** Cable Trays
Standard: Interpret electrical working drawings showing cable tray fittings.

114 **Topic:** Cable Trays
Standard: Size cable tray for the number and type of conductors contained in the system.

115
Topic: Cable Trays
Standard: Select rollers and sheaves for pulling cable in specific cable tray situations.

116
Topic: Cable Trays
Standard: Designate the required locations of rollers and sheaves for a specific cable pull.

117
Topic: Cable Trays
Standard: Fabricate an offset for a cable tray.

118
Topic: Cable Trays
Standard: Discuss cable carriers.

119
Topic: Conductor Terminations
Standard: Describe how to make a good conductor termination.

120
Topic: Conductor Terminations
Standard: Prepare cable ends for terminations and splices.

121
Topic: Conductor Terminations
Standard: Install lugs and connectors onto conductors.

122
Topic: Conductor Terminations
Standard: Train cable at termination points.

123
Topic: Conductor Terminations
Standard: Explain the role of NEC in making cable terminations and splices.

124
Topic: Conductor Terminations
Standard: Explain why mechanical stress should be avoided at cable termination points.

125
Topic: Conductor Terminations
Standard: Describe the importance of using proper bolt torque when bolting lugs onto bus bars.

126
Topic: Conductor Terminations
Standard: Describe crimping techniques.

127
Topic: Conductor Terminations
Standard: Select the proper lugs or connector for the job.

128
Topic: Conductor Terminations
Standard: Describe splicing techniques.

129
Topic: Conductor Terminations
Standard: Describe the installation rules for parallel conductors.

130
Topic: Conductor Terminations
Standard: Explain how to use hand and power crimping tools.

131
Topic: Installation of Electrial Services
Standard: Describe various types of electric services for commercial and industrial installations.

132
Topic: Installation of Electrial Services
Standard: Read electrical blueprints and diagrams describing service installations.

133
Topic: Installation of Electrial Services
Standard: Calculate and select service-entrance equipment.

134
Topic: Installation of Electrial Services
Standard: Explain the role of the NEC in service installations.

135 **Topic:** Installation of Electrial Services
Standard: Install main disconnect switches, panel boards, and overcurrent protection devices.

136 **Topic:** Installation of Electrial Services
Standard: Identify the circuit loads, number of circuits required, and installation requirements for distribution panels.

137 **Topic:** Installation of Electrial Services
Standard: Explain the types and purposes of service grounding.

138 **Topic:** Installation of Electrial Services
Standard: Explain the purpose of ground fault circuit interrupters and where they must be installed.

139 **Topic:** Installation of Electrial Services
Standard: Describe single-phase service connectors.

140 **Topic:** Installation of Electrial Services
Standard: Describe both wyes- and delta-connected three-phase services.

141 **Topic:** Circuit Breakers and Fuses
Standard: Explain the necessity of overcurrent protection devices in electrical circuits.

142 **Topic:** Circuit Breakers and Fuses
Standard: Define the terms associated with fuses and circuit breakers.

143 **Topic:** Circuit Breakers and Fuses
Standard: Describe the operation of a circuit breaker.

144 **Topic:** Circuit Breakers and Fuses
Standard: Select the most suitable overcurrent device for the application.

145 **Topic:** Circuit Breakers and Fuses
Standard: Explain the role of the NEC in specifying overcurrent devices.

146 **Topic:** Circuit Breakers and Fuses
Standard: Describe the operation of single-element and time-delay fuses.

147 **Topic:** Circuit Breakers and Fuses
Standard: Explain how ground fault circuit interrupters (GFCIs) can save lives.

148 **Topic:** Circuit Breakers and Fuses
Standard: Replace a renewable fuse link.

149 **Topic:** Circuit Breakers and Fuses
Standard: Calculate short circuit currents.

150 **Topic:** Circuit Breakers and Fuses
Standard: Describe troubleshooting and maintenance techniques for overcurrent devices.

151 **Topic:** Contractors and Relays
Standard: Describe the operating principles of contractors and relays.

152 **Topic:** Contractors and Relays
Standard: Select contactors and relays for use in specific electrical systems.

153 **Topic:** Contractors and Relays
Standard: Explain how mechanical contactors operate.

154 **Topic:** Contractors and Relays
Standard: Explain how solid-state contactors operate.

155 **Topic:** Contractors and Relays
Standard: Install contactors and relays according to the NEC requirements.

156 **Topic:** Contractors and Relays
Standard: Select and install contactors and relays for lighting control.

157 **Topic:** Contractors and Relays
Standard: Read wiring diagrams involving contactors and relays.

158 **Topic:** Contractors and Relays
Standard: Describe how overload relays operate.

159 **Topic:** Contractors and Relays
Standard: Connect a simple control circuit.

160 **Topic:** Contractors and Relays
Standard: Test control circuits.

Course: Manufacturing: 49.53400 Mechanical and Electrical Systems I

35 **Topic:** Lubrication
Standard: Explain OSHA standards.

36 **Topic:** Lubrication
Standard: Read and interpret an MSDA.

37 **Topic:** Lubrication
Standard: Explain the federal requirements for labeling of materials, i.e. Hazmat Labels.

38 **Topic:** Lubrication
Standard: Explain the EPA program.

39 **Topic:** Lubrication
Standard: Explain lubricant storage.

40 **Topic:** Lubrication
Standard: Explain lubricant classification.

41 **Topic:** Lubrication
Standard: Explain lubricant film protection.

42 **Topic:** Lubrication
Standard: Explain properties of lubricants and how lubricants work.

43 **Topic:** Lubrication
Standard: Explain properties of greases.

44 **Topic:** Lubrication
Standard: Explain how to select lubricants.

45 **Topic:** Lubrication
Standard: Identify and explain types of additives.

46 **Topic:** Lubrication
Standard: Identify and explain types of lubricating oils.

47 **Topic:** Lubrication
Standard: Identify and use lubrication equipment to apply lubricants.

48

Topic: Lubrication

Standard: Read and interpret a lubrication chart.

49

Topic: Lubrication

Standard: Discuss lubricant filtration.

50

Topic: Inroduction to Bearings

Standard: Identify and explain the following: Plain bearings, Ball bearings, Roller bearings, Thrust bearings, Guide bearings, Flanged bearings, Pillow Block bearings, Take-up bearings, Bearing materials.

51

Topic: Inroduction to Bearings

Standard: Explain bearing designation.

52

Topic: Inroduction to Bearings

Standard: Use bearing cross reference data when replacing a bearing.

53

Topic: Piping Practices and Systems: Copper and Plastic

Standard: State the precautions that must be taken when installing refrigerant piping.

54

Topic: Piping Practices and Systems: Copper and Plastic

Standard: Select the right tubing for a job.

55

Topic: Piping Practices and Systems: Copper and Plastic

Standard: Cut and bend tubing.

56

Topic: Piping Practices and Systems: Copper and Plastic

Standard: Join tubing by using flare and compression fittings.

57

Topic: Piping Practices and Systems: Copper and Plastic

Standard: Determine the kinds of hangers and support needed for refrigerant piping.

58

Topic: Piping Practices and Systems: Copper and Plastic

Standard: Insulate refrigerant piping.

59

Topic: Piping Practices and Systems: Copper and Plastic

Standard: State the basic requirements for pressure-testing a system once it has been installed.

60

Topic: Piping Practices and Systems: Copper and Plastic

Standard: Explain and show how to calculate pressure in a system.

61

Topic: Piping Practices and Systems: Copper and Plastic

Standard: Follow basic safety precautions for the installation, operation, and maintenance of refrigerating and air conditioning equipment.

62

Topic: Piping Practices and Systems: Copper and Plastic

Standard: Identify plastic piping types, applications, and pressure ratings.

63

Topic: Piping Practices and Systems: Ferrous Metals

Standard: Identify the types of ferrous metal pipes.

64

Topic: Piping Practices and Systems: Ferrous Metals

Standard: Measure the sizes of ferrous metal pipes.

65

Topic: Piping Practices and Systems: Ferrous Metals

Standard: Identify the common malleable iron fittings.

66

Topic: Piping Practices and Systems: Ferrous Metals

Standard: Cut, ream, and thread ferrous metal pipe.

67

Topic: Piping Practices and Systems: Ferrous Metals

Standard: Join lengths of threaded pipe together and install fittings.

68 **Topic:** Piping Practices and Systems: Ferrous Metals
Standard: Describe the main points to consider when installing pipe runs.

69 **Topic:** Piping Practices and Systems: Ferrous Metals
Standard: Describe the method used to join grooved piping.

70 **Topic:** Piping Practices and Systems: Systems
Standard: Identify and explain the types of piping systems.

71 **Topic:** Piping Practices and Systems: Systems
Standard: Identify piping systems according to color-coding.

72 **Topic:** Piping Practices and Systems: Systems
Standard: Explain thermal expansion.

73 **Topic:** Piping Practices and Systems: Systems
Standard: Explain types and applications of pipe insulation.

74 **Topic:** Smaw Equipment and Setup
Standard: Identify and explain: SMAW safety, welding electrical current, and welding machines.

75 **Topic:** Smaw Equipment and Setup
Standard: Explain setting up arc welding equipment.

76 **Topic:** Smaw Equipment and Setup
Standard: Identify and explain tools for weld cleaning.

77 **Topic:** Smaw Equipment and Setup
Standard: Discuss fume control, hood designs, and ARC goughing & plasma cutters.

78 **Topic:** Overcurrent Protection
Standard: Explain the importance of overcurrent protection.

79 **Topic:** Overcurrent Protection
Standard: Explain the key NEC requirements regarding overcurrent protection.

80 **Topic:** Overcurrent Protection
Standard: Check electrical drawings for conformance to NEC sections that cover short circuit current, fault currents, interrupting ratings, and other sections relating to overcurrent protection.

81 **Topic:** Overcurrent Protection
Standard: Determine let-through current values (peak and rms) when current-limiting overcurrent devices are used.

82 **Topic:** Overcurrent Protection
Standard: Select and size overcurrent protection for specific applications.

83 **Topic:** Distribution Equipment
Standard: List the voltage classifications used in the industry.

84 **Topic:** Distribution Equipment
Standard: Describe the purpose of switchgear.

85 **Topic:** Distribution Equipment
Standard: Describe the basic physical makeup of a switchboard.

86 **Topic:** Distribution Equipment
Standard: Describe the four general classifications of circuit breakers and list the major circuit breaker ratings.

87 **Topic:** Distribution Equipment
Standard: Describe switchgear construction, metering layouts, wiring requirements, and maintenance.

88 **Topic:** Distribution Equipment

Standard: List NEC requirements pertaining to switchgear.

89 **Topic:** Distribution Equipment

Standard: Describe the visual and mechanical inspections and electrical tests associated with low-voltage and medium-voltage cables, metal-enclosed bus ways, and metering and instrumentation.

90 **Topic:** Distribution Equipment

Standard: Describe a ground fault relay system and explain how to test it.

91 **Topic:** Distribution Equipment

Standard: Describe an HVL switch.

92 **Topic:** Distribution Equipment

Standard: Describe a bolted pressure switch and list its maintenance requirements.

93 **Topic:** Distribution Equipment

Standard: Describe a typical switchgear transformer and lists its testing and maintenance requirements.

94 **Topic:** Distribution Equipment

Standard: List the safety precautions associated with instrument transformers and describe their maintenance requirements.

95 **Topic:** Motor Controls

Standard: Describe the operating principles of motor controls and control circuits.

96 **Topic:** Motor Controls

Standard: Select motor controls for specific applications.

97 **Topic:** Motor Controls

Standard: Connect motor controllers for specific applications.

98 **Topic:** Motor Controls

Standard: Explain NEC regulations governing the installation of motor controls.

99 **Topic:** Motor Controls

Standard: Follow NEC requirements when installing motor control circuits.

100 **Topic:** Motor Controls

Standard: Interpret motor control diagrams.

101 **Topic:** Motor Controls

Standard: Size and select thermal overload relays and other protective devices for motor controls.

102 **Topic:** Motor Controls

Standard: Connect control transformers in conjunction with motor control circuits.

103 **Topic:** Motor Maintenance

Standard: Properly store motors and generators.

104 **Topic:** Motor Maintenance

Standard: Test motors and generators.

105 **Topic:** Motor Maintenance

Standard: Make connections for specific types of motors and generators.

106 **Topic:** Motor Maintenance

Standard: Clean open-frame motors.

107 **Topic:** Motor Maintenance

Standard: Lubricate motors that require this type of maintenance.

108 **Topic:** Motor Maintenance
Standard: Collect and record motor data.

109 **Topic:** Motor Maintenance
Standard: Select tools for motor maintenance.

110 **Topic:** Motor Maintenance
Standard: Select instruments for motor testing.

111 **Topic:** Motor Maintenance
Standard: Test motor winding resistance upon receiving a motor and after setting it in place.

112 **Topic:** Motor Maintenance
Standard: Select and use motor testing equipment.

113 **Topic:** Motor Maintenance
Standard: Change the rotation of single-phase, three-phase, and DC motors.

114 **Topic:** Motor Maintenance
Standard: Clean and test open frame motors.

115 **Topic:** Motor Maintenance
Standard: Meter motor circuits for measuring power factors.

116 **Topic:** Motor Maintenance
Standard: Clean, dry, and test motors that have been subjected to water damage.

117 **Topic:** Motor Maintenance
Standard: Describe motor wrapping techniques.

118 **Topic:** Motor Maintenance
Standard: Properly ground flexible wiring systems and motor frames.

119 **Topic:** Motor Maintenance
Standard: Troubleshoot electric motors.

Course: Manufacturing: 49.53500 Mechanical and Electrical Systems II

35 **Topic:** Installation of Components: Couplings
Standard: Identify and explain coupling types.

36 **Topic:** Installation of Components:Couplings
Standard: Install couplings.

37 **Topic:** Installation of Components:Couplings
Standard: Remove couplings.

38 **Topic:** Installation of Components:Couplings
Standard: Perform coupling alignment.

39 **Topic:** Installation of Components: Mechanical Seals
Standard: Identify and explain types of mechanical seals.

40 **Topic:** Installation of Components: Mechanical Seals
Standard: Explain mechanical seal classification.

41 **Topic:** Installation of Components: Mechanical Seals
Standard: Safely and accurately remove and inspect mechanical seals.

42 **Topic:** Installation of Components: Mechanical Seals
Standard: Safely and accurately install mechanical seals.

43 **Topic:** Installation of Components: Belts and Chain Drives
Standard: Identify and explain belt drive types.

44 **Topic:** Installation of Components: Belts and Chain Drives
Standard: Install belt drives.

45 **Topic:** Installation of Components: Belts and Chain Drives
Standard: Identify and explain chain drive types.

46 **Topic:** Installation of Components: Belts and Chain Drives
Standard: Install chain drives.

47 **Topic:** Installation of Components: Belts and Chain Drives
Standard: Install guarding chain and belt drives.

48 **Topic:** Installation of Components: Belts and Chain Drives
Standard: Explain the importance and show how to calculate speeds (motor rpm, gear box ratio, space lot sizes, etc.).

49 **Topic:** Installation of Components: Bearings
Standard: Remove bearings.

50 **Topic:** Installation of Components: Bearings
Standard: Troubleshoot bearings.

51 **Topic:** Installation of Components: Bearings
Standard: Install bearings.

52 **Topic:** Installation of Components: Gaskets and Packing
Standard: Identify various types of gaskets and gasket material.

53 **Topic:** Installation of Components: Gaskets and Packing
Standard: Identify various types of packing.

54 **Topic:** Installation of Components: Gaskets and Packing
Standard: Describe uses of packing.

55 **Topic:** Installation of Components: Gaskets and Packing
Standard: Describe uses of O-rings.

56 **Topic:** Installation of Components: Gaskets and Packing
Standard: Describe uses of gaskets.

57 **Topic:** Installation of Components: Gaskets and Packing
Standard: Fabricate gaskets.

58 **Topic:** Installation of Components: Gaskets and Packing
Standard: Use gasket sealants.

59 **Topic:** Installation of Components: Seals
Standard: Identify and explain types of seals.

60 **Topic:** Installation of Components: Seals
Standard: Identify and explain seal materials.

61 **Topic:** Installation of Components: Seals
Standard: Remove and install seals.

62 **Topic:** Pumps

Standard: Identify and explain centrifugal pumps, rotary pumps, reciprocating pumps, metering pumps, and vacuum pumps.

63 **Topic:** Pumps

Standard: Explain net positive suction head and cavitations.

64 **Topic:** Pumps

Standard: Install pumps.

65 **Topic:** Pumps

Standard: Use pump curves for troubleshooting.

66 **Topic:** Pumps

Standard: Identify pumps needed for hazardous materials, i.e. acid & caustic.

67 **Topic:** Basic Hydraulic Systems

Standard: Explain hydraulic system safety.

68 **Topic:** Basic Hydraulic Systems

Standard: Explain the principles of hydraulics.

69 **Topic:** Basic Hydraulic Systems

Standard: Identify and explain hydraulic fluids, valves, pumps and motors.

70 **Topic:** Basic Hydraulic Systems

Standard: Explain when to use a hydraulic control system.

71 **Topic:** Basic Pneumatic Systems

Standard: Explain pneumatic safety.

72 **Topic:** Basic Pneumatic Systems

Standard: Explain the physical characteristics of gases.

73 **Topic:** Basic Pneumatic Systems

Standard: Explain the pneumatic transmission of energy.

74 **Topic:** Basic Pneumatic Systems

Standard: Explain the principles of compressor operation.

75 **Topic:** Basic Pneumatic Systems

Standard: Identify and explain types of compressors.

76 **Topic:** Basic Pneumatic Systems

Standard: Explain compressed-air treatment/drying.

77 **Topic:** Basic Pneumatic Systems

Standard: Identify and explain pneumatic system components and symbols.

78 **Topic:** Basic Pneumatic Systems

Standard: Explain when to use a pneumatic control system.

Course: Manufacturing: 49.53600 Integrating Systems

35 **Topic:** Basic Electronic Theory

Standard: Identify electronic system components.

36 **Topic:** Basic Electronic Theory

Standard: Describe the electrical characteristics of solid-state devices.

37

Topic: Basic Electronic Theory

Standard: Describe the basic materials that make up solid-state devices.

38

Topic: Basic Electronic Theory

Standard: Describe and identify the various types of transistors and explain how they operate.

39

Topic: Basic Electronic Theory

Standard: Interpret electronic schematic diagrams.

40

Topic: Basic Electronic Theory

Standard: Describe and connect diodes.

41

Topic: Basic Electronic Theory

Standard: Describe and connect light-emitting diodes (LED - LCD).

42

Topic: Basic Electronic Theory

Standard: Describe and connect silicon-controlled rectifiers (SCR).

43

Topic: Basic Electronic Theory

Standard: Identify the leads of various solid=state devices.

44

Topic: Basic Electronic Theory

Standard: Describe the three basic operational amplifier circuits.

45

Topic: Programmable Logic Controllers

Standard: Describe the function and purpose of a programmable logic controller.

46

Topic: Programmable Logic Controllers

Standard: Compare hardwired and PLC systems.

47

Topic: Programmable Logic Controllers

Standard: Count and convert between the following number systems: decimal, binary, octal, hexadecimal.

48

Topic: Programmable Logic Controllers

Standard: Explain the purpose of the following binary codes: ASCII, BCD, Gray.

49

Topic: Programmable Logic Controllers

Standard: Describe the purpose of the various power supplies used within a PLC.

50

Topic: Programmable Logic Controllers

Standard: Explain the general function of an Input/Output Module including the following types: discrete, numerical data, special, remote.

51

Topic: Programmable Logic Controllers

Standard: Explain the power supply and ground connections to I/O Modules.

52

Topic: Programmable Logic Controllers

Standard: State the function of the PLC processor module.

53

Topic: Programmable Logic Controllers

Standard: Explain the interrelations between the following microprocessor components: communication buses, microprocessor IC, memory.

54

Topic: Programmable Logic Controllers

Standard: State the characteristics of the following types of memory: RAM, ROM, PROM, EPROM, EEPROM/UVPROM.

55

Topic: Programmable Logic Controllers

Standard: Describe the characteristics and features of a PLC processor and module including: front panel features, scanning, memory.

56

Topic: Programmable Logic Controllers

Standard: Explain the purpose of PLC software and firmware.

57

Topic: Programmable Logic Controllers

Standard: Describe the features and the differences between the following PLC programming languages: Relay ladder logic, Boolean mnemonics, English statements, functional blocks, and machine stage.

58

Topic: Programmable Logic Controllers

Standard: Describe the features of the following: Relay ladder logic instruction categories: relay, timer/counter, arithmetic, data manipulation, data transfer, and program control.

59

Topic: Programmable Logic Controllers

Standard: Explain the principles used to correlate PLC hardware components to software instructions.

60

Topic: Programmable Logic Controllers

Standard: Explain the purpose and use of the following MS-DOS commands: Selecting the drive, directories, subdirectories, copying files, deleting files, and wildcards.

61

Topic: Manufacturing Processes

Standard: Define the terms separating and forming as it relates to manufacturing.

62

Topic: Manufacturing Processes

Standard: Differentiate between separating processes such as shearing, machining, and nontraditional separating.

63

Topic: Manufacturing Processes

Standard: Identify forming processes including casting, molding, compression, stretching, and conditioning.

64

Topic: Manufacturing Processes

Standard: Describe differences among various combining processes: mixing, bonding, coating, and mechanical fastening.

65

Topic: Manufacturing Processes

Standard: Describe the differences in separating with manual machines versus computerized numerical machines.

66

Topic: Manufacturing Processes

Standard: Describe non-ferrous extrusion and plastic extrusion.

67

Topic: Manufacturing Processes

Standard: Explain the purpose and use of: digital communications, man-machine interfaces, variable speed drive systems, and principles of calibration.

68

Topic: Computerized Numerical Controlled Equipment

Standard: Identify the components of a CNC machine (Mill and/or Lathe).

69

Topic: Computerized Numerical Controlled Equipment

Standard: Follow proper safety procedures in operating a CNC machine.

70

Topic: Computerized Numerical Controlled Equipment

Standard: Operate the CNC Control Panel.

71

Topic: Computerized Numerical Controlled Equipment

Standard: Explain the functions of G- and M- codes.

72

Topic: Computerized Numerical Controlled Equipment

Standard: Design a basic CNC program.

73

Topic: Computerized Numerical Controlled Equipment

Standard: Machine a piece from the program.

74

Topic: Computerized Numerical Controlled Equipment

Standard: Explain what is meant by CAD/CAM.

75

Topic: Forming

Standard: Identify different types of conditioning.

76 **Topic:** Forming
Standard: Identify several major types of casting and molding processes.

77 **Topic:** Forming
Standard: Identify products that are commonly created from casting and molding processes.

78 **Topic:** Automation and Material Handling
Standard: Define manufacturing terms: assembly lines, factory system, mass production.

79 **Topic:** Automation and Material Handling
Standard: Describe the use of computers in the manufacturing environment.

80 **Topic:** Automation and Material Handling
Standard: Explain how robots are used in manufacturing processes.

81 **Topic:** Automation and Material Handling
Standard: Operate a robot.

82 **Topic:** Automation and Material Handling
Standard: Define automation islands.

83 **Topic:** Automation and Material Handling
Standard: Define industrial control systems.

84 **Topic:** Automation and Material Handling
Standard: Compare and contrast open and closed loop systems.

85 **Topic:** Automation and Material Handling
Standard: Define and identify types of control devices.

86 **Topic:** Automation and Material Handling
Standard: Define a manufacturing cell and explain the purpose.

87 **Topic:** Automation and Material Handling
Standard: Define methods of automated assembly in a flexible manufacturing cell.

88 **Topic:** Automation and Material Handling
Standard: Define types of material handling equipment.

89 **Topic:** Automation and Material Handling
Standard: Explain how conveyors differ.

90 **Topic:** Automation and Material Handling
Standard: Define an automated guided vehicle (AGV).

91 **Topic:** Automation and Material Handling
Standard: Define bar coding and explain how it works.

92 **Topic:** Automation and Material Handling
Standard: Define types of packaging equipment and explain how it works.

Course: Sheet Metal: Core Skills

1 **Topic:** Basic Skills
Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills

Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills

Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills

Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills

Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills

Standard: Identify problems, alternative solutions, and consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15 **Topic:** Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16 **Topic:** Interpersonal Skills

Standard: Share knowledge and skills with others.

17 **Topic:** Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18 **Topic:** Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19 **Topic:** Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20 **Topic:** Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21 **Topic:** Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22 **Topic:** Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23 **Topic:** Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24 **Topic:** Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25 **Topic:** Technology

Standard: Utilize a variety of technologies.

26 **Topic:** Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27 **Topic:** Business Aspects

Standard: Identify forms of business ownership.

28 **Topic:** Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29 **Topic:** Business Aspects

Standard: Demonstrate understanding of the individual's role, responsibilities, and relationships in the organizational structure of a business.

30 **Topic:** Business Aspects

Standard: Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

31 **Topic:** Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32 **Topic:** Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33 **Topic:** Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34 **Topic:** Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

Course: Sheet Metal: 48.58100 Introduction to Metals

35 **Topic:** Oxyfuel Cutting

Standard: Explain oxyfuel cutting safety.

36 **Topic:** Oxyfuel Cutting

Standard: Identify and explain oxyfuel cutting equipment.

37 **Topic:** Oxyfuel Cutting

Standard: Set up oxyfuel equipment.

38 **Topic:** Oxyfuel Cutting
Standard: Light and adjust an oxyfuel torch.

39 **Topic:** Oxyfuel Cutting
Standard: Shut down oxyfuel cutting equipment.

40 **Topic:** Oxyfuel Cutting
Standard: Disassemble oxyfuel equipment.

41 **Topic:** Oxyfuel Cutting
Standard: Change empty cylinders.

42 **Topic:** Oxyfuel Cutting
Standard: Perform oxyfuel cutting: · Straight line and square shapes · Piercing and slot cutting · Bevels · Washing · Gouging

43 **Topic:** Shielded Metal Arc Welding-Equipment And Setup
Standard: Identify and explain SMAW safety.

44 **Topic:** Shielded Metal Arc Welding-Equipment And Setup
Standard: Identify and explain welding electrical current.

45 **Topic:** Shielded Metal Arc Welding-Equipment And Setup
Standard: Identify and explain arc welding machines.

46 **Topic:** Shielded Metal Arc Welding-Equipment And Setup
Standard: Explain setting up arc welding equipment.

47 **Topic:** Shielded Metal Arc Welding-Equipment And Setup
Standard: Identify and explain tools for weld cleaning.

48 **Topic:** Shielded Metal Arc Welding-Electrodes And Selection
Standard: Explain considerations for selecting electrodes.

49 **Topic:** Shielded Metal Arc Welding-Electrodes And Selection
Standard: Identify and explain the American Welding Society (AWS) and the American Society of Mechanical Engineers (ASME) filler metal classification system.

50 **Topic:** Shielded Metal Arc Welding-Electrodes And Selection
Standard: Identify and explain different types of filler metals.

51 **Topic:** Shielded Metal Arc Welding-Electrodes And Selection
Standard: Explain the storage and control of filler metals.

52 **Topic:** Shielded Metal Arc Welding-Electrodes And Selection
Standard: Explain filler metal traceability requirements and how to use applicable code requirements.

53 **Topic:** Introduction To The Sheet Metal Trade
Standard: Describe what is meant by pride of workmanship in the sheet metal trade.

54 **Topic:** Introduction To The Sheet Metal Trade
Standard: Name the general applications of sheet metal construction.

55 **Topic:** Introduction To The Sheet Metal Trade
Standard: List the basic materials used in sheet metal work.

56 **Topic:** Introduction To The Sheet Metal Trade
Standard: Summarize the history and development of the trade.

57 **Topic:** Introduction To The Sheet Metal Trade
Standard: Describe the development of apprenticeship training.

58 **Topic:** Introduction To The Sheet Metal Trade

Standard: Describe what is involved in becoming part of a sheet metal apprentice-training program in the United States today.

59 **Topic:** Tools Of The Trade

Standard: Identify and describe the proper use of tools used in the sheet metal trade.

60 **Topic:** Tools Of The Trade

Standard: State general rules for safety when using tools.

61 **Topic:** Tools Of The Trade

Standard: Describe proper maintenance procedures for tools.

62 **Topic:** Principles Of Layout

Standard: Define basic trade terms pertaining to sheet metal layout.

63 **Topic:** Principles Of Layout

Standard: Identify and explain the three development methods for laying out sheet metal patterns.

64 **Topic:** Introduction To Sheet Metal Processes

Standard: Demonstrate skill and competence in the selection and use of layout and marking tools.

65 **Topic:** Introduction To Sheet Metal Processes

Standard: Demonstrate skill in the selection and use of hand snips for cutting out sheet metal parts and patterns.

66 **Topic:** Introduction To Sheet Metal Processes

Standard: Demonstrate skill and competence in the selection and use of cutting and forming tools and equipment.

67 **Topic:** Introduction To Sheet Metal Processes

Standard: Demonstrate skill and competence in the construction of seams and edges.

68 **Topic:** Introduction To Sheet Metal Processes

Standard: Demonstrate skill and competence in riveting and soldering sheet metal products.

69 **Topic:** Orientation To The Machining Trade

Standard: Describe the history of the machining trade.

70 **Topic:** Orientation To The Machining Trade

Standard: Identify the stages of progress within the machining trade.

71 **Topic:** Orientation To The Machining Trade

Standard: Identify the responsibility of a person working in the machining industry.

72 **Topic:** Orientation To The Machining Trade

Standard: State the personal characteristics of a professional.

73 **Topic:** Orientation To The Machining Trade

Standard: Explain the importance of safety in the machining industry.

74 **Topic:** Reading, Working With, And Drawing Blueprints

Standard: Identify and explain a machinist print.

75 **Topic:** Reading, Working With, And Drawing Blueprints

Standard: Identify and explain lines and section views.

76 **Topic:** Reading, Working With, And Drawing Blueprints

Standard: Identify and explain object views.

77 **Topic:** Reading, Working With, And Drawing Blueprints

Standard: Identify and explain dimensioning.

78 **Topic:** Reading, Working With, And Drawing Blueprints
Standard: Identify and explain notes and special requirements.

79 **Topic:** Reading, Working With, And Drawing Blueprints
Standard: Read machinist shop prints.

80 **Topic:** Machining Hand And Power Tools
Standard: Identify the hand tools used by machinists and describe their uses.

81 **Topic:** Machining Hand And Power Tools
Standard: Use hand tools in a safe and appropriate manner.

82 **Topic:** Machining Hand And Power Tools
Standard: State the general safety rules for operating all types of power tools.

83 **Topic:** Machining Hand And Power Tools
Standard: Identify stationary power tools commonly used by machinists.

84 **Topic:** Machining Hand And Power Tools
Standard: Identify the portable power tools commonly use by machinists.

85 **Topic:** Machining Hand Power Tools
Standard: Use portable and stationary tools in a safe and appropriate manner.

Course: Sheet Metal: 48.58200 Foundations of Sheet Metal

35 **Topic:** Math Applications I
Standard: Convert denominate numbers and multiply and divide them.

36 **Topic:** Math Applications I
Standard: Calculate successfully using various rule measurements.

37 **Topic:** Math Applications I
Standard: Calculate successfully using appropriate linear, square, weight, and volume measurements.

38 **Topic:** Math Applications I
Standard: Construct simple geometric figures and solve basic geometry problems that relate to the sheet metal trade.

39 **Topic:** Fasteners, Hangers, Supports
Standard: Identify the various kinds of fasteners used in sheet metal work.

40 **Topic:** Fasteners, Hangers, And Supports
Standard: Use the right fasteners for the right job.

41 **Topic:** Fasteners, Hangers, And Supports
Standard: Identify the various aspects of screw and bolt configurations.

42 **Topic:** Fasteners, Hangers, And Supports
Standard: Describe some of the more common methods of supporting ducts.

43 **Topic:** Fasteners, Hangers, And Supports
Standard: Identify the materials used for hanging and supporting ducts.

44 **Topic:** Fasteners, Hangers, And Supports
Standard: Identify the factors that pertain to the selection and use of hangers and supports.

45 **Topic:** Fasteners, Hangers, And Supports
Standard: Demonstrate skill in the installation of duct fasteners, hangers, and supports.

46 **Topic:** Steel And Other Metals

Standard: State the difference between a pure metal and an alloy.

47 **Topic:** Steel And Other Metals

Standard: List the eleven common properties of metals.

48 **Topic:** Steel And Other Metals

Standard: State the chief types of metals.

49 **Topic:** Steel And Other Metals

Standard: Measure the gauge of sheet metal.

50 **Topic:** Basic Piping Practices

Standard: State the various materials for which pipe is made.

51 **Topic:** Basic Piping Practices

Standard: List applications of various materials.

52 **Topic:** Basic Piping Practices

Standard: List the common methods employed for joining pipe.

53 **Topic:** Basic Piping Practices

Standard: List the common types of pipe hangers and supports.

Course: Sheet Metal: 48.58300 Parallel Line Development

35 **Topic:** Fabrication I- Parallel Line Development

Standard: Demonstrate an understanding of parallel line development as one of the three development methods for laying out sheet metal patterns.

36 **Topic:** Fabrication I- Parallel Line Development

Standard: Demonstrate competency in parallel line development layout procedures.

37 **Topic:** Fabrication I- Parallel Line Development

Standard: Demonstrate how to lay out patterns utilizing basic parallel line development.

38 **Topic:** Fabrication I- Parallel Line Development

Standard: Demonstrate an understanding of parallel line development as a method for fabricating sheet metal fittings and other items.

39 **Topic:** Fabrication I- Parallel Line Development

Standard: Demonstrate the proper cutting and forming of basic patterns utilizing parallel line development.

40 **Topic:** Fabrication I- Parallel Line Development

Standard: Correctly fabricate selected duct run fittings.

41 **Topic:** Blueprints And Specifications

Standard: Demonstrate an ability to interpret blueprints and specifications.

42 **Topic:** Blueprints And Specifications

Standard: Demonstrate an ability to use section, elevation, and detail views or plans for interpreting drawings and blueprints.

43 **Topic:** Blueprints And Specifications

Standard: Demonstrate an ability to use mechanical, electrical, and plumbing drawings to interpret architectural information.

44 **Topic:** Blueprints And Specifications

Standard: Demonstrate an ability to use specifications for information pertaining to specific portions of the construction job.

35 **Topic:** Math Applications II

Standard: Perform mathematical tasks necessary for solving linear, area, volume, and angular measurement problems.

36 **Topic:** Math Applications II

Standard: Correctly apply mathematical symbols in the solution of mathematical problems.

37 **Topic:** Math Applications II

Standard: Solve percentage problems.

38 **Topic:** Math Applications II

Standard: Understand, define, and solve ratio and proportion problems and equations.

39 **Topic:** Math Applications II

Standard: Sequentially solve problems with the use of simple equations.

40 **Topic:** Math Applications II

Standard: Understand how to use protractors, vernier calipers, and micrometers for angle and tolerance measurement problems.

41 **Topic:** Math Applications II

Standard: Calculate the number of fitting blanks that can be cut from a given dimension of sheet metal stock.

42 **Topic:** Math Applications II

Standard: Calculate stretchouts of square fittings, rectangular fittings, rectangular box fittings, circular, and cone fittings.

43 **Topic:** Bend Allowances

Standard: Describe the factors that influence bend allowances on sheet metal blanks.

44 **Topic:** Bend Allowances

Standard: Demonstrate an understanding of the calculations necessary for determining proper bend allowances on selected sheet metal problems.

45 **Topic:** Bend Allowances

Standard: Demonstrate skill in the determining bend allowances on selected sheet metal problems.

46 **Topic:** Soldering

Standard: Identify soldering tools and materials.

47 **Topic:** Soldering

Standard: Use and skillfully manipulate soldering tools and materials.

48 **Topic:** The SMACNA Manuals

Standard: Demonstrate skill in locating standards for selected topics, fittings, or components.

49 **Topic:** The SMACNA Manuals

Standard: Define the difference between standards and codes or ordinances.

50 **Topic:** The SMACNA Manuals

Standard: Demonstrate skill in locating selected information in illustrations and tables.

51 **Topic:** The SMACNA Manuals

Standard: List other pertinent organizations that establish codes and standards.

52 **Topic:** Sheet Metal Duct Fabrication Standards

Standard: Understand the effect of operating pressure on the design of a duct system.

53 **Topic:** Sheet Metal Duct Fabrication Standards

Standard: Determine sealing requirements for a selected duct run by using reference charts and tables.

54 **Topic:** Sheet Metal Duct Fabrication Standards

Standard: Determine minimum gauge requirements for selected duct runs by using reference charts and tables.

55 **Topic:** Sheet Metal Duct Fabrication Standards

Standard: Determine minimum connector and reinforcing requirements for selected duct runs by using reference charts and tables.

56 **Topic:** Sheet Metal Duct Fabrication Standards

Standard: Describe the purpose of a tie rod and determine when a tie rod is optional or mandatory by using reference charts and tables.

57 **Topic:** Sheet Metal Duct Fabrication Standards

Standard: Identify the different types of acceptable longitudinal seams, including application and any limitations.

58 **Topic:** Insulation

Standard: Describe the principles of thermal and acoustic insulation as they apply to the sheet metal industry.

59 **Topic:** Insulation

Standard: Describe the types of insulation commonly used in the sheet metal trade.

60 **Topic:** Insulation

Standard: Demonstrate a degree of competency in the installation of selected types of duct insulation.

61 **Topic:** Roof Flashing

Standard: Demonstrate skill in understanding the principles of weather sealing as they apply to architectural sheet metal work.

62 **Topic:** Roof Flashing

Standard: Demonstrate skill in fabricating selected flashing components.

63 **Topic:** Roof Flashing

Standard: Demonstrate skill in understanding installation procedures for selected chimney flashing members.

Course: Sheet Metal: 48.58500 Radial Line Development

35 **Topic:** Fabrication II- Radial Line Development

Standard: Describe the principles of radial line development used to determine layouts for sheet metal fittings.

36 **Topic:** Fabrication II- Radial Line Development

Standard: Use the principles of radial line development for the layout of selected sheet metal fittings.

37 **Topic:** Fabrication II- Radial Line Development

Standard: Demonstrate skill in the layout and fabrication of selected sheet metal fittings and related tasks.

38 **Topic:** Gutters And Downspouts

Standard: Demonstrate skill in understanding the principles of roof design and drainage systems.

39 **Topic:** Gutters And Downspouts

Standard: Demonstrate skill in the calculating downspout and gutter sizes.

40 **Topic:** Gutters And Downspouts

Standard: Identify, lay out, and fabricate selected drainage components.

35 **Topic:** Principles Of Airflow
Standard: Explain the principles of airflow that affect the design and sizing of duct run systems.

36 **Topic:** Principles Of Airflow
Standard: Identify the components of an air distribution system.

37 **Topic:** Principles Of Airflow
Standard: Define the terms related to airflow in ducts.

38 **Topic:** Principles Of Airflow
Standard: Understand the effects of duct sizes, duct shapes, and duct fittings on airflow.

39 **Topic:** Associated Equipment
Standard: Recognize heating and cooling equipment associated with sheet metal installation.

40 **Topic:** Associtated Equipment
Standard: Describe the function and operation of each piece of equipment.

41 **Topic:** Associated Equipment
Standard: Explain the location of selected pieces of equipment in the HVACR system.

42 **Topic:** Principles Of Refrigeration
Standard: Describe the refrigeration cycle.

43 **Topic:** Principles Of Refrigeration
Standard: Identify refrigeration system components.

44 **Topic:** Principles Of Refrigeration
Standard: Indicate the placement of selected cooling system components and air-delivery duct runs.

45 **Topic:** Fiberglass Duct
Standard: Describe the type of material used for fabricating fiberglass duct.

46 **Topic:** Fiberglass Duct
Standard: Describe the common procedures necessary for the layout and fabrication of selected fiberglass duct run fittings.

47 **Topic:** Fiberglass Duct
Standard: Identify the tools and equipment necessary for the fabrication of selected fiberglass duct run fittings.

48 **Topic:** Fiberglass Duct
Standard: Demonstrate competence in the layout and fabrication of selected fiberglass duct run fittings.

49 **Topic:** Field Measuring And Fitting
Standard: Describe common practices used for field measuring and layout of duct runs and fittings.

50 **Topic:** Field Measuring And Fitting
Standard: Demonstrate competence in solving selected field measuring problems.

51 **Topic:** Field Measuring And Fitting
Standard: Apply standard rules and practice for solving selected field measurement problems.

Course: Sheet Metal: 48.58700 Triangulation Fabrication

35 **Topic:** Fabrication III- Triangulation
Standard: Describe the principles of triangulation used to determine measurements for duct run fittings.

36 **Topic:** Fabrication III- Triangulation
Standard: Use the principles of triangulation for laying out selected duct run fittings.

37 **Topic:** Fabrication III- Triangulation
Standard: Demonstrate skill in the development, layout, and fabrication of selected duct run fittings and related tasks.

38 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Understand the basic theory of arc welding.

39 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: List the health and safety hazards of arc welding.

40 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Explain the characteristics and uses of direct-current welding machines, alternating current machines, and AC-DC arc-welding machines.

41 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Describe the types and uses of electrodes.

42 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Categorize welding electrodes according to the American Welding Society's (AWS) classification system.

43 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Specify the safety requirements for welding helmets and protective clothing.

44 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Make button welds, run weld beads, and build a pad of beads with shielded metal-arc welding (SMAW) electrodes.

45 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Weld in the flat, horizontal, vertical, and overhead positions with SMAW electrodes.

46 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Describe the basic setups for the gas metal-arc and gas tungsten-arc welding processes.

47 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Describe the basic brazing process.

48 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: State the safety precautions governing flame cutting.

49 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Light and extinguish the oxyacetylene torch properly and safely.

50 **Topic:** Introduction To Welding, Brazing, And Cutting
Standard: Make straight cuts on carbon steel plate.

Course: Sheet Metal: 48.58800 Sheet Metal Speciality Skills

35 **Topic:** Shop Production And Organization
Standard: Outline the procedure necessary for planning the workday.

36 **Topic:** Shop Production And Organization

Standard: Identify the factors that affect speed, efficiency, and minimum waste of material.

37 **Topic:** Shop Production And Organization

Standard: Describe methods of utilizing scrap metal.

38 **Topic:** Shop Production And Organization

Standard: Explain how shop assignment procedures are organized.

39 **Topic:** Shop Production And Organization

Standard: Outline a typical job planning and production flow for a sheet metal production shop.

40 **Topic:** Shop Production And Organization

Standard: Describe how to coordinate sheet metal work with other trades.

41 **Topic:** Shop Production And Organization

Standard: Explain how to project manpower and material costs.

42 **Topic:** Shop Production And Organization

Standard: Identify a procedure for utilizing manpower effectively.

43 **Topic:** Shop Production And Organization

Standard: Describe the role relationships between the supervisory and production staff for a typical sheet metal shop operation.

44 **Topic:** Air Balance

Standard: Explain the principles of air balance.

45 **Topic:** Air Balance

Standard: Define common terms associated with grilles, registers, and diffusers.

46 **Topic:** Air Balance

Standard: Describe the more commonly accepted methods of performing air balancing procedures.

47 **Topic:** Air Balance

Standard: Identify the tools and instruments necessary for balancing air distribution systems.

48 **Topic:** Air Balance

Standard: Describe the operation and control of air balancing components.

49 **Topic:** Louvers, Dampers, And Access Doors

Standard: Explain the purpose of selected louvers, dampers, and access doors.

50 **Topic:** Louvers, Dampers, And Access Doors

Standard: Describe the procedures necessary for fabrication of selected louvers, dampers, and access doors.

51 **Topic:** Louvers, Dampers, And Access Doors

Standard: Demonstrate competence in the layout, development, and fabrication of selected louvers, dampers, and access doors.

Course: Sheet Metal: 48.58900 Specialized Layout Techniques

35 **Topic:** Fabrication IV-Comprehensive Review

Standard: Demonstrate understanding of parallel line development, radial line development, and triangulation as the three development methods for laying out sheet metal patterns.

36 **Topic:** Fabrication IV-Comprehensive Review

Standard: Demonstrate skill in the layout and fabrication of selected sheet metal fittings by using the most suitable development method.

37 **Topic:** Fabrication IV-Comprehensive Review

Standard: Develop knowledge of shortcuts in fabrication.

38 **Topic:** Fume And Exhaust Systems Design

Standard: Describe how to interpret codes and specifications pertaining to selected fume or exhaust systems.

39 **Topic:** Fume And Exhaust Systems Design

Standard: Select appropriate materials for fabrication of identified exhaust or fume systems or components.

40 **Topic:** Fume And Exhaust Systems Designs

Standard: Lay out, fabricate, and install selected fume or exhaust systems or components.

Course: Telecommunications Technology: 10.53100 Fundamentals of Telecommunications

35 **Topic:** Communication Orientation

Standard: Identify technical career opportunities and employment requirements in the telecommunications industry.

36 **Topic:** Communication Orientation

Standard: Identify professional associations related to the telecommunications profession.

37 **Topic:** Communication Orientation

Standard: Describe the history and components of telecommunications.

38 **Topic:** Communication Orientation

Standard: Describe the evolution of telecommunications, including analog-to-frequency and frequency-to-analog conversion.

39 **Topic:** Communication Orientation

Standard: Describe current issues impacting the telecommunications industry.

40 **Topic:** Communication Orientation

Standard: Explain how organizational structure affects job performance, customer service, assigned duties, developments of policies and procedures, profits, diversity, teamwork, and joint committees.

41 **Topic:** Communication Orientation

Standard: Explain the meaning of symbols, acronyms, and references, wiring diagrams, schematics and maps.

42 **Topic:** Communication Orientation

Standard: Describe the impact of communication standards and governing agencies within the telecommunications industry including: IEEE, ITEA, BICSI, and EIA.

43 **Topic:** Safety in the Telecommunications Profession

Standard: Comply with safety practices involving tools, hands, and eyes: mechanical, electrical, and environmental conditions: microwave radiation; vehicles; optical laser; Radar/high frequency radio; fiber optic handling; aerial lift system and platforms; ladders; Hazcom and Hazardous Material.

44 **Topic:** Safety in the Telecommunications Profession

Standard: Use appropriate protective equipment.

45 **Topic:** Safety in the Telecommunications Profession

Standard: Comply with local, state, and federal procedures for placing flags, signs, cones, and flares.

46 **Topic:** Safety in the Telecommunications Profession

Standard: Communicate appropriate safety precautions to the public.

47 **Topic:** Safety in the Telecommunications Profession

Standard: Maintain basic first aid and CPR competencies.

48 **Topic:** Safety in the Telecommunications Profession

Standard: Identify hazards at a work site.

49

Topic: Safety in the Telecommunications Profession

Standard: Identify possible consequences resulting from failure to notify (i.e., "call before you dig," [BUD]).

50

Topic: Customer Service

Standard: Gather and confirm information related to customer needs.

51

Topic: Customer Service

Standard: Apply knowledge of telecommunications to improve the service and solve problems for customers.

52

Topic: Customer Service

Standard: Demonstrate expected customer service despite crisis situations including natural disasters.

53

Topic: Customer Service

Standard: Demonstrate service that meets the intent of state and national guidelines for customer rights.

54

Topic: Customer Service

Standard: Demonstrate the ability to explain to customers the difference between analog and digital transmission and their applications within the entire service loop.

55

Topic: Customer Service

Standard: Identify accurate data related to problems, time for repair, and extent of the service required to solve problem.

56

Topic: Customer Service

Standard: Demonstrate working knowledge of Microsoft Office Suites (including Outlook).

57

Topic: Customer Service

Standard: Explain the products and/or service that best meet the needs of customers.

58

Topic: Customer Service

Standard: Greet customers.

59

Topic: Customer Service

Standard: Describe the call center working environment and related technology.

60

Topic: Customer Service

Standard: Analyze customers' verbal signals.

61

Topic: Customer Service

Standard: Demonstrate the use of customer service skills and procedures during service calls.

62

Topic: Legal Issues

Standard: Comply with applicable codes, rules, regulations and standards at the city, state, and federal levels.

63

Topic: Legal Issues

Standard: Adapt rules and principles to new applications, still following codes, rules, and standards.

64

Topic: Legal Issues

Standard: Comply with FCC and other rules regulations related to the telecommunications industry.

65

Topic: Legal Issues

Standard: Describe the impact of the Department of Justice in the telecommunications industry.

66

Topic: Legal Issues

Standard: State the impact of the international regulatory board on U.S. companies.

67

Topic: Communication Systems and Signal Processing

Standard: Identify the basic elements that make up communication systems.

68

Topic: Communication Systems and Signal Processing

Standard: Identify and describe the principle types of communications systems available today.

69 **Topic:** Communication Systems and Signal Processing

Standard: Describe circuits and components that are contained in the elements of communication systems.

70 **Topic:** Communication Systems and Signal Processing

Standard: State the two fundamental limiting factors in communication systems.

71 **Topic:** Communication Systems and Signal Processing

Standard: Distinguish the difference between analog and digital technologies including applications of AC/DC and applications of digital theory.

72 **Topic:** Communication Systems and Signal Processing

Standard: Identify various signal processing techniques.

73 **Topic:** Telephone Systems

Standard: Define and describe all aspects of basic telephone service.

74 **Topic:** Telephone Systems

Standard: Define the basic telephone system construction.

75 **Topic:** Telephone Systems

Standard: Define POTS, DID, OPX, tie lines, and WAT lines.

76 **Topic:** Telephone Systems

Standard: Describe broadband DSL and ISDN.

77 **Topic:** Telephone Systems

Standard: Explain the difference between LAN and a WAN.

78 **Topic:** Telephone Systems

Standard: Diagram the flow of information within a telephone system including: LATA, NPA, NANP, NXX, IDD, ANI, CO, TO, POP, IOT, and IMT.

79 **Topic:** Telephone Systems

Standard: Define the local area telephone network.

80 **Topic:** Telephone Systems

Standard: Describe local area telephone calling.

81 **Topic:** Telephone Systems

Standard: Describe the local loop.

82 **Topic:** Telephone Systems

Standard: Describe the long distance telephone network.

83 **Topic:** Telephone Systems

Standard: Describe a typical long distance hierarchy telephone system.

84 **Topic:** Telephone Equipment

Standard: List the principle parts of a telephone and explain the function of each.

85 **Topic:** Telephone Equipment

Standard: Describe the operation of mechanical and electronic telephone sets.

86 **Topic:** Telephone Equipment

Standard: Disassemble and reassemble a telephone set.

87 **Topic:** Telephone Equipment

Standard: Describe the operation of an electronic telephone set and local loop.

88 **Topic:** Telephone Equipment

Standard: Measure signals in the local loop of an electronic telephone set.

35 **Topic:** Transmission Service Providers

Standard: Define and explain the purpose of LEC's and the differences between LEC's and Regional Operating Companies.

36 **Topic:** Transmission Service Providers

Standard: Define Independent Telephone Company.

37 **Topic:** Transmission Service Providers

Standard: Define network control points and define NOC.

38 **Topic:** Transmission Service Providers

Standard: Distinguish between bit rate and baud rates.

39 **Topic:** Transmission Service Providers

Standard: Define In-band and Common Channel Signaling (CCS) and SS7, Signaling System 7.

40 **Topic:** Transmission Service Providers

Standard: Identify the basic components of the LEC/IC and PBX communication systems.

41 **Topic:** Transmission Service Providers

Standard: Define CO and list its purpose.

42 **Topic:** Transmission Service Providers

Standard: Define and explain basic switching methods and its evolution.

43 **Topic:** Transmission Service Providers

Standard: Define and discuss common carriers.

44 **Topic:** Transmission Service Providers

Standard: Explain network structures, transmission, and media including: DAL, T1, T3, SONET and OC3-OC 192.

45 **Topic:** Transmission Service Providers

Standard: Explain multiplexing and its importance to today's communication systems.

46 **Topic:** Fundamental of Network Concepts and Transmission Modes

Standard: Define, describe, and discuss fundamental concepts of data communication networks.

47 **Topic:** Fundamental of Network Concepts and Transmission Modes

Standard: Identify fundamental concepts of wireless communication.

48 **Topic:** Fundamental of Network Concepts and Transmission Modes

Standard: Describe the usage of conformance testing and equipment.

49 **Topic:** Fundamental of Network Concepts and Transmission Modes

Standard: Explain the purpose and benefits of end-to-end testing.

50 **Topic:** Fundamental of Network Concepts and Transmission Modes

Standard: Discuss the basic modes of transmission and their relation to various types of transmission media.

51 **Topic:** Transmission Modes

Standard: Explain simplex, duplex, and half-duplex transmission modes.

52 **Topic:** Transmission Modes

Standard: Explain full-duplex transmission over two-wire and four-wire lines.

53 **Topic:** Transmission Media

Standard: Describe the advantages and disadvantages of different transmission media such as copper pairs, coaxial cable, fiber optics, satellite, and microwave

54 **Topic:** Transmission Media

Standard: Explain the strengths and weaknesses with a physical layout including fiber, coaxial, copper, and other medium.

55 **Topic:** Transmission Media

Standard: Explain the meaning of standards related to media installations.

56 **Topic:** Frequency and Bandwidth

Standard: Explain the difference between baseband and broadband signals.

57 **Topic:** Frequency and Bandwidth

Standard: Identify the voice frequency spectrum.

58 **Topic:** Frequency and Bandwidth

Standard: Define attenuation.

59 **Topic:** Frequency and Bandwidth

Standard: Compare and contrast Nyquist's laws, Shannon's law, and their application.

60 **Topic:** Modulation Techniques

Standard: Define analog pulse modulation.

61 **Topic:** Modulation Techniques

Standard: Describe amplitude, width, and position modulation.

62 **Topic:** Modulation Techniques

Standard: Describe Pulse Code Modulation and the characteristics of PCM signals.

63 **Topic:** Modulation Techniques

Standard: Describe the block diagram of a PCM modular and demodulator.

64 **Topic:** Modulation Techniques

Standard: Identify a typical PCM modulator and demodulator circuit.

65 **Topic:** Modulation Techniques

Standard: Measure and observe the operation of a typical PCM modulator and demodulator circuit.

66 **Topic:** Modulation Techniques

Standard: Troubleshoot PCM communication system.

67 **Topic:** Modulation Techniques

Standard: Describe Delta Modulation and the characteristics of DM signals.

68 **Topic:** Modulation Techniques

Standard: Identify a typical DM modulator and demodulator circuit.

69 **Topic:** Modulation Techniques

Standard: Measure and observe the operation of a typical DM modulator and demodulator circuit.

70 **Topic:** Modulation Techniques

Standard: Troubleshoot a DM communication system.

71 **Topic:** Modulation Techniques

Standard: Describe Frequency Shift Keying and the characteristics of FSK signals.

72 **Topic:** Modulation Techniques

Standard: Identify a typical FSK modulator and demodulator circuit.

73 **Topic:** Modulation Techniques

Standard: Measure and observe the operation of a typical FSK modular and demodulator circuit.

74 **Topic:** Modulation Techniques
Standard: Troubleshoot a FSK communication system.

75 **Topic:** Modulation Techniques
Standard: Describe Phase Shift Keying and the characteristics of PSK signals.

76 **Topic:** Modulation Techniques
Standard: Identify a typical PSK modulator and demodulator circuit.

77 **Topic:** Modulation Techniques
Standard: Measure and observe the operation of a typical PSK modulator and demodulator circuit.

78 **Topic:** Modulation Techniques
Standard: Troubleshoot a PSK communication system.

79 **Topic:** Multiplexing Techniques
Standard: Describe time division multiplexing and the characteristics of TDM signals.

80 **Topic:** Multiplexing Techniques
Standard: Identify a typical TDM circuit.

81 **Topic:** Multiplexing Techniques
Standard: Measure the operation of a typical TDM circuit.

82 **Topic:** Multiplexing Techniques
Standard: Troubleshoot a TDM communication system.

83 **Topic:** Multiplexing Techniques
Standard: Describe frequency division multiplexing and the characteristics of FDM signals.

84 **Topic:** Multiplexing Techniques
Standard: Measure the operation of a typical FDM circuit.

85 **Topic:** Multiplexing Techniques
Standard: Troubleshoot a FDM communication system.

86 **Topic:** Multiplexing Techniques
Standard: Describe wave division multiplexing and the characteristics of WDM signals.

Course: Telecommunications Technology: 10.53300 Network Systems

35 **Topic:** Cables and Cabling
Standard: Discuss where unshielded twisted pairs (UTP) are used.

36 **Topic:** Cables and Cabline
Standard: Install and troubleshoot telephone connectors and fittings.

37 **Topic:** Cables and Cabling
Standard: Identify types of copper cables and terminating equipment.

38 **Topic:** Cables and Cabling
Standard: Identify uses of standard binder color/terminal count application and cable pair identification including white/blue, white/orange, white/green, white/brown, and data cable use (Cat2, Cat3, Cat5).

39 **Topic:** Cables and Cabling
Standard: Terminate cable using industry standards configuration termination RJ11, RJ12, RJ45, BNC, and AUI.

40 **Topic:** Cables and Cabling
Standard: Install cable using industry standard tools, telepole, and fishtape.

41 **Topic:** Cables and Cabling
Standard: Perform splicing techniques for copper wire.

42 **Topic:** Cables and Cabling
Standard: Punchdown cables on standard wiring blocks.

43 **Topic:** Cables and Cabling
Standard: Route cable over aerial and buried drops.

44 **Topic:** Cables and Cabling
Standard: Recognize the effects of improper cabling.

45 **Topic:** Cables and Cabling
Standard: State the importance of cable impedance.

46 **Topic:** Cables and Cabling
Standard: Show how to detect shorted and open cables.

47 **Topic:** Cables and Cabling
Standard: Identify methods used for testing wires and cables.

48 **Topic:** Cables and Cabling
Standard: Operate butt-in, toners, subscriber line, and cable locators to detect faults.

49 **Topic:** LANs and Internet Access
Standard: Discuss network architecture and the OSI model.

50 **Topic:** LANs and Internet Access
Standard: Discuss and describe LAN, WAN and the World Wide Web.

51 **Topic:** LANs and Internet Access
Standard: Run LAN Cat 3, coaxial, and fiber optic cable.

52 **Topic:** LANs and Internet Access
Standard: Discuss and interconnect with LANs.

53 **Topic:** LANs and Internet Access
Standard: Discuss and define network protocols.

54 **Topic:** LANs and Internet Access
Standard: Describe procedures/application for residential networks.

55 **Topic:** LANs and Internet Access
Standard: Install and configure Microsoft Windows.

56 **Topic:** LANs and Internet Access
Standard: Install and configure NIC (Network Interface Card)

57 **Topic:** LANs and Internet Access
Standard: Access the Internet.

58 **Topic:** LANs and Internet Access
Standard: Describe principles of Internet Search Engines, Name Servers, and IP Addressing.

59 **Topic:** LANs and Internet Access
Standard: Use Device Manger to check drivers and IRQ setting.

60 **Topic:** LANs and Internet Access
Standard: List Common IRQ conflicts and settings.

61 **Topic:** LANs and Internet Access
Standard: Define the functions of a modem.

62 **Topic:** LANs and Internet Access
Standard: Describe the applications for various modems.

63 **Topic:** LANs and Internet Access
Standard: Describe applications for HUBS and Routers.

64 **Topic:** Fiber Optics
Standard: Identify the components of the visible spectrum and the optical spectrum.

65 **Topic:** Fiber Optics
Standard: Identify the law of reflection and Snell's Law.

66 **Topic:** Fiber Optics
Standard: Describe basic fiber optic communications principles.

67 **Topic:** Fibert Optics
Standard: Explain the operation and describe the three section of a fiber optic system.

68 **Topic:** Fiber Optics
Standard: Identify some optical light sources and optical detectors.

69 **Topic:** Fiber Optics
Standard: Describe singlemode and multimode waveguides.

70 **Topic:** Fiber Optics
Standard: Define SNR and BER.

71 **Topic:** Fiber Optics
Standard: Describe the basic steps to properly splice waveguides.

72 **Topic:** Fiber Optics
Standard: Perform splicing techniques for optical fibers.

73 **Topic:** Fiber Optics
Standard: Determine the losses of adding a non-permanent mechanical splice to a fiber optic cable.

74 **Topic:** Fiber Optics
Standard: Identify a faulted fiber optic system.

75 **Topic:** PBX Systems
Standard: Describe the equipment cabinet, parts, circuit card function and available features of the PBX.

76 **Topic:** PBX Systems
Standard: Identify and inspect a circuit card and describe installation requirements.

77 **Topic:** PBX Systems
Standard: Explain the system configuration.

78 **Topic:** PBX Systems
Standard: Explain installation and test procedures for the PBX system.

79 **Topic:** PBX Systems
Standard: Identify and locate error code display.

80 **Topic:** PBX Systems
Standard: Perform troubleshooting and maintenance procedure on the PBX system.

81 **Topic:** PBX Systems
Standard: Explain multi-line extension telephones

82 **Topic:** Voice Network and Network Communication
Standard: Discuss the public and private switching telephone network.

83 **Topic:** Voice Network and Network Communication
Standard: Describe voice processing and call distribution.

84 **Topic:** Voice Network and Network Communication
Standard: Describe T1 networks and frame and line coding options.

85 **Topic:** Voice Network and Network Communication
Standard: Describe virtual networks.

86 **Topic:** Voice Network and Network Communication
Standard: Troubleshoot network communication interfaces.

87 **Topic:** Voice Network and Network Communication
Standard: Discuss and diagram SNA, X.25 packet switched networks, and SS7.

88 **Topic:** Voice Network and Network Communication
Standard: Discuss, operate, and troubleshoot and ISDN and SONET network media.

89 **Topic:** Microwave and Satellite Systems
Standard: Identify basic microwave principles and recognize the Radio Frequency Spectrum.

90 **Topic:** Microwave and Satellite Systems
Standard: Identify components used for two-way radio, cellular, paging, and mechanized dispatch systems.

91 **Topic:** Microwave and Satellite Systems
Standard: Describe components and applications for wireless networking.

92 **Topic:** Microwave and Satellite Systems
Standard: Identify microwave frequencies factors affecting communication.

93 **Topic:** Microwave and Satellite Systems
Standard: Draw a block diagram of a microwave radio transmitter/receiver system and explain its operation.

94 **Topic:** Microwave and Satellite Systems
Standard: Compare advantages and disadvantages of different microwave transmission lines and accessories.

95 **Topic:** Microwave and Satellite Systems
Standard: Describe the differences between terminal, junction, and point-to-point relay stations used in microwave applications.

96 **Topic:** Microwave and Satellite Systems
Standard: Identify and describe the operation of different types of antennae, solid-state oscillators, and power amplifiers used in microwave radios.

97 **Topic:** Microwave and Satellite Systems
Standard: Describe the basic principle of satellite reception.

98 **Topic:** Microwave and Satellite Systems
Standard: Identify the types of satellite systems and describe their functions and differences.

99 **Topic:** Microwave and Satellite Systems
Standard: Draw and define a block diagram of a satellite system including both uplinks and down-links components.

100 **Topic:** Microwave and Satellite Systems
Standard: Set up both C and KU band television to receive (TVRO) satellite systems.

101 **Topic:** Microwave and Satellite Systems
Standard: Troubleshoot a TVRO system.

102 **Topic:** Microwave and Satellite Systems

Standard: Draw and explain a block diagram of a cellular telephone system illustrating the process and equipment used in transmitting and receiving calls.

103 **Topic:** Microwave and Satellite Systems

Standard: Describe the process by which cellular telephones are interfaced with public switched systems.

Course: Telecommunications Technology: Core Skills

1 **Topic:** Basic Skills

Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically, and create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

3 **Topic:** Basic Skills

Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

4 **Topic:** Basic Skills

Standard: Receive, interpret, and respond to verbal and nonverbal messages in a manner appropriate to a given situation.

5 **Topic:** Basic Skills

Standard: Organize ideas and communicate orally in a clear, concise, and courteous manner.

6 **Topic:** Thinking Skills

Standard: Specify goals, objectives, constraints, and supporting factors.

7 **Topic:** Thinking Skills

Standard: Identify problems, alternative solutions, consequences of alternative solutions, and use appropriate techniques to resolve given problems.

8 **Topic:** Thinking Skills

Standard: Implement a plan of action making modifications as needed to achieve stated objectives.

9 **Topic:** Thinking Skills

Standard: Use effective learning techniques to acquire and apply new knowledge and skills.

10 **Topic:** Personal Qualities

Standard: Assess self accurately, set personal goals, monitor progress, and exhibit self-control.

11 **Topic:** Personal Qualities

Standard: Choose ethical courses of action.

12 **Topic:** Personal Qualities

Standard: Take initiative to accomplish tasks in a timely manner.

13 **Topic:** Personal Qualities

Standard: Exert a high level of effort and persevere towards goal attainment.

14 **Topic:** Personal Qualities

Standard: Demonstrate adaptability, dependability, and responsibility and such social behaviors as tolerance, honesty, empathy, and courtesy.

15

Topic: Interpersonal Skills

Standard: Participate and interact as a team member and leader.

16

Topic: Interpersonal Skills

Standard: Share knowledge and skills with others.

17

Topic: Interpersonal Skills

Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

18

Topic: Interpersonal Skills

Standard: Work to satisfy customer/client expectations.

19

Topic: Interpersonal Skills

Standard: Use strategies appropriate to a given situation to prevent and resolve conflicts.

20

Topic: Resources

Standard: Select goal-relevant activities, prioritize them, manage time, and prepare and follow schedules.

21

Topic: Resources

Standard: Use or prepare budgets, make projections, keep records, and make adjustments to meet objectives.

22

Topic: Resources

Standard: Acquire, store, allocate, and use materials and space efficiently.

23

Topic: Technology

Standard: Prevent, identify, or solve problems with technical or electronic equipment.

24

Topic: Technology

Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

25

Topic: Technology

Standard: Utilize a variety of technologies.

26

Topic: Business Aspects

Standard: Demonstrate understanding of basic economic concepts and how they are applied in business functions and activities.

27

Topic: Business Aspects

Standard: Identify forms of business ownership.

28

Topic: Business Aspects

Standard: Demonstrate understanding of the scope of a business, its place within an industry, and the interrelationship of its parts.

29

Topic: Business Aspects

Standard: Demonstrate understanding of the individual’s role, responsibilities, and relationships in the organizational structure of a business.

30

Topic: Business Aspects

Standard: Maintain safety, health, and environmental standards, and address ergonomic concerns.

31

Topic: Career Development

Standard: Make potential career decisions based upon interests, abilities, and values and formulate appropriate plans to reach career goals.

32

Topic: Career Development

Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

33

Topic: Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

34 **Topic:** Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

Course: Welding: Core Skills

1 **Topic:** Basic Skills

Standard: Locate, understand, and interpret written information in a variety of formats, including such documents as manuals, graphs, reports, and schedules.

2 **Topic:** Basic Skills

Standard: Communicate thoughts, ideas, information, and messages in writing and technologically create documents such as letters, directions, manuals, reports, graphs, and flowcharts.

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Standard: Perform and apply numerical concepts and calculations, and solve problems by choosing appropriately from a variety of mathematical techniques using mental, manual, and technological methods.

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Standard: Demonstrate understanding of the relationship between educational achievement and career planning and how career choices impact family patterns and lifestyle.

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Topic: Career Development

Standard: Demonstrate effective skills for seeking and securing employment.

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Topic: Career Development

Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.

Course: Welding: 48.55100 Arc Welding Processes I

35 **Topic:** Shielded Metal Arc Welding - Beads
Standard: Prepare AC welding equipment.

36 **Topic:** Shielded Metal Arc Welding - Beads
Standard: Strike an arc.

37 **Topic:** Shielded Metal Arc Welding - Beads
Standard: Detect an arc blow.

38 **Topic:** Shielded Metal Arc Welding - Beads
Standard: Make stringer, weave, and overlapping beads.

39 **Topic:** Weld Quality
Standard: Identify and explain codes governing welding.

40 **Topic:** Weld Quality
Standard: Identify and explain weld imperfections and their causes.

41 **Topic:** Weld Quality
Standard: Identify and explain nondestructive examination practices.

42 **Topic:** Weld Quality
Standard: Identify and explain welder qualification tests.

43 **Topic:** Weld Quality
Standard: Explain the importance of quality workmanship.

44 **Topic:** Base Metal Preparation
Standard: Clean base metal for welding or cutting.

45 **Topic:** Base Metal Preparation
Standard: Identify and explain joint design.

46 **Topic:** Base Metal Preparation
Standard: Explain joint design considerations.

47 **Topic:** Base Metal Preparation
Standard: Prepare base metal joints for welding.

Course: Welding: 48.55200 Arc Welding Processes II

35 **Topic:** Shielded Metal Arc Welding - Fillet Welds
Standard: Make fillet welds: · Butt · Edge · Corner · Lap · Tee

36 **Topic:** Joint Fit-Up and Alignment
Standard: Identify and explain job code specifications.

37 **Topic:** Joint Fit-Up and Alignment
Standard: Use fit-up gauges and measuring devices to check joint fit-up.

38 **Topic:** Joint Fit-Up and Alignment
Standard: Use plate and pipe fit-up tools to fit up joints.

39 **Topic:** Joint Fit-Up and Alignment
Standard: Identify and explain distortion and how it is controlled.

40 **Topic:** Joint Fit-Up and Alignment
Standard: Check for joint misalignment and poor fit-up.

41 **Topic:** Welding Symbols
Standard: Identify and explain the various parts of a welding symbol.

42 **Topic:** Welding Symbols
Standard: Identify and explain fillet and groove weld symbols.

43 **Topic:** Welding Symbols
Standard: Identify and explain nondestructive examination symbols.

44 **Topic:** Welding Symbols
Standard: Read welding symbols on drawings, specifications, and Welding Procedure Specifications (WPSs).

45 **Topic:** Physical Characteristics and Mechanical Properties of Metals
Standard: Identify and explain the composition and classifications of base metals.

46 **Topic:** Physical Characteristics and Mechanical Properties of Metals
Standard: Explain and demonstrate field identification methods for base metals.

47 **Topic:** Physical Characteristics and Mechanical Properties of Metals
Standard: Identify and explain the physical characteristics and mechanical properties of metals.

48 **Topic:** Physical Characteristics and Mechanical Properties of Metals
Standard: Identify and explain forms and shapes of structural metals.

49 **Topic:** Physical Characteristics and Mechanical Properties of Metals
Standard: Explain metallurgical considerations for welding metals.

50 **Topic:** Plasma Arc-Cutting
Standard: Set up plasma arc cutting equipment.

51 **Topic:** Plasma Arc-Cutting
Standard: Prepare the work area to safely perform plasma arc cutting.

52 **Topic:** Plasma Arc-Cutting
Standard: Select the correct amperage and gas pressures or flow rates for the type and thickness of metal to be cut.

53 **Topic:** Plasma Arc-Cutting
Standard: Use plasma arc cutting equipment to pierce and cut slots in metal.

54 **Topic:** Plasma Arc-Cutting
Standard: Use plasma arc cutting equipment to square cut metal.

55 **Topic:** Plasma Arc-Cutting
Standard: Use plasma arc cutting equipment to bevel cut metal.

56 **Topic:** Plasma Arc-Cutting
Standard: Dismantle and store the equipment and clean the work area.

Course: Welding: 48.55300 Intermediate Arc Welding Processes I

35 **Topic:** Shielded Metal Arc Welding – Grove Welds with Backing
Standard: Identify and explain groove welds.

36 **Topic:** Shielded Metal Arc Welding – Grove Welds with Backing
Standard: Prepare arc welding equipment for groove welds.

37 **Topic:** Shielded Metal Arc Welding – Grove Welds with Backing

Standard: Identify and explain groove welds with backing.

38 **Topic:** Shielded Metal Arc Welding – Grove Welds with Backing

Standard: Perform shielded metal arc welding (SMAW) on V-butt grove joints: · Flat welds · Horizontal welds · Vertical welds · Overhead welds

39 **Topic:** Shielded Metal Arc Welding – Open V-Butt Welds

Standard: Prepare arc welding equipment for open V-butt welds.

40 **Topic:** Shielded Metal Arc Welding – Open V-Butt Welds

Standard: Identify and explain open V-butt joints and welds.

41 **Topic:** Shielded Metal Arc Welding – Open V-Butt Welds

Standard: Perform shielded metal arc welding (SMAW) on open V-butt joints: · Flat welds · Horizontal welds · Vertical welds · Overhead welds

Course: Welding: 48.55400 Intermediate Arc Welding II

35 **Topic:** Reading Welding Detail Drawings

Standard: Identify and explain a welding detail drawing.

36 **Topic:** Reading Welding Detail Drawings

Standard: Identify and explain lines and section fills.

37 **Topic:** Reading Welding Detail Drawings

Standard: Identify and explain object views.

38 **Topic:** Reading Welding Detail Drawings

Standard: Identify and explain dimensioning.

39 **Topic:** Reading Welding Detail Drawings

Standard: Identify and explain notes and bill of materials.

40 **Topic:** Reading Welding Detail Drawings

Standard: Read welding detail drawings.

41 **Topic:** Shielded Metal Arc Welding – Open-Root Pipe Welds

Standard: Prepare arc welding equipment for open-root V-butt pipe welds.

42 **Topic:** Perform shielded metal arc welding (SMAW) on open-root pipe welds: · 1G welds · 2G welds · 5G welds · 6G welds

Standard: Identify and explain open-root V-butt pipe welds.

43 **Topic:** Shielded Metal Arc Welding – Open-Root Pipe Welds

Standard: Perform shielded metal arc welding (SMAW) on open-root pipe welds: · 1G welds · 2G welds · 5G welds · 6G welds

44 **Topic:** Air Carbon Cutting Arc and Gouging

Standard: Identify and explain the air carbon arc cutting (CAC-A) process and equipment.

45 **Topic:** Air Carbon Cutting Arc and Gouging

Standard: Explain how to select and install air carbon arc cutting (CAC-A) electrodes.

46 **Topic:** Air Carbon Cutting Arc and Gouging

Standard: Prepare the work area and air carbon arc cutting (CAC-A) equipment for safe operation.

47 **Topic:** Air Carbon Cutting Arc and Gouging

Standard: Use air carbon arc equipment for washing and gouging activities.

48 **Topic:** Air Carbon Cutting Arc and Gouging

Standard: Perform storage and housekeeping activities for air carbon arc cutting (CAC-A)equipment.

Course: Welding: 48.55500 Advanced Arc Welding Processes I

35 **Topic:** Preheating and Post-Weld Treatment of Metals

Standard: Explain how to preheat metals.

36 **Topic:** Preheating and Post-Weld Treatment of Metals

Standard: Describe maintaining interpass temperature.

37 **Topic:** Preheating and Post-Weld Treatment of Metals

Standard: Explain post-weld heat treatment of metals.

38 **Topic:** Preheating and Post-Weld Treatment of Metals

Standard: Identify and explain the effects of welding on metals.

39 **Topic:** Gas Tungsten Arc Welding Equipment and Filler Metals

Standard: Explain gas tungsten arc welding (GTAW) safety.

40 **Topic:** Gas Tungsten Arc Welding Equipment and Filler Metals

Standard: Identify and explain the use of GTAW equipment.

41 **Topic:** Gas Tungsten Arc Welding Equipment and Filler Metals

Standard: Identify and explain the use of GTAW filler metals.

42 **Topic:** Gas Tungsten Arc Welding Equipment and Filler Metals

Standard: Identify and explain the use of GTAW shielding gases.

43 **Topic:** Gas Tungsten Arc Welding Equipment and Filler Metals

Standard: Set up GTAW welding equipment.

44 **Topic:** Gas Tungsten Arc Welding – Plate

Standard: Pad in all positions with stringer beads using GTAW and carbon steel filler metal.

45 **Topic:** Gas Tungsten Arc Welding – Plate

Standard: Make multipass V-butt open-groove welds on mild steel plate in the 1G (flat) position

46 **Topic:** Gas Tungsten Arc Welding – Plate

Standard: Make multipass V-butt open-groove welds on mild steel plate in the 2G (horizontal) position using GTAW and carbon steel filler metal.

47 **Topic:** Gas Tungsten Arc Welding – Plate

Standard: Make multipass V-butt open-groove welds on mild steel plate in the 3G (vertical) position using GTAW and carbon steel filler metal.

48 **Topic:** Gas Tungsten Arc Welding – Plate

Standard: Make multipass V-butt open-groove welds on mild steel plate in the 4G (overhead) position using GTAW and carbon steel filler metal.

49 **Topic:** GMAW and FCAW – Equipment and Filler Metals

Standard: Explain Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW) safety.

50 **Topic:** GMAW and FCAW – Equipment and Filler Metals

Standard: Explain the characteristics of welding current and power supplies.

51 **Topic:** GMAW and FCAW – Equipment and Filler Metals

Standard: Identify and explain the use of GMAW and FCAW equipment: · Spray arc · Globular · Short circuiting · Pulse

52 **Topic:** GMAW and FCAW – Equipment and Filler Metals

Standard: Identify and explain the use of GMAW and FCAW shielding gases and filler metals.

53 **Topic:** GMAW and FCAW – Equipment and Filler Metals

Standard: Set up GMAW and FCAW equipment and identify tools for weld cleaning.

54 **Topic:** Gas Metal Arc Welding (GMAW) Plate

Standard: Pad with GMAW stringer beads, using carbon steel wire and shielding gas.

55 **Topic:** Gas Metal Arc Welding (GMAW) Plate

Standard: Pad with GMAW weave beads, using carbon steel wire and shielding gas.

56 **Topic:** Gas Metal Arc Welding (GMAW) Plate

Standard: Perform GMAW multipass fillet welds on plate, using carbon steel wire and shielding gas in the following positions: · 1F position (flat) · 2F position (horizontal) · 3F position (vertical) · 4F position (overhead)

57 **Topic:** Flux Cored Arc Welding (FCAW) Plate

Standard: Set up FCAW equipment.

58 **Topic:** Flux Cored Arc Welding (FCAW) Plate

Standard: Make stringer beads using FCAW.

59 **Topic:** Flux Cored Arc Welding (FCAW) Plate

Standard: Make weave beads using FCAW.

60 **Topic:** Flux Cored Arc Welding (FCAW) Plate

Standard: Perform FCAW multipass fillet welds on plate in the following positions: · 1F position (flat) · 2F position (horizontal) · 3F position (vertical) · 4F position (overhead)

61 **Topic:** Flux Cored Arc Welding (FCAW) Plate

Standard: Perform FCAW multipass groove welds on plate in the following positions: · 1G position (flat) · 2G position (horizontal) · 3G position (vertical) · 4G position (overhead)

Course: Welding: 48.55600 Advanced Arc Welding Processes II

35 **Topic:** Gas Tungsten Arc Welding – Carbon Steel Pipe

Standard: Set up GTAW equipment.

36 **Topic:** Gas Tungsten Arc Welding – Carbon Steel Pipe

Standard: Make GTAW open-root V-groove welds on carbon steel pipe in the 1G position using carbon steel filler metal and argon gas.

37 **Topic:** Gas Tungsten Arc Welding – Carbon Steel Pipe

Standard: Make GTAW open-root V-groove welds on carbon steel pipe in the 2G position using carbon steel filler metal and argon gas.

38 **Topic:** Gas Tungsten Arc Welding – Carbon Steel Pipe

Standard: Make GTAW open-root V-groove welds on carbon steel pipe in the 5G position using carbon steel filler metal and argon gas.

39 **Topic:** Gas Tungsten Arc Welding – Carbon Steel Pipe

Standard: Make GTAW open-root V-groove welds on carbon steel pipe in the 6G position using carbon steel filler metal and argon gas.

40 **Topic:** Flux Cored Arc Welding (FCAW) Pipe

Standard: Prepare arc welding equipment for V-groove pipe welds.

41 **Topic:** Flux Cored Arc Welding (FCAW) Pipe

Standard: Identify and explain V-groove pipe welds.

42 **Topic:** Flux Cored Arc Welding (FCAW) Pipe

Standard: Perform flux cored arc welding (FCAW) on V-groove pipe welds: · 1G position · 2G position · 5G position · 6G position

Course: Welding: 48.55700 Gas Metal Arc Welding (GMAW) Specialty

35 **Topic:** Gas Metal Arc Welding (GMAW) Pipe

Standard: Prepare GMAW equipment for open-root V-groove pipe welds.

36 **Topic:** Gas Metal Arc Welding (GMAW) Pipe

Standard: Identify and explain open-root V-groove pipe welds.

37 **Topic:** Gas Metal Arc Welding (GMAW) Pipe

Standard: Perform gas metal arc welding (GMAW) on open-root V-groove pipe welds: · 1G position · 2G position · 5G position · 6G position

38 **Topic:** Gas Metal Arc Welding (GMAW) Aluminum Plate and Pipe

Standard: Explain GMAW and set up equipment to weld aluminum.

39 **Topic:** Gas Metal Arc Welding (GMAW) Aluminum Plate and Pipe

Standard: Pad with stringer beads and weave beads, using aluminum wire and shielding gas.

40 **Topic:** Gas Metal Arc Welding (GMAW) Aluminum Plate and Pipe

Standard: Perform multipass fillet welds on aluminum plate, using aluminum wire and shielding gas, in the following positions: · 1F (flat) · 2F (horizontal) · 3F (vertical) · 4F (overhead)

41 **Topic:** Gas Metal Arc Welding (GMAW) Aluminum Plate and Pipe

Standard: Perform V-groove welds on aluminum plate, using aluminum wire and shielding gas, in the following positions: · 1G (flat) · 2G (horizontal) · 3G (vertical) · 4G (overhead)

42 **Topic:** Gas Metal Arc Welding (GMAW) Aluminum Plate and Pipe

Standard: Perform V-groove welds on aluminum pipe, using aluminum wire and shielding gas, in the following positions: · 1G (horizontal rolled) · 2G (vertical) · 5G (horizontal fixed) · 6G (inclined)

Course: Welding: 48.55800 Gas Tungsten Arc Welding (GTAW) Specialty

35 **Topic:** Gas Tungsten Arc Welding – Low-Alloy Steel Pipe

Standard: Identify the mechanical properties of low-alloy steels.

36 **Topic:** Gas Tungsten Arc Welding – Low-Alloy Steel Pipe

Standard: Explain joint preparation for gas tungsten arc welding (GTAW) low-alloy steel pipe.

37 **Topic:** Gas Tungsten Arc Welding – Low-Alloy Steel Pipe

Standard: Make GTAW open-root V-groove welds on pipe in the 2G position, using low-alloy steel filler metal.

38 **Topic:** Gas Tungsten Arc Welding – Low-Alloy Steel Pipe

Standard: Make GTAW open-root V-groove welds on pipe in the 5G position, using low-alloy steel filler metal.

39 **Topic:** Gas Tungsten Arc Welding – Low-Alloy Steel Pipe

Standard: Make GTAW open-root V-groove welds on pipe in the 6G position, using low-alloy steel filler metal.

40 **Topic:** Gas Tungsten Arc Welding (GTAW) Aluminum Plate And Pipe

Standard: Identify and explain aluminum metallurgy.

41 **Topic:** Gas Tungsten Arc Welding (GTAW) Aluminum Plate And Pipe

Standard: Explain and identify characteristics of aluminum.

42 **Topic:** Gas Tungsten Arc Welding (GTAW) Aluminum Plate And Pipe

Standard: Explain GTAW and set up equipment to weld aluminum plate and pipe.

43 **Topic:** Gas Tungsten Arc Welding (GTAW) Aluminum Plate And Pipe

Standard: Explain and practice GTAW techniques for plate and pipe, including padding in the flat position with stringer beads, using aluminum filler metal.

44 **Topic:** Gas Tungsten Arc Welding (GTAW) Aluminum Plate And Pipe

Standard: Make fillet welds on aluminum plate in the following positions: · 1F (flat) · 2F (horizontal) · 3F (vertical) · 4F (overhead)

45 **Topic:** Gas Tungsten Arc Welding (GTAW) Aluminum Plate And Pipe

Standard: Make multipass open groove, V-butt welds on aluminum plate in the following positions: · 1G (flat) · 2G (horizontal) · 3G (vertical) · 4G (overhead)

46 **Topic:** Gas Tungsten Arc Welding (GTAW) Aluminum Plate And Pipe

Standard: Make multipass open-root, V-groove welds on aluminum pipe in the following positions: · 2G (vertical) · 5G (horizontal) · 6G (inclined)

Course: Welding: 48.55900 Arc Welding Specialty – Stainless Steel

35 **Topic:** Shielded Metal Arc Welding – Stainless Steel Groove Welds

Standard: Identify and explain stainless steel metallurgy.

36 **Topic:** Shielded Metal Arc Welding – Stainless Steel Groove Welds

Standard: Identify and explain the selection of electrodes for welding stainless steel.

37 **Topic:** Shielded Metal Arc Welding – Stainless Steel Groove Welds

Standard: Identify and explain welding variations for stainless steel.

38 **Topic:** Shielded Metal Arc Welding – Stainless Steel Groove Welds

Standard: Prepare arc welding equipment for stainless steel welds.

39 **Topic:** Shielded Metal Arc Welding – Stainless Steel Groove Welds

Standard: Explain stainless steel open V-butt joint welds.

40 **Topic:** Shielded Metal Arc Welding – Stainless Steel Groove Welds

Standard: Perform shielded metal arc welding (SMAW) on stainless steel groove joints: · Flat welds · Horizontal welds · Vertical welds · Overhead welds

41 **Topic:** Gas Tungsten Arc Welding – Stainless Steel Pipe

Standard: Identify and explain stainless steel metallurgy.

42 **Topic:** Gas Tungsten Arc Welding – Stainless Steel Pipe

Standard: Set up GTAW equipment to perform stainless steel pipe welding.

43 **Topic:** Gas Tungsten Arc Welding – Stainless Steel Pipe

Standard: Make GTAW open-root V-groove welds on pipe in the 2G position using stainless steel filler metal.

44 **Topic:** Gas Tungsten Arc Welding – Stainless Steel Pipe

Standard: Make GTAW open-root V-groove welds on pipe in the 5G position using stainless steel filler metal.

45 **Topic:** Gas Tungsten Arc Welding – Stainless Steel Pipe

Standard: Make GTAW open-root V-groove welds on pipe in the 6G position using stainless steel filler metal.