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.
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

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.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Career Planning</td>
<td>Identify the breadth and scope of the automotive service technology industry.</td>
</tr>
<tr>
<td>Career Planning</td>
<td>Identify major trends and issues in automotive service technology.</td>
</tr>
<tr>
<td>Career Planning</td>
<td>Identify auto technician career opportunities and the duties of a suspension and steering system technician.</td>
</tr>
<tr>
<td>Career Planning</td>
<td>Identify auto technical career opportunities and the duties of a brake system technician.</td>
</tr>
<tr>
<td>Career Planning</td>
<td>Identify auto technician career opportunities and the duties of an electrical/electronics systems technician.</td>
</tr>
<tr>
<td>Career Planning</td>
<td>Identify auto technician career opportunities and the duties of an engine performance technician.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Identify the safe use of chemicals used in the suspension and steering system.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Identify the safe use of hand tools used in the suspension and steering system.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Identify the safe use of power tools used in the suspension and steering system.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Identify the safe use of protective clothing and equipment for working in the suspension and steering system.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Identify the safe use of fire protection equipment for working in the suspension and steering system.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Identify the safe use of shop equipment for working in the suspension and steering system.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Follow Environmental Protection Agency (EPA) and Occupational Safety and Health Act (OSHA) regulations for working in the suspension and steering system.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Communicate with customers and write suspension and steering system repair orders.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Estimate time and cost for suspension and steering system job and order parts.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Obtain appropriate suspension and steering system repair information from shop manuals.</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Practice clean and orderly work habits (vehicle, tools, and work area).</td>
</tr>
<tr>
<td>Suspension And Steering</td>
<td>Identify the basic function and operation of the suspension and steering system components.</td>
</tr>
</tbody>
</table>
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.
Topic: Engine Performance
Standard: Estimate time and cost for an engine performance job and order parts.

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

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

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

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

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

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

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

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.

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

Topic: Engine Performance
Standard: Access and use electronic service information.

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

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

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

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

Topic: Engine Performance
Standard: Replace fuel filters.

Topic: Engine Performance
Standard: Verify engine operating temperature; determine necessary action.

Course: AST: 47.57200 Foundations of Automotive Service Technology

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

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

**Topic:** Engine Performance  
**Standard:** Remove, service, and install a throttle body; adjust related linkages.

**Topic:** Engine Performance  
**Standard:** Inspect, test, and clean fuel injectors.

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

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

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

**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

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

**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.

**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.

**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.

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

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

**Topic:** Competencies  
**Standard:** Diagnose emissions and driveability problems caused by the failure of the exhaust gas recirculation (EGR) system; determine 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.
Course: Construction/Carpentry: 46.55200 Construction Site Layout

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
Course: Construction/Carpentry: 46.55300 Commercial Carpentry

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

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.

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

Topic: Foundations and Flatwork
Standard: Demonstrate the ability to set screeds on grade.

Topic: Concrete Forms
Standard: Identify the various types of concrete forms.

Topic: Concrete Forms
Standard: Identify the components of each type of form.

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

Topic: Concrete Forms
Standard: Construct wall, column, beam, and stair forms.

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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Topic: Conduit Bending
Standard: Avoid excessive waste when working with conduit systems.

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

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.
<table>
<thead>
<tr>
<th>Topic: Cable Tray</th>
<th>Standard: Select rollers and sheaves for pulling cable in specific cable tray situations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic: Cable Tray</td>
<td>Standard: Designate the required locations of rollers and sheaves for a specific cable pull.</td>
</tr>
<tr>
<td>Topic: Cable Tray</td>
<td>Standard: Fabricate an offset for a cable tray.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Describe how to make a good conductor termination.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Prepare cable ends for terminations and splices.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Install lugs and connectors onto conductors.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Train cable at termination points.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Explain the role of the NEC in making cable terminations and splices.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Explain why mechanical stress should be avoided at cable termination points.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Describe the importance of using proper bolt torque when bolting lugs onto busbars.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Describe crimping techniques.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Select the proper lug or connector for the job.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Describe splicing techniques.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Describe the installation rules for parallel conductors.</td>
</tr>
<tr>
<td>Topic: Conductor Terminations and Splices</td>
<td>Standard: Explain how to use hand and power crimping tools.</td>
</tr>
<tr>
<td>Topic: Installation of Electric Services</td>
<td>Standard: Describe various types of electric services for commercial and industrial installations.</td>
</tr>
<tr>
<td>Topic: Installation of Electric Services</td>
<td>Standard: Read electrical blueprints and diagrams describing service installations.</td>
</tr>
<tr>
<td>Topic: Installation of Electric Services</td>
<td>Standard: Calculate and select service-entrance equipment.</td>
</tr>
<tr>
<td>Topic: Installation of Electric Services</td>
<td>Standard: Explain the role of the NEC in service installations.</td>
</tr>
</tbody>
</table>
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.
**Course:** Construction/Masonry: 46.57200 Design Masonry

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

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

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

**Topic:** Advanced Laying Techniques  
**Standard:** Construct specialty structures such as manholes, segmented block walls, and screens.
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, sepia, 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.
Topic: Reading Residential Plumbing Drawings  
**Standard:** Understand the relationships that exist among the various drawings.

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

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

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

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

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

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

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

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

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

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

---

**Course:** Construction/Plumbing: 46.58100 Residential Plumbing

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

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

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

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

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

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

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

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

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.

   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.
Topic: Water Meters
Standard: Identify the three major types of water meters.

Topic: Water Meters
Standard: Describe the basic working principles of a disk type meter, a turbine meter, and a compound meter.

Topic: Water Meters
Standard: Identify several types of water meter yokes and their applications.

Topic: Types of Fixtures
Standard: Identify materials use in the manufacture of plumbing fixtures.

Topic: Types of Fixtures
Standard: Identify dfu (drain flow unit) ratings for given types of plumbing fixtures.

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

Topic: Setting Fixtures
Standard: Identify the general installation considerations which should be followed before installing any fixture.

Topic: Setting Fixtures
Standard: Identify the general process for installing bathtubs and shower stalls.

Topic: Setting Fixtures
Standard: Describe the basic procedures for installing lavatories and sinks.

Topic: Setting Fixtures
Standard: Differentiate the procedures for installing built-in and wall-hung sinks and lavatories.

Topic: Setting Fixtures
Standard: Describe the process for installing water closets.

Topic: Setting Fixtures
Standard: Describe how installed water closets can be protected.

Topic: Setting Fixtures
Standard: Describe the process of installing urinals.

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)

Topic: Basic Safety
Standard: Identify the responsibilities and personal characteristics of a professional craftsperson.

Topic: Basic Safety
Standard: Explain the role that safety plays in the construction crafts.

Topic: Basic Safety
Standard: Describe what job-site safety means.

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: State 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.
Topic: Tools and Equipment
Standard: Associate trade terms with the appropriate tools and equipment.

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.

Topic: Mortar
Standard: Name and describe the primary ingredients in mortar and their properties.

Topic: Mortar
Standard: Identify the various types of mortar used in masonry work.

Topic: Mortar
Standard: Describe the common admixtures and their uses.

Topic: Mortar
Standard: Identify the common problems found in mortar application and their solutions.

Topic: Mortar
Standard: Properly set up the mortar mixing area.

Topic: Mortar
Standard: Properly mix mortar by hand.

Topic: Mortar
Standard: Properly mix mortar with a mechanical mixer.

Topic: The Plumbing Trade
Standard: Discuss the historical development of the trade.

Topic: The Plumbing Trade
Standard: Discuss the functions of water supply and sewage treatment systems.

Topic: The Plumbing Trade
Standard: Discuss the importance of plumbers in modern society.

Topic: Basic Plumbing Tools
Standard: Discuss safety as it applies to plumbing tools.

Topic: Basic Plumbing Tools
Standard: Identify the basic hand and power tools used in the plumbing trade.

Topic: Basic Plumbing Tools
Standard: Discuss the proper maintenance procedures to be used for hand and power tools.

Topic: Copper and Plastic Piping Practices
Standard: State the precautions that must be taken when installing refrigerant piping.

Topic: Copper and Plastic Piping Practices
Standard: Select the right tubing for a job.

Topic: Copper and Plastic Piping Practices
Standard: Cut and bend tubing.

Topic: Copper and Plastic Piping Practices
Standard: Join tubing by using flare and compression fittings.

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.
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.
**Topic:** Introduction to Lightening and Hair Coloring  
**Standard:** Demonstrate how to give a shampoo, color rinse, and semi-permanent tint.

**Topic:** Introduction to Lightening and Hair Coloring  
**Standard:** Demonstrate how to block/section for a virgin tint or touch-up application.

**Topic:** Introduction to Lightening and Hair Coloring  
**Standard:** Demonstrate how to "mix" an aniline derivative tint.

**Topic:** Introduction to Lightening and Hair Coloring  
**Standard:** Demonstrate process of giving a one-step virgin tint and a one-step tint retouch.

**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.

**Topic:** Introduction to Lightening and Hair Coloring  
**Standard:** Demonstrate introductory techniques and procedures for giving a frosting, tipping, streaking and blonde-on-blonde treatment.

**Topic:** Introduction to Lightening and Hair Coloring  
**Standard:** Demonstrate safety and infection control procedures for lightening and hair coloring services.

**Topic:** Intermediate Styling Principals  
**Standard:** Explain the relationship of facial types to styling principles.

**Topic:** Intermediate Styling Principals  
**Standard:** List the various facial types.

**Topic:** Intermediate Styling Principals  
**Standard:** Identify instruments used in blow drying and thermal techniques.

**Topic:** Intermediate Styling Principals  
**Standard:** Demonstrate the proper use and handling of thermal curling irons.

**Topic:** Intermediate Styling Principals  
**Standard:** Demonstrate proper maintenance and sanitary procedures for styling tools.

**Topic:** Intermediate Styling Principals  
**Standard:** Describe thermal heaters and pressing instruments.

**Topic:** Intermediate Styling Principals  
**Standard:** Demonstrate hair pressing techniques.

**Topic:** Intermediate Styling Principals  
**Standard:** Demonstrate thermal waving techniques.

**Topic:** Intermediate Styling Principals  
**Standard:** Demonstrate procedures for fitting, cleaning, shaping, and styling human hair and synthetic wigs and hairpieces.

**Topic:** Intermediate Styling Principals  
**Standard:** Demonstrate safety and infection control procedures for styling services.

---

**Course:** Cosmetology: 12.54700 Advanced Styling Principles

**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 haircuts.

36 Topic: Haircutting
   Standard: Demonstrate and demonstrate the geometric lines used in haircuts.

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 haircuts.
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.
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.

Topic: Chemical Relaxing
Standard: Follow all safety precautions and procedures while performing this service.

Topic: Hair Lightening and Coloring Techniques
Standard: Demonstrate applying hair color with a bottle and with a bowl and brush.

Topic: Hair Lightening and Coloring Techniques
Standard: Demonstrate the mixing of more than one color in a single step application process.

Topic: Hair Lightening and Coloring Techniques
Standard: Demonstrate a single and a double-process tint application.

Topic: Hair Lightening and Coloring Techniques
Standard: List a minimum of three reasons for needing corrective hair coloring treatments.

Topic: Hair Lightening and Coloring Techniques
Standard: List preventive steps to avoid hair coloring problems.

Topic: Hair Lightening and Coloring Techniques
Standard: List steps in performing corrective hair coloring procedures.

Topic: Hair Lightening and Coloring Techniques
Standard: Demonstrate the use of special effects using foil techniques.

Topic: Hair Lightening and Coloring Techniques
Standard: Demonstrate the use of special effects using cap and hook techniques.

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.

Topic: Hair Lightening and Coloring Techniques
Standard: Demonstrate effective consulting and communication skills while discussing hair color services with the client.

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

Topic: Practicum
Standard: Use proper procedures in shampooing.

Topic: Practicum
Standard: Perform proper procedures in hair and scalp treatments.

Topic: Practicum
Standard: Give basic haircuts.

Topic: Practicum
Standard: Demonstrate proper procedures in permanent waving and relaxing.

Topic: Practicum
Standard: Perform lightening and hair coloring procedures.
Course: Cosmetology: 12.55200 Cosmetology Practicum II

Topic: Practicum  
Standard: Demonstrate procedures and techniques in facial and nail care services.

Topic: Practicum  
Standard: Demonstrate skills in operating a dispensary.

Topic: Practicum  
Standard: Demonstrate skills in operating a receptionist desk.

Topic: Practicum  
Standard: Demonstrate skills in salon management.

Topic: Practicum  
Standard: Follow all safety and infection control procedures.

Topic: Practicum  
Standard: Exercise good personal hygiene habits while working in the salon.

Topic: Practicum  
Standard: Demonstrate good communication skills when determining client’s request for services.

Topic: Practicum  
Standard: Demonstrate proper procedures in performing shampoos on clients.

Topic: Practicum  
Standard: Perform hair and scalp treatments according to the need of the client.

Topic: Practicum  
Standard: Give basic haircuts.

Topic: Practicum  
Standard: Give permanent wave to clients.

Topic: Practicum  
Standard: Give chemical relaxer to clients.

Topic: Practicum  
Standard: Demonstrate soft curl perm.

Topic: Practicum  
Standard: Lighten a client’s hair.

Topic: Practicum  
Standard: Perform hair coloring services according to client’s need.

Topic: Practicum  
Standard: Give facials to clients, based on client’s need.

Topic: Practicum  
Standard: Perform eyebrow and lash services.

Topic: Practicum  
Standard: Give basic manicures.

Topic: Practicum  
Standard: Give basic pedicures.
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 Resources  
**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 Resources  
**Standard:** Describe advantages and disadvantages of various pay structures for the salon owner.

40 **Topic:** Human Resources  
**Standard:** Identify key types of people to call for potential employee reference checks.

41 **Topic:** Human Resources  
**Standard:** Demonstrate how to develop a proper resume and job application for a cosmetologist.

42 **Topic:** Human Resources  
**Standard:** Identify key times and days that are most productive for personnel in a salon.

43 **Topic:** Human Resources  
**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:** Identify 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.
Course:  Cosmetology: 12.55500 Advanced Skin & Nail Care

- **Topic:** Retailing
  **Standard:** Demonstrate educating a client on services and products.

- **Topic:** Marketing
  **Standard:** Identify a minimum of three ways to market a salon.

- **Topic:** Marketing
  **Standard:** Describe a marketing plan for the opening of a salon.

- **Topic:** Marketing
  **Standard:** Prepare an advertisement for a salon.

- **Topic:** Marketing
  **Standard:** Identify ways to evaluate marketing of the salon.

- **Topic:** Receptionist Duties
  **Standard:** Demonstrate appropriate welcome for clients entering salon.

- **Topic:** Receptionist Duties
  **Standard:** Demonstrate proper procedures for answering the telephone.

- **Topic:** Receptionist Duties
  **Standard:** Demonstrate proper operations of a receptionist desk.

- **Topic:** Receptionist Duties
  **Standard:** Resolve customer complaints.

- **Topic:** Receptionist Duties
  **Standard:** Demonstrate use of a manual and computerized system for operating a receptionist desk.

- **Topic:** Receptionist Duties
  **Standard:** Demonstrate proper procedures for financial transactions.

- **Topic:** Client Retention
  **Standard:** List three reasons why a client might stop utilizing the services of a salon.

- **Topic:** Client Retention
  **Standard:** Identify types of information to be kept on a client card or computer file.

- **Topic:** Client Retention
  **Standard:** Demonstrate effective communication between client and cosmetologist while performing salon services.

- **Topic:** Hair Removal
  **Standard:** Identify ways to remove unwanted facial hair.

- **Topic:** Hair Removal
  **Standard:** Identify three methods of temporary hair removal.

- **Topic:** Hair Removal
  **Standard:** Identify methods for permanently removing hair.

- **Topic:** Hair Removal
  **Standard:** Demonstrate safety and infection control for hair removal services.

- **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.
Topic: Practicum
Standard: Demonstrate skin care services.

Topic: Practicum
Standard: Demonstrate nail care services.

Topic: Practicum
Standard: Perform salon management duties.

Topic: Practicum
Standard: Follow safety and infection control procedures.

Topic: Practicum
Standard: Follow good personal hygiene habits.

Topic: Practicum
Standard: Demonstrate effective communication skills between clients and co-workers.

Course: Cosmetology: 12.55800 Cosmetology Practicum VI

Topic: Practicum
Standard: Perform shampooing and styling services.

Topic: Practicum
Standard: Perform hair and scalp treatments.

Topic: Practicum
Standard: Give haircuts.

Topic: Practicum
Standard: Demonstrate chemical waving procedures.

Topic: Practicum
Standard: Demonstrate chemical relaxing procedures.

Topic: Practicum
Standard: Perform lightening and hair color services.

Topic: Practicum
Standard: Demonstrate skin care services.

Topic: Practicum
Standard: Demonstrate nail care services.

Topic: Practicum
Standard: Practice salon management techniques.

Topic: Practicum
Standard: Practice good personal hygiene.

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.
<table>
<thead>
<tr>
<th></th>
<th>Topic</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Digital File Preparation</td>
<td>Define preflighting.</td>
</tr>
<tr>
<td>36</td>
<td>Digital File Preparation</td>
<td>Preflight a document using application preflight software.</td>
</tr>
<tr>
<td>37</td>
<td>Digital File Preparation</td>
<td>Define CTP.</td>
</tr>
<tr>
<td>38</td>
<td>Digital File Preparation</td>
<td>Explain the difference between True Type, Type 1, and Open Type Fonts.</td>
</tr>
<tr>
<td>39</td>
<td>Digital File Preparation</td>
<td>Demonstrate the proper use of loading, displaying, and organizing fonts using a font management software application.</td>
</tr>
<tr>
<td>40</td>
<td>Digital File Preparation</td>
<td>Demonstrate the use of page layout software.</td>
</tr>
<tr>
<td>41</td>
<td>Digital File Preparation</td>
<td>Demonstrate the use of photo manipulation software.</td>
</tr>
<tr>
<td>42</td>
<td>Digital File Preparation</td>
<td>Demonstrate the use of illustration software.</td>
</tr>
<tr>
<td>43</td>
<td>Digital File Preparation</td>
<td>Create a two-sided, three-panel brochure using graphics and text.</td>
</tr>
<tr>
<td>44</td>
<td>Digital File Preparation</td>
<td>Create a four-page newsletter using windows, blocks, text, graphics, frames, and headings.</td>
</tr>
<tr>
<td>45</td>
<td>Digital File Preparation</td>
<td>Create a two-page newsletter using drop caps for paragraph openings, wrap-a-rounds (run-a-rounds), and graphics.</td>
</tr>
<tr>
<td>46</td>
<td>Digital File Preparation</td>
<td>Explain the basic principles of dot gain and its impact on printed materials.</td>
</tr>
<tr>
<td>47</td>
<td>Digital File Output</td>
<td>Read and interpret production information from job jacket/ticket.</td>
</tr>
<tr>
<td>48</td>
<td>Digital File Output</td>
<td>Identify safety considerations in film imagesetting.</td>
</tr>
<tr>
<td>49</td>
<td>Digital File Output</td>
<td>Read and explain material safety data sheets (MSDS).</td>
</tr>
<tr>
<td>50</td>
<td>Digital File Output</td>
<td>Demonstrate the proper disposal methods for used chemistry.</td>
</tr>
<tr>
<td>51</td>
<td>Digital File Output</td>
<td>Define preflighting and file repair.</td>
</tr>
</tbody>
</table>
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).
Topic: Digital File Output

**Standard:** Make additions, deletions, and repairs to an offset plate.

---

Topic: Digital File Output

**Standard:** Identify basic parts of a digital proofing system.

---

Topic: Digital File Output

**Standard:** List the advantages and disadvantages of different color proofing systems.

---

Topic: Digital File Output

**Standard:** Identify digital proofing materials.

---

Topic: Digital File Output

**Standard:** Define CTP technology.

---

Topic: Digital File Output

**Standard:** Identify digital plate materials and plate types.

---

Topic: Digital File Output

**Standard:** Describe the various laser technologies found in computer-to-plate system.

---

Topic: Digital File Output

**Standard:** Prepare digital plates (image, process, inspect, and store).

---

Topic: Digital File Output

**Standard:** List the considerations in imaging related to the characteristics of paper and other printing substrates (foil, plastic).

---

Topic: Digital File Output

**Standard:** Describe the effect of dot gain or loss on the reproduction system.

---

Topic: Digital File Output

**Standard:** Describe the differences between undercolor removal (UCR) and gray component replacement (GCR).

---

Topic: Digital File Output

**Standard:** Explain the differences between a densitometer, plate reader, and spectrophotometer.

---

Topic: Digital File Output

**Standard:** Describe process control procedures necessary for successful digital file output.

---

Topic: Digital File Output

**Standard:** Identify and describe direct imaging technologies on press.

---

Topic: Digital File Output

**Standard:** Describe the use of plate scanning and ink key presetting technologies.

---

Topic: Digital File Output

**Standard:** Explain the CIP4 protocol and how it is used in the printing plant.

---

Topic: Digital File Output

**Standard:** Observe analog and digital platemaking operations at a commercial printer.

---

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

---

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.
Topic: Press Operations
Standard: Practice safe work habits in press operations.

Topic: Press Operations
Standard: Identify basic parts and systems of a press.

Topic: Press Operations
Standard: Identify basic press operation procedures.

Topic: Press Operations
Standard: Identify basic paper types and sizes.

Topic: Press Operations
Standard: Determine grain direction of paper.

Topic: Press Operations
Standard: Handle and jog paper stock (wire/felt, watermarks, carbonless sequence).

Topic: Press Operations
Standard: Identify mixed fountain solution testing material, equipment, and procedures.

Topic: Press Operations
Standard: Mix fountain solutions using appropriate ratios.

Topic: Press Operations
Standard: Perform makeready steps for paper: sheet size, impression cylinder pressure, etc..

Topic: Press Operations
Standard: Perform makeready of the inking system.

Topic: Press Operations
Standard: Print a single-color, one-sided job using a metal plate.

Topic: Press Operations
Standard: Print a single-color job using photo direct and/or electrostatic masters.

Topic: Press Operations
Standard: Practice safe handling of chemicals, fountain wash, blanket wash, and other chemicals, and wear appropriate protective gear.

Topic: Press Operations
Standard: Identify how press waste and material cost affects a company.

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.

Topic: Job Application and Interpersonal Skills
Standard: Demonstrate proper work ethic/habits.

Topic: Job Application and Interpersonal Skills
Standard: Demonstrate how to locate job listings through a variety of sources (Internet, associations, newspapers, agencies, etc.).

Topic: Job Application and Interpersonal Skills
Standard: Read and explain various want ads.

Topic: Job Application and Interpersonal Skills
Standard: Write a personal resume.
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.
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.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Binding and Finishing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Standard</strong>: Demonstrate how to check the squareness of stock.</td>
</tr>
<tr>
<td>64</td>
<td><strong>Standard</strong>: Identify common production problems in the bindery.</td>
</tr>
<tr>
<td>65</td>
<td><strong>Standard</strong>: Prepare folding dummies for commonly-used impositions.</td>
</tr>
<tr>
<td>66</td>
<td><strong>Standard</strong>: Set up and operate folder consistent with job specifications.</td>
</tr>
<tr>
<td>67</td>
<td><strong>Standard</strong>: Describe quality control methods for bound products.</td>
</tr>
<tr>
<td>68</td>
<td><strong>Standard</strong>: Perform preventative maintenance on a folder.</td>
</tr>
<tr>
<td>69</td>
<td><strong>Standard</strong>: Perform preventative maintenance on a paper cutter.</td>
</tr>
<tr>
<td>70</td>
<td><strong>Standard</strong>: Define folding terminology and identify different folding techniques.</td>
</tr>
<tr>
<td>71</td>
<td><strong>Standard</strong>: Use folding equipment to produce a high-folio lip signature and a low-folio signature and describe the advantages of both.</td>
</tr>
<tr>
<td>72</td>
<td><strong>Standard</strong>: Identify various ancillary equipment such as gluing, ink jetting, and wet scoring.</td>
</tr>
<tr>
<td>73</td>
<td><strong>Standard</strong>: Describe the use of brick stacking.</td>
</tr>
<tr>
<td>74</td>
<td><strong>Standard</strong>: Demonstrate the use of brick stacking.</td>
</tr>
<tr>
<td>75</td>
<td><strong>Standard</strong>: Set up and use a three-hole drill to produce a drilled job.</td>
</tr>
<tr>
<td>76</td>
<td><strong>Standard</strong>: Describe the applications of database information in the bindery for ink jet personalization and demographic binding.</td>
</tr>
<tr>
<td>77</td>
<td><strong>Standard</strong>: Observe a commercial bindery operation.</td>
</tr>
</tbody>
</table>

**Course:** DRAFT - Graphic Communications: 48.56600 Printing Technology Lab 1

<table>
<thead>
<tr>
<th>Topic</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td><strong>Standard</strong>: Read and interpret production information from job jacket/ticket.</td>
</tr>
<tr>
<td>36</td>
<td><strong>Standard</strong>: Identify safety considerations in production job.</td>
</tr>
<tr>
<td>37</td>
<td><strong>Standard</strong>: Read and describe material safety data sheets (MSDS).</td>
</tr>
</tbody>
</table>
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

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 (degassing).

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.
Topic: Finishing and Binding
Standard: Demonstrate how to check the squareness of stock.

Topic: Finishing and Binding
Standard: Identify common production problems in the bindery.

Topic: Finishing and Binding
Standard: Prepare folding dummies for commonly used impositions.

Topic: Finishing and Binding
Standard: Set up and operate folder consistent with job specifications.

Topic: Finishing and Binding
Standard: Set up and use a three-hole drill to produce a drilled job.

Topic: Screen Printing
Standard: Identify proper hand tools, equipment, and materials for screen printing.

Topic: Screen Printing
Standard: Discuss characteristics of fabrics, frames, and screen tension.

Topic: Screen Printing
Standard: Describe the process of using stencils in screen printing.

Topic: Screen Printing
Standard: Define and describe squeegees.

Topic: Screen Printing
Standard: Identify screen printing substrates.

Topic: Screen Printing
Standard: Identify printing inks.

Topic: Screen Printing
Standard: Identify printing dryers.

Topic: Screen Printing
Standard: Prepare and/or select art design for screen printing job.

Topic: Screen Printing
Standard: Prepare stencil for screen printing.

Topic: Screen Printing
Standard: Prepare machine for operation.

Topic: Screen Printing
Standard: Prepare ink and additives.

Topic: Screen Printing
Standard: Operate and monitor machines.

Topic: Screen Printing
Standard: Inspect quality against required standards.

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 (deglozing).

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.
Topic: Screen Printing
Standard: Follow all safety procedures while performing screen printing tasks.

Topic: Screen Printing
Standard: Demonstrate procedures for completing a screen printing job.

Topic: Screen Printing
Standard: Demonstrate proper cleanup procedures upon completion of screen printing job.

Topic: Screen Printing
Standard: Demonstrate proper maintenance procedures for screen printing equipment.

Topic: Screen Printing
Standard: Properly dispose of liquid waste.

Course: DRAFT - Graphic Communications: 48.56100 Introduction to Graphic Communications

Topic: Careers in Graphic Communications
Standard: Define the role of graphics in the free enterprise system.

Topic: Careers in Graphic Communications
Standard: Identify print markets and types of print businesses.

Topic: Careers in Graphic Communications
Standard: Explain the history of the printing industry and how careers have changed over time.

Topic: Careers in Graphic Communications
Standard: Identify commercial art design opportunities in the graphic communications industry.

Topic: Careers in Graphic Communications
Standard: Explain how technological changes affect the graphic communications industry as it relates to printing and commercial art.

Topic: Careers in Graphic Communications
Standard: Identify and describe the major printing processes (including digital printing).

Topic: Careers in Graphic Communications
Standard: List the advantages and disadvantages of each major process.

Topic: Careers in Graphic Communications
Standard: List the products produced by each major process.

Topic: Careers in Graphic Communications
Standard: List in order the business flow of printing from initial concept to final product.

Topic: Careers in Graphic Communications
Standard: List in order the technical production flow from idea to finished product.

Topic: Careers in Graphic Communications
Standard: Identify major occupations in the graphic communications industry and explain the basic training needed for each.

Topic: Careers in Graphic Communications
Standard: List major responsibilities for each of the major occupations identified.

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.
Topic: Basic Math for Graphic Communications
Standard: Solve subtraction of fraction problems.

Topic: Basic Math for Graphic Communications
Standard: Solve subtraction of decimal problems two and three digits.

Topic: Basic Math for Graphic Communications
Standard: Solve multiplication of whole numbers two and three digits.

Topic: Basic Math for Graphic Communications
Standard: Solve multiplication of decimal problems two and three digits.

Topic: Basic Math for Graphic Communications
Standard: Solve division of whole number problems two and three digits.

Topic: Basic Math for Graphic Communications
Standard: Solve division of decimals problems two and three digits.

Topic: Basic Math for Graphic Communications
Standard: Solve decimals to percent conversion problems

Topic: Basic Math for Graphic Communications
Standard: Solve percent to decimal conversion problems.

Topic: Basic Math for Graphic Communications
Standard: Solve basic ratio and proportion problems.

Topic: Basic Math for Graphic Communications
Standard: Solve basic linear measurement problems.

Topic: Basic Math for Graphic Communications
Standard: Solve basic type calculation problems.

Topic: Basic Math for Graphic Communications
Standard: Solve basic liquid measure problems.

Topic: Basic Math for Graphic Communications
Standard: Solve basic paper cutting calculations.

Topic: Basic Math for Graphic Communications
Standard: Solve inches to points conversion problems.

Topic: Basic Math for Graphic Communications
Standard: Solve points to inches conversion problems.

Topic: Basic Math for Graphic Communications
Standard: Solve cost calculating problems.

Topic: Basic Math for Graphic Communications
Standard: Solve inches to decimal conversion problems.

Topic: Measurement in Graphic Communications
Standard: Measure linear dimensions for printing materials in inches & fractions of inches.

Topic: Measurement in Graphic Communications
Standard: Measure type and leading in points.

Topic: Measurement in Graphic Communications
Standard: Measure volume for mixing chemicals for pressroom operations.
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.
Topic: Interpersonal Skills
Standard: Perform effectively in various environments with people of different ages, genders, cultures, socioeconomic backgrounds, attitudes, and abilities.

Topic: Interpersonal Skills
Standard: Work to satisfy customer/client expectations.

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

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

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

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

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

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

Topic: Technology
Standard: Utilize a variety of technologies.

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

Topic: Business Aspects
Standard: Identify forms of business ownership.

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

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

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

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

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

Topic: Career Development
Standard: Demonstrate effective skills for seeking and securing employment.

Topic: Career Development
Standard: Demonstrate understanding of education and career development as a lifelong learning process that requires preparation for change.
Topic: Safety
**Standard:** List general safety rules for the machining laboratory.

Topic: Safety
**Standard:** List the specific safety rules applicable to the CNC Turning Center.

Topic: Safety
**Standard:** Identify the location of the following: fire extinguisher(s), eye wash station, first aid kit, emergency electrical shutoff(s).

Topic: Safety
**Standard:** Describe the types of fires possible in a machining environment and identify the appropriate fire extinguisher for each type of fire.

Topic: Safety
**Standard:** Demonstrate the use of a fire extinguisher.

Topic: Safety
**Standard:** Demonstrate basic first aid to stop bleeding and prevent shock.

Topic: Safety
**Standard:** Describe the procedure for obtaining outside emergency medical response.

Topic: Safety
**Standard:** Demonstrate emergency shutoff procedures.

Topic: Safety
**Standard:** Demonstrate shop evacuation procedures.

Topic: Safety
**Standard:** Identify location of Material Safety and Data Sheets (MSDS).

Topic: Safety
**Standard:** Execute an emergency stop of a CNC lathe.

Topic: Intermediate Computer Numerical Control (CNC)
**Standard:** Calculate coordinates and dimensions on a CNC machine.

Topic: Intermediate Computer Numerical Control (CNC)
**Standard:** Write a basic CNC lathe program for turning, facing, and corner radii.

Topic: Intermediate Computer Numerical Control (CNC)
**Standard:** Edit a CNC program.

Topic: Intermediate Computer Numerical Control (CNC)
**Standard:** Describe how computer aided manufacturing (CAM) programs can facilitate CNC production.

Topic: Career Planning
**Standard:** Prepare a list of companies that hire CNC machinists.

Topic: Career Planning
**Standard:** Write a resume.

Topic: Career Planning
**Standard:** Conduct mock job interviews.
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.
<table>
<thead>
<tr>
<th>Page</th>
<th>Topic: Job Planning and Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td><strong>Standard:</strong> Fill out an operations sheet listing the sequence of operations.</td>
</tr>
<tr>
<td>52</td>
<td><strong>Topic:</strong> Job Planning and Management</td>
</tr>
<tr>
<td>53</td>
<td><strong>Standard:</strong> Complete a materials list and identify required hand tools, fixtures, and cutting fluids.</td>
</tr>
<tr>
<td>54</td>
<td><strong>Topic:</strong> Heat Treatment</td>
</tr>
<tr>
<td>55</td>
<td><strong>Standard:</strong> Describe the types of heat treatment.</td>
</tr>
<tr>
<td>56</td>
<td><strong>Topic:</strong> Heat Treatment</td>
</tr>
<tr>
<td>57</td>
<td><strong>Standard:</strong> Demonstrate stress relief using a peening process.</td>
</tr>
<tr>
<td>58</td>
<td><strong>Topic:</strong> Heat Treatment</td>
</tr>
<tr>
<td>59</td>
<td><strong>Standard:</strong> Demonstrate the proper operation of a heat treatment furnace.</td>
</tr>
<tr>
<td>60</td>
<td><strong>Topic:</strong> Layout and Benchwork</td>
</tr>
<tr>
<td>61</td>
<td><strong>Standard:</strong> Demonstrate proper use of a precision surface plate and height gauge with scribe.</td>
</tr>
<tr>
<td>62</td>
<td><strong>Topic:</strong> Layout and Benchwork</td>
</tr>
<tr>
<td>63</td>
<td><strong>Standard:</strong> Conduct layout operations using layout ink, scribe, radius gauges, and templates.</td>
</tr>
<tr>
<td>64</td>
<td><strong>Topic:</strong> Layout and Benchwork</td>
</tr>
<tr>
<td>65</td>
<td><strong>Standard:</strong> Perform drilling, cutting, and filing operations using appropriate hand tools.</td>
</tr>
<tr>
<td>66</td>
<td><strong>Topic:</strong> Layout and Benchwork</td>
</tr>
<tr>
<td>67</td>
<td><strong>Standard:</strong> Check tolerances with a six inch caliper.</td>
</tr>
<tr>
<td>68</td>
<td><strong>Topic:</strong> Layout and Benchwork</td>
</tr>
<tr>
<td>69</td>
<td><strong>Standard:</strong> Complete NIMS Layout Level I project.</td>
</tr>
<tr>
<td>70</td>
<td><strong>Topic:</strong> Drill Press Operations</td>
</tr>
<tr>
<td>71</td>
<td><strong>Standard:</strong> Complete NIMS Drill Press Level I project.</td>
</tr>
</tbody>
</table>
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.
Topic: Basic Mill
Standard: Indicate head for X and Y axis alignment.

Topic: Basic Mill
Standard: Calculate feeds and speeds for various materials.

Topic: Basic Mill
Standard: Set up milling machine for various feeds and speeds.

Topic: Basic Mill
Standard: Align milling machine fixtures and attachments.

Topic: Basic Mill
Standard: Identify milling cutters used in vertical milling.

Topic: Basic Mill
Standard: Demonstrate drilling operations.

Topic: Basic Mill
Standard: Demonstrate reaming operations.

Topic: Basic Mill
Standard: Demonstrate boring operations.

Topic: Basic Mill
Standard: Demonstrate end milling operations.

Topic: Basic Mill
Standard: Demonstrate face milling operations.

Topic: Basic Mill
Standard: Demonstrate fly cutting operations (optional).

Topic: Basic Mill
Standard: Square a work piece to specified tolerances with and without the use of digital readout (DRO).

Topic: Quality Control
Standard: Develop an inspection plan.

Topic: Quality Control
Standard: Select required measuring instruments.

Topic: Quality Control
Standard: Inspect a part produced on a lathe.

Topic: Quality Control
Standard: Inspect a part produced on a milling machine.

Topic: Quality Control
Standard: Complete a written inspection report to include a decision to accept or reject the part.

Topic: Quality Control
Standard: Describe inspection procedures, results, and decisions.

Topic: Machinery Maintenance
Standard: Perform incidental and preventative maintenance on a lathe and a milling machine.

Topic: Machinery Maintenance
Standard: Report problems that are beyond the scope of authority.
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.
**Course:** DRAFT - Precision Machining: 48.59400 Advanced Machine Tool Operations

**Topic:** Intermediate Milling Machine  
**Standard:** Set up milling machine for various feeds and speeds.

**Topic:** Intermediate Milling Machine  
**Standard:** Align milling machine fixtures and attachments.

**Topic:** Intermediate Milling Machine  
**Standard:** Locate work with center finder, edge finders, and indicators.

**Topic:** Intermediate Milling Machine  
**Standard:** Demonstrate proper use of a T-slot cutter.

**Topic:** Intermediate Milling Machine  
**Standard:** Demonstrate proper use of a Woodruff keyseat cutter.

**Topic:** Intermediate Milling Machine  
**Standard:** Mill a keyway.

**Topic:** Intermediate Milling Machine  
**Standard:** Mill a chamfer.

**Topic:** Intermediate Milling Machine  
**Standard:** Complete NIMS Milling Level I project.

**Topic:** Quality Control  
**Standard:** Develop an inspection plan.

**Topic:** Quality Control  
**Standard:** Select required measuring instruments.

**Topic:** Quality Control  
**Standard:** Inspect a part produced on a lathe.

**Topic:** Quality Control  
**Standard:** Inspect a part produced on a milling machine.

**Topic:** Quality Control  
**Standard:** Inspect a part produced on a surface grinder.

**Topic:** Quality Control  
**Standard:** Complete a written inspection report to include a decision to accept or reject the parts.

**Topic:** Machinery Maintenance  
**Standard:** Perform incidental and preventative maintenance on a lathe and a milling machine.

**Topic:** Machinery Maintenance  
**Standard:** Report problems that are beyond the scope of authority.

**Topic:** Machinery Maintenance  
**Standard:** Fill out the history form for tracking maintenance.

**Topic:** Safety  
**Standard:** List general safety rules for the machining laboratory.

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

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

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

Topic: Personal Qualities
Standard: Choose ethical courses of action.

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

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

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

Topic: Interpersonal Skills
Standard: Participate and interact as a team member and leader.

Topic: Interpersonal Skills
Standard: Share knowledge and skills with others.

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

Topic: Interpersonal Skills
Standard: Work to satisfy customer/client expectations.

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

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

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

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

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

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

Topic: Technology
Standard: Utilize a variety of technologies.

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.
Course: Electronics: 47.59200 Alternating Current Circuits and Basic Computer Usage

35

**Topic:** Basic Computer Usage

**Standard:** Demonstrate the use of microcomputer operating systems.
Topic: Basic Computer Usage
Standard: Demonstrate the use of high-level computer language.

Topic: Basic Computer Usage
Standard: Demonstrate the use of microcomputer application programs (i.e., word processing, database and spreadsheet).

Topic: Alternating Current (AC) Circuits
Standard: Solve basic trigonometric problems applicable to electronics.

Topic: Alternating Current (AC) Circuits
Standard: Describe basic magnetism.

Topic: Alternating Current (AC) Circuits
Standard: Define basic generator theory and operation.

Topic: Alternating Current (AC) Circuits
Standard: Identify the characteristics of sinusoidal waves.

Topic: Alternating Current (AC) Circuits
Standard: Describe magnetic properties of circuits and devices.

Topic: Alternating Current (AC) Circuits
Standard: Determine the physical and electrical characteristics of capacitors and inductors.

Topic: Alternating Current (AC) Circuits
Standard: Define the characteristics of AC capacitive circuits.

Topic: Alternating Current (AC) Circuits
Standard: Construct and measure the operation of AC capacitive circuits.

Topic: Alternating Current (AC) Circuits
Standard: Define the characteristics of AC inductive circuits.

Topic: Alternating Current (AC) Circuits
Standard: Construct and measure the operation of AC inductive circuits.

Topic: Alternating Current (AC) Circuits
Standard: Define and apply the principles of transformers to AC circuits.

Topic: Alternating Current (AC) Circuits
Standard: Construct and measure the operation of AC circuits utilizing transformers.

Topic: Alternating Current (AC) Circuits
Standard: State the principle of impedance matching.

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.

Topic: Alternating Current (AC) Circuits
Standard: Construct and measure the operation of differentiators and integrators to determine R-C and R-L time constraints.

Topic: Alternating Current (AC) Circuits
Standard: State the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel, and complex.)

Topic: Alternating Current (AC) Circuits
Standard: Construct and measure the operation of series and parallel resonant circuits.
Course: Electronics: 47.59300 Analog 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.
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.
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, siren 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.
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.
Course: Engineering: 48.54800 Civil Engineering Drawing

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.
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.
Topic: Copper And Plastic Piping Practices
Standard: State the basic requirements for pressure-testing a system once it has been installed.

Topic: Copper And Plastic Piping Practices
Standard: Follow basic safety precautions for the installation, operation, and maintenance of refrigerating and air conditioning equipment.

Topic: Soldering And Brazing
Standard: Assemble and operate the tools used for soldering.

Topic: Soldering And Brazing
Standard: Prepare tubing and fittings for soldering.

Topic: Soldering And Brazing
Standard: Identify the purposes and use of solder and solder fluxes.

Topic: Soldering And Brazing
Standard: Solder copper tubing and fittings.

Topic: Soldering And Brazing
Standard: Assemble and operate the tools used for brazing.

Topic: Soldering And Brazing
Standard: Prepare tubing and fittings for brazing.

Topic: Soldering And Brazing
Standard: Identify the purposes and use of filler metals and fluxes used for brazing.

Topic: Soldering And Brazing
Standard: Braze copper tubing and fittings.

Topic: Soldering And Brazing
Standard: Identify the inert gases that can safely be used to purge tubing when brazing.

Topic: Ferrous Metal Piping Practices
Standard: Identify the types of ferrous metal pipes.

Topic: Ferrous Metal Piping Practices
Standard: Measure the sizes of ferrous metal pipes.

Topic: Ferrous Metal Piping Practices
Standard: Identify the common malleable iron fittings.

Topic: Ferrous Metal Piping Practices
Standard: Cut, ream, and thread ferrous metal pipe.

Topic: Ferrous Metal Piping Practices
Standard: Join lengths and threaded pipe together and install fittings.

Standard: Describe the main points to consider when installing pipe runs.

Topic: Ferrous Metal Piping Practices
Standard: Describe the method used to join grooved piping.

Topic: Basic Electricity
Standard: State how electrical power is generated and distributed.

Topic: Basic Electricity
Standard: Describe how voltage, current, resistance, and power are related.

Topic: Basic Electricity
Standard: Use Ohm’s Law to calculate the current, voltage, and resistance in a circuit.
Topic: Basic Electricity
**Standard:** Use the power formula to calculate how much power a circuit consumes.

Topic: Basic Electricity
**Standard:** Describe the differences between series and parallel circuits.

Topic: Basic Electricity
**Standard:** Recognize and describe the purpose and operation of the various electrical components used in HVAC equipment.

Topic: Basic Electricity
**Standard:** State and demonstrate the safety precautions that must be followed when working on electrical equipment.

Topic: Basic Electricity
**Standard:** Make voltage, current, and resistance measurements using electrical test equipment.

Course: HVAC: 47.51200 HVAC Heating and Cooling Basics

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.

Topic: Introduction To Cooling
**Standard:** Calculate the temperature and pressure relationships at key points in the refrigeration cycle.

Topic: Introduction to Cooling
**Standard:** Under supervision, use temperature and pressure measuring instruments to make readings at key points in the refrigeration cycle.

Topic: Introduction To Cooling
**Standard:** Identify commonly used refrigerants and demonstrate the procedures for handling these refrigerants.

Topic: Introduction To Cooling
**Standard:** Recognize the major components of a cooling system and explain how each type works.

Topic: Introduction To Cooling
**Standard:** Recognize the major accessories available with cooling systems and explain how each type works.

Topic: Introduction To Cooling
**Standard:** Recognize the control devices used in cooling systems and explain how each type works.

Topic: Introduction To Cooling
**Standard:** Under supervision, perform basic power-off maintenance procedures applicable to cooling systems.

Topic: Introduction To Cooling
**Standard:** State the correct methods to be used when piping a refrigeration or cooling system.

Topic: Introduction To Heating
**Standard:** Explain the three methods by which heat is transferred and give an example of each.

Topic: Introduction To Heating
**Standard:** Describe how combustion occurs and identify the by-products of combustion.

Topic: Introduction To Heating
**Standard:** Identify the various types of fuels used in heating.

Topic: Introduction To Heating
**Standard:** Recognize the major components and accessories of a forced-air furnace and explain the function of each component.
**Course:** HVACR: 47.51300 Air Flow Systems and Maintenance

### 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.

### 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 psychrometric 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 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:** HVAC Controls  
**Standard:** Explain the function of a thermostat in an HVACR system.

47 **Topic:** HVAC Controls  
**Standard:** Describe different types of thermostats and explain how they are used.

48 **Topic:** HVAC Controls  
**Standard:** Demonstrate the correct installation and adjustment of a thermostat using proper siting and wiring techniques.

49 **Topic:** HVAC Controls  
**Standard:** Explain the basic principles applicable to all control systems.

50 **Topic:** HVAC Controls  
**Standard:** Identify the various types of electromechanical, electronic, and pneumatic HVAC controls, and explain their function and operation.

51 **Topic:** HVAC Controls  
**Standard:** Perform simulated troubleshooting of a typical HVAC 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 HVAC 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 devices 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.
Course: HVAC: 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 dehydrration.

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.
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.
Course: HVAC: 47.51700 HVACR Servicing and Troubleshooting II
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.
Topic: Technology
Standard: Operate and maintain technical equipment and the work environment safely following applicable industry regulations and guidelines.

Topic: Technology
Standard: Utilize a variety of technologies.

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

Topic: Business Aspects
Standard: Identify forms of business ownership.

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

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

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

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

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

Topic: Career Development
Standard: Demonstrate effective skills for seeking and securing employment.

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

Topic: Overview of Manufacturing/Engineering
Standard: Identify and describe types of careers available in manufacturing/engineering.

Topic: Overview of Manufacturing/Engineering
Standard: Identify educational and work experience required for identified careers.

Topic: Overview of Manufacturing/Engineering
Standard: List professional organizations available for workers in manufacturing/engineering careers.

Topic: Overview of Manufacturing/Engineering
Standard: Identify functions of an engineering research and development group.

Topic: Overview of Manufacturing/Engineering
Standard: Define the concepts and principles of total Quality Management.

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

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, Megometer, 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.
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 250-5Z.

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

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

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

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

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

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

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

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

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

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

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

**Topic:** Cable Trays  
**Standard:** Describe the components that makeup a cable tray assembly.

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

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

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

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

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

**Topic:** Cable Trays  
**Standard:** Select the required fittings to ensure equipment-grounding continuity in cable tray systems.

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

**Topic:** Cable Trays  
**Standard:** Size cable tray for the number and type of conductors contained in the system.
Topic: Cable Trays
Standard: Select rollers and sheaves for pulling cable in specific cable tray situations.

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

Topic: Cable Trays
Standard: Fabricate an offset for a cable tray.

Topic: Cable Trays
Standard: Discuss cable carriers.

Topic: Conductor Terminations
Standard: Describe how to make a good conductor termination.

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

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

Topic: Conductor Terminations
Standard: Train cable at termination points.

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

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

Topic: Conductor Terminations
Standard: Describe the importance of using proper bolt torque when bolting lugs onto bus bars.

Topic: Conductor Terminations
Standard: Describe crimping techniques.

Topic: Conductor Terminations
Standard: Select the proper lugs or connector for the job.

Topic: Conductor Terminations
Standard: Describe splicing techniques.

Topic: Conductor Terminations
Standard: Describe the installation rules for parallel conductors.

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

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

Topic: Installation of Electrical Services
Standard: Read electrical blueprints and diagrams describing service installations.

Topic: Installation of Electrical Services
Standard: Calculate and select service-entrance equipment.

Topic: Installation of Electrical Services
Standard: Explain the role of the NEC in service installations.
135 **Topic:** Installation of Electrical Services  
**Standard:** Install main disconnect switches, panel boards, and overcurrent protection devices.

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

137 **Topic:** Installation of Electrical Services  
**Standard:** Explain the types and purposes of service grounding.

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

139 **Topic:** Installation of Electrical Services  
**Standard:** Describe single-phase service connectors.

140 **Topic:** Installation of Electrical 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 contractors 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:** Introduction 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:** Introduction to Bearings  
**Standard:** Explain bearing designation.

52  **Topic:** Introduction 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 gouging & 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.
**Topic:** Pumps  
**Standard:** Identify and explain centrifugal pumps, rotary pumps, reciprocating pumps, metering pumps, and vacuum pumps.

**Topic:** Pumps  
**Standard:** Explain net positive suction head and cavitations.

**Topic:** Pumps  
**Standard:** Install pumps.

**Topic:** Pumps  
**Standard:** Use pump curves for troubleshooting.

**Topic:** Pumps  
**Standard:** Identify pumps needed for hazardous materials, i.e. acid & caustic.

**Topic:** Basic Hydraulic Systems  
**Standard:** Explain hydraulic system safety.

**Topic:** Basic Hydraulic Systems  
**Standard:** Explain the principles of hydraulics.

**Topic:** Basic Hydraulic Systems  
**Standard:** Identify and explain hydraulic fluids, valves, pumps and motors.

**Topic:** Basic Hydraulic Systems  
**Standard:** Explain when to use a hydraulic control system.

**Topic:** Basic Pneumatic Systems  
**Standard:** Explain pneumatic safety.

**Topic:** Basic Pneumatic Systems  
**Standard:** Explain the physical characteristics of gases.

**Topic:** Basic Pneumatic Systems  
**Standard:** Explain the pneumatic transmission of energy.

**Topic:** Basic Pneumatic Systems  
**Standard:** Explain the principles of compressor operation.

**Topic:** Basic Pneumatic Systems  
**Standard:** Identify and explain types of compressors.

**Topic:** Basic Pneumatic Systems  
**Standard:** Explain compressed-air treatment/drying.

**Topic:** Basic Pneumatic Systems  
**Standard:** Identify and explain pneumatic system components and symbols.

**Topic:** Basic Pneumatic Systems  
**Standard:** Explain when to use a pneumatic control system.

---

**Course:** Manufacturing: 49.53600 Integrating Systems

**Topic:** Basic Electronic Theory  
**Standard:** Identify electronic system components.

**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/UVVPROM.

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

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

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

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

Topic: Technology  
**Standard:** Utilize a variety of technologies.

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

Topic: Business Aspects  
**Standard:** Identify forms of business ownership.

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

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

Topic: Business Aspects  
**Standard:** Maintain safety, health, and environmental standards, and addresses ergonomic concerns.

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

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

Topic: Career Development  
**Standard:** Demonstrate effective skills for seeking and securing employment.

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

Topic: Oxyfuel Cutting  
**Standard:** Explain oxyfuel cutting safety.

Topic: Oxyfuel Cutting  
**Standard:** Identify and explain oxyfuel cutting equipment.

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.
Topic: Reading, Working With, And Drawing Blueprints  
Standard: Identify and explain notes and special requirements.

Topic: Reading, Working With, And Drawing Blueprints  
Standard: Read machinist shop prints.

Topic: Machining Hand And Power Tools  
Standard: Identify the hand tools used by machinists and describe their uses.

Topic: Machining Hand And Power Tools  
Standard: Use hand tools in a safe and appropriate manner.

Topic: Machining Hand And Power Tools  
Standard: State the general safety rules for operating all types of power tools.

Topic: Machining Hand And Power Tools  
Standard: Identify stationary power tools commonly used by machinists.

Topic: Machining Hand And Power Tools  
Standard: Identify the portable power tools commonly use by machinists.

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.
<table>
<thead>
<tr>
<th>Page</th>
<th>Topic</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Math Applications II</td>
<td>Perform mathematical tasks necessary for solving linear, area, volume, and angular measurement problems.</td>
</tr>
<tr>
<td>36</td>
<td>Math Applications II</td>
<td>Correctly apply mathematical symbols in the solution of mathematical problems.</td>
</tr>
<tr>
<td>37</td>
<td>Math Applications II</td>
<td>Solve percentage problems.</td>
</tr>
<tr>
<td>38</td>
<td>Math Applications II</td>
<td>Understand, define, and solve ratio and proportion problems and equations.</td>
</tr>
<tr>
<td>39</td>
<td>Math Applications II</td>
<td>Sequentially solve problems with the use of simple equations.</td>
</tr>
<tr>
<td>40</td>
<td>Math Applications II</td>
<td>Understand how to use protractors, vernier calipers, and micrometers for angle and tolerance measurement problems.</td>
</tr>
<tr>
<td>41</td>
<td>Math Applications II</td>
<td>Calculate the number of fitting blanks that can be cut from a given dimension of sheet metal stock.</td>
</tr>
<tr>
<td>42</td>
<td>Math Applications II</td>
<td>Calculate stretchouts of square fittings, rectangular fittings, rectangular box fittings, circular, and cone fittings.</td>
</tr>
<tr>
<td>43</td>
<td>Bend Allowances</td>
<td>Describe the factors that influence bend allowances on sheet metal blanks.</td>
</tr>
<tr>
<td>44</td>
<td>Bend Allowances</td>
<td>Demonstrate an understanding of the calculations necessary for determining proper bend allowances on selected sheet metal problems.</td>
</tr>
<tr>
<td>45</td>
<td>Bend Allowances</td>
<td>Demonstrate skill in the determining bend allowances on selected sheet metal problems.</td>
</tr>
<tr>
<td>46</td>
<td>Soldering</td>
<td>Identify soldering tools and materials.</td>
</tr>
<tr>
<td>47</td>
<td>Soldering</td>
<td>Use and skillfully manipulate soldering tools and materials.</td>
</tr>
<tr>
<td>48</td>
<td>The SMACNA Manuals</td>
<td>Demonstrate skill in locating standards for selected topics, fittings, or components.</td>
</tr>
<tr>
<td>49</td>
<td>The SMACNA Manuals</td>
<td>Define the difference between standards and codes or ordinances.</td>
</tr>
<tr>
<td>50</td>
<td>The SMACNA Manuals</td>
<td>Demonstrate skill in locating selected information in illustrations and tables.</td>
</tr>
<tr>
<td>51</td>
<td>The SMACNA Manuals</td>
<td>List other pertinent organizations that establish codes and standards.</td>
</tr>
<tr>
<td>52</td>
<td>Sheet Metal Duct Fabrication Standards</td>
<td>Understand the effect of operating pressure on the design of a duct system.</td>
</tr>
</tbody>
</table>
Course: Sheet Metal: 48.58500 Radial Line Development

**Topic:** Fabrication II- Radial Line Development
**Standard:** Describe the principles of radial line development used to determine layouts for sheet metal fittings.

**Topic:** Fabrication II- Radial Line Development
**Standard:** Use the principles of radial line development for the layout of selected sheet metal fittings.

**Topic:** Fabrication II- Radial Line Development
**Standard:** Demonstrate skill in the layout and fabrication of selected sheet metal fittings and related tasks.

**Topic:** Gutters And Downspouts
**Standard:** Demonstrate skill in understanding the principles of roof design and drainage systems.

**Topic:** Gutters And Downspouts
**Standard:** Demonstrate skill in the calculating downspout and gutter sizes.

**Topic:** Gutters And Downspouts
**Standard:** Identify, lay out, and fabricate selected drainage components.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principles Of Airflow</td>
<td><strong>Standard:</strong> Explain the principles of airflow that affect the design and sizing of duct run systems.</td>
</tr>
<tr>
<td>Principles Of Airflow</td>
<td><strong>Standard:</strong> Identify the components of an air distribution system.</td>
</tr>
<tr>
<td>Principles Of Airflow</td>
<td><strong>Standard:</strong> Define the terms related to airflow in ducts.</td>
</tr>
<tr>
<td>Principles Of Airflow</td>
<td><strong>Standard:</strong> Understand the effects of duct sizes, duct shapes, and duct fittings on airflow.</td>
</tr>
<tr>
<td>Associated Equipment</td>
<td><strong>Standard:</strong> Recognize heating and cooling equipment associated with sheet metal installation.</td>
</tr>
<tr>
<td>Associated Equipment</td>
<td><strong>Standard:</strong> Describe the function and operation of each piece of equipment.</td>
</tr>
<tr>
<td>Associated Equipment</td>
<td><strong>Standard:</strong> Explain the location of selected pieces of equipment in the HVACR system.</td>
</tr>
<tr>
<td>Principles Of Refrigeration</td>
<td><strong>Standard:</strong> Describe the refrigeration cycle.</td>
</tr>
<tr>
<td>Principles Of Refrigeration</td>
<td><strong>Standard:</strong> Identify refrigeration system components.</td>
</tr>
<tr>
<td>Principles Of Refrigeration</td>
<td><strong>Standard:</strong> Indicate the placement of selected cooling system components and air-delivery duct runs.</td>
</tr>
<tr>
<td>Fiberglass Duct</td>
<td><strong>Standard:</strong> Describe the type of material used for fabricating fiberglass duct.</td>
</tr>
<tr>
<td>Fiberglass Duct</td>
<td><strong>Standard:</strong> Describe the common procedures necessary for the layout and fabrication of selected fiberglass duct run fittings.</td>
</tr>
<tr>
<td>Fiberglass Duct</td>
<td><strong>Standard:</strong> Identify the tools and equipment necessary for the fabrication of selected fiberglass duct run fittings.</td>
</tr>
<tr>
<td>Fiberglass Duct</td>
<td><strong>Standard:</strong> Demonstrate competence in the layout and fabrication of selected fiberglass duct run fittings.</td>
</tr>
<tr>
<td>Field Measuring And Fitting</td>
<td><strong>Standard:</strong> Describe common practices used for field measuring and layout of duct runs and fittings.</td>
</tr>
<tr>
<td>Field Measuring And Fitting</td>
<td><strong>Standard:</strong> Demonstrate competence in solving selected field measuring problems.</td>
</tr>
<tr>
<td>Field Measuring And Fitting</td>
<td><strong>Standard:</strong> Apply standard rules and practice for solving selected field measurement problems.</td>
</tr>
</tbody>
</table>
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.
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.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Transmission Service Providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td><strong>Standard:</strong> Define and explain the purpose of LEC’s and the differences between LEC’s and Regional Operating Companies.</td>
</tr>
<tr>
<td>36</td>
<td><strong>Standard:</strong> Define Independent Telephone Company.</td>
</tr>
<tr>
<td>37</td>
<td><strong>Standard:</strong> Define network control points and define NOC.</td>
</tr>
<tr>
<td>38</td>
<td><strong>Standard:</strong> Distinguish between bit rate and baud rates.</td>
</tr>
<tr>
<td>39</td>
<td><strong>Standard:</strong> Define In-band and Common Channel Signaling (CCS) and SS7, Signaling System 7.</td>
</tr>
<tr>
<td>40</td>
<td><strong>Standard:</strong> Identify the basic components of the LEC/IC and PBX communication systems.</td>
</tr>
<tr>
<td>41</td>
<td><strong>Standard:</strong> Define CO and list its purpose.</td>
</tr>
<tr>
<td>42</td>
<td><strong>Standard:</strong> Define and explain basic switching methods and its evolution.</td>
</tr>
<tr>
<td>43</td>
<td><strong>Standard:</strong> Define and discuss common carriers.</td>
</tr>
<tr>
<td>44</td>
<td><strong>Standard:</strong> Explain network structures, transmission, and media including: DAL, T1, T3, SONET and OC3-OC 192.</td>
</tr>
<tr>
<td>45</td>
<td><strong>Standard:</strong> Explain multiplexing and its importance to today’s communication systems.</td>
</tr>
<tr>
<td>46</td>
<td><strong>Standard:</strong> Define, describe, and discuss fundamental concepts of data communication networks.</td>
</tr>
<tr>
<td>47</td>
<td><strong>Standard:</strong> Identify fundamental concepts of wireless communication.</td>
</tr>
<tr>
<td>48</td>
<td><strong>Standard:</strong> Describe the usage of conformance testing and equipment.</td>
</tr>
<tr>
<td>49</td>
<td><strong>Standard:</strong> Explain the purpose and benefits of end-to-end testing.</td>
</tr>
<tr>
<td>50</td>
<td><strong>Standard:</strong> Discuss the basic modes of transmission and their relation to various types of transmission media.</td>
</tr>
<tr>
<td>51</td>
<td><strong>Standard:</strong> Explain simplex, duplex, and half-duplex transmission modes.</td>
</tr>
<tr>
<td>52</td>
<td><strong>Standard:</strong> Explain full-duplex transmission over two-wire and four-wire lines.</td>
</tr>
<tr>
<td>53</td>
<td><strong>Standard:</strong> Describe the advantages and disadvantages of different transmission media such as copper pairs, coaxial cable, fiber optics, satellite, and microwave</td>
</tr>
</tbody>
</table>
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 modulator 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.
Topic: LANs and Internet Access
Standard: Define the functions of a modem.

Topic: LANs and Internet Access
Standard: Describe the applications for various modems.

Topic: LANs and Internet Access
Standard: Describe applications for HUBS and Routers.

Topic: Fiber Optics
Standard: Identify the components of the visible spectrum and the optical spectrum.

Topic: Fiber Optics
Standard: Identify the law of reflection and Snell’s Law.

Topic: Fiber Optics
Standard: Describe basic fiber optic communications principles.

Topic: Fiber Optics
Standard: Explain the operation and describe the three section of a fiber optic system.

Topic: Fiber Optics
Standard: Identify some optical light sources and optical detectors.

Topic: Fiber Optics
Standard: Describe singlemode and multimode waveguides.

Topic: Fiber Optics
Standard: Define SNR and BER.

Topic: Fiber Optics
Standard: Describe the basic steps to properly splice waveguides.

Topic: Fiber Optics
Standard: Perform splicing techniques for optical fibers.

Topic: Fiber Optics
Standard: Determine the losses of adding a non-permanent mechanical splice to a fiber optic cable.

Topic: Fiber Optics
Standard: Identify a faulted fiber optic system.

Topic: PBX Systems
Standard: Describe the equipment cabinet, parts, circuit card function and available features of the PBX.

Topic: PBX Systems
Standard: Identify and inspect a circuit card and describe installation requirements.

Topic: PBX Systems
Standard: Explain the system configuration.

Topic: PBX Systems
Standard: Explain installation and test procedures for the PBX system.

Topic: PBX Systems
Standard: Identify and locate error code display.

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.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Course: Telecommunications Technology: Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td><strong>Topic</strong>: Microwave and Satellite Systems</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Draw and explain a block diagram of</td>
</tr>
<tr>
<td></td>
<td>a cellular telephone system illustrating the</td>
</tr>
<tr>
<td></td>
<td>process and equipment used in transmitting and</td>
</tr>
<tr>
<td></td>
<td>receiving calls.</td>
</tr>
<tr>
<td>103</td>
<td><strong>Topic</strong>: Microwave and Satellite Systems</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Describe the process by which</td>
</tr>
<tr>
<td></td>
<td>cellular telephones are interfaced with public</td>
</tr>
<tr>
<td></td>
<td>switched systems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic</th>
<th>Course: Telecommunications Technology: Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Topic</strong>: Basic Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Locate, understand, and interpret</td>
</tr>
<tr>
<td></td>
<td>written information in a variety of formats,</td>
</tr>
<tr>
<td></td>
<td>including such documents as manuals, graphs,</td>
</tr>
<tr>
<td></td>
<td>reports, and schedules.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Basic Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Communicate thoughts, ideas,</td>
</tr>
<tr>
<td></td>
<td>information, and messages in writing and</td>
</tr>
<tr>
<td></td>
<td>technologically, and create documents such as</td>
</tr>
<tr>
<td></td>
<td>letters, directions, manuals, reports, graphs,</td>
</tr>
<tr>
<td></td>
<td>and flowcharts.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Basic Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Perform and apply numerical</td>
</tr>
<tr>
<td></td>
<td>concepts and calculations, and solve problems</td>
</tr>
<tr>
<td></td>
<td>by choosing appropriately from a variety of</td>
</tr>
<tr>
<td></td>
<td>mathematical techniques using mental, manual,</td>
</tr>
<tr>
<td></td>
<td>and technological methods.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Basic Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Receive, interpret, and respond</td>
</tr>
<tr>
<td></td>
<td>to verbal and nonverbal messages in a manner</td>
</tr>
<tr>
<td></td>
<td>appropriate to a given situation.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Basic Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Organize ideas and communicate</td>
</tr>
<tr>
<td></td>
<td>orally in a clear, concise, and courteous</td>
</tr>
<tr>
<td></td>
<td>manner.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Thinking Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Specify goals, objectives,</td>
</tr>
<tr>
<td></td>
<td>constraints, and supporting factors.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Thinking Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Identify problems, alternative</td>
</tr>
<tr>
<td></td>
<td>solutions, consequences of alternative</td>
</tr>
<tr>
<td></td>
<td>solutions, and use appropriate techniques to</td>
</tr>
<tr>
<td></td>
<td>resolve given problems.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Thinking Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Implement a plan of action</td>
</tr>
<tr>
<td></td>
<td>making modifications as needed to achieve</td>
</tr>
<tr>
<td></td>
<td>stated objectives.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Thinking Skills</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Use effective learning techniques</td>
</tr>
<tr>
<td></td>
<td>to acquire and apply new knowledge and skills.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Personal Qualities</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Assess self accurately, set</td>
</tr>
<tr>
<td></td>
<td>personal goals, monitor progress, and exhibit</td>
</tr>
<tr>
<td></td>
<td>self-control.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Personal Qualities</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Choose ethical courses of action.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Personal Qualities</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Take initiative to accomplish</td>
</tr>
<tr>
<td></td>
<td>tasks in a timely manner.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Personal Qualities</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Exert a high level of effort and</td>
</tr>
<tr>
<td></td>
<td>persevere towards goal attainment.</td>
</tr>
<tr>
<td></td>
<td><strong>Topic</strong>: Personal Qualities</td>
</tr>
<tr>
<td></td>
<td><strong>Standard</strong>: Demonstrate adaptability,</td>
</tr>
<tr>
<td></td>
<td>dependability, and responsibility and such</td>
</tr>
<tr>
<td></td>
<td>social behaviors as tolerance, honesty,</td>
</tr>
<tr>
<td></td>
<td>empathy, and courtesy.</td>
</tr>
</tbody>
</table>
Topic: Interpersonal Skills  
Standard: Participate and interact as a team member and leader.

Topic: Interpersonal Skills  
Standard: Share knowledge and skills with others.

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

Topic: Interpersonal Skills  
Standard: Work to satisfy customer/client expectations.

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

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

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

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

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

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

Topic: Technology  
Standard: Utilize a variety of technologies.

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

Topic: Business Aspects  
Standard: Identify forms of business ownership.

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

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

Topic: Business Aspects  
Standard: Maintain safety, health, and environmental standards, and address ergonomic concerns.

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

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

Topic: Career Development  
Standard: Demonstrate effective skills for seeking and securing employment.
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.

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:  Welding: 48.55100 Arc Welding Processes I

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Shielded Metal Arc Welding - Beads  &lt;br&gt; Prepare AC welding equipment.</td>
</tr>
<tr>
<td>36</td>
<td>Shielded Metal Arc Welding - Beads  &lt;br&gt; Strike an arc.</td>
</tr>
<tr>
<td>37</td>
<td>Shielded Metal Arc Welding - Beads  &lt;br&gt; Detect an arc blow.</td>
</tr>
<tr>
<td>38</td>
<td>Shielded Metal Arc Welding - Beads  &lt;br&gt; Make stringer, weave, and overlapping beads.</td>
</tr>
<tr>
<td>39</td>
<td>Weld Quality  &lt;br&gt; Identify and explain codes governing welding.</td>
</tr>
<tr>
<td>40</td>
<td>Weld Quality  &lt;br&gt; Identify and explain weld imperfections and their causes.</td>
</tr>
<tr>
<td>41</td>
<td>Weld Quality  &lt;br&gt; Identify and explain nondestructive examination practices.</td>
</tr>
<tr>
<td>42</td>
<td>Weld Quality  &lt;br&gt; Identify and explain welder qualification tests.</td>
</tr>
<tr>
<td>43</td>
<td>Weld Quality  &lt;br&gt; Explain the importance of quality workmanship.</td>
</tr>
<tr>
<td>44</td>
<td>Base Metal Preparation  &lt;br&gt; Clean base metal for welding or cutting.</td>
</tr>
<tr>
<td>45</td>
<td>Base Metal Preparation  &lt;br&gt; Identify and explain joint design.</td>
</tr>
<tr>
<td>46</td>
<td>Base Metal Preparation  &lt;br&gt; Explain joint design considerations.</td>
</tr>
<tr>
<td>47</td>
<td>Base Metal Preparation  &lt;br&gt; Prepare base metal joints for welding.</td>
</tr>
</tbody>
</table>

## Course:  Welding: 48.55200 Arc Welding Processes II

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Shielded Metal Arc Welding - Fillet Welds  &lt;br&gt; Make fillet welds: · Butt · Edge · Corner · Lap · Tee</td>
</tr>
<tr>
<td>36</td>
<td>Joint Fit-Up and Alignment  &lt;br&gt; Identify and explain job code specifications.</td>
</tr>
<tr>
<td>37</td>
<td>Joint Fit-Up and Alignment  &lt;br&gt; Use fit-up gauges and measuring devices to check joint fit-up.</td>
</tr>
<tr>
<td>38</td>
<td>Joint Fit-Up and Alignment  &lt;br&gt; Use plate and pipe fit-up tools to fit up joints.</td>
</tr>
<tr>
<td>39</td>
<td>Joint Fit-Up and Alignment  &lt;br&gt; Identify and explain distortion and how it is controlled.</td>
</tr>
</tbody>
</table>
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 – Groove Welds with Backing  
**Standard:** Identify and explain groove welds.

36  **Topic:** Shielded Metal Arc Welding – Groove Welds with Backing  
**Standard:** Prepare arc welding equipment for groove 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-but 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-but 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.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course: Welding: 48.55500 Advanced Arc Welding Processes I</strong></td>
<td></td>
</tr>
<tr>
<td>35 Topic: Preheating and Post-Weld Treatment of Metals</td>
<td>Explain how to preheat metals.</td>
</tr>
<tr>
<td>36 Topic: Preheating and Post-Weld Treatment of Metals</td>
<td>Describe maintaining interpass temperature.</td>
</tr>
<tr>
<td>38 Topic: Preheating and Post-Weld Treatment of Metals</td>
<td>Identify and explain the effects of welding on metals.</td>
</tr>
<tr>
<td>39 Topic: Gas Tungsten Arc Welding Equipment and Filler Metals</td>
<td>Explain gas tungsten arc welding (GTAW) safety.</td>
</tr>
<tr>
<td>40 Topic: Gas Tungsten Arc Welding Equipment and Filler Metals</td>
<td>Identify and explain the use of GTAW equipment.</td>
</tr>
<tr>
<td>41 Topic: Gas Tungsten Arc Welding Equipment and Filler Metals</td>
<td>Identify and explain the use of GTAW filler metals.</td>
</tr>
<tr>
<td>42 Topic: Gas Tungsten Arc Welding Equipment and Filler Metals</td>
<td>Identify and explain the use of GTAW shielding gases.</td>
</tr>
<tr>
<td>43 Topic: Gas Tungsten Arc Welding Equipment and Filler Metals</td>
<td>Set up GTAW welding equipment.</td>
</tr>
<tr>
<td>44 Topic: Gas Tungsten Arc Welding – Plate</td>
<td>Pad in all positions with stringer beads using GTAW and carbon steel filler metal.</td>
</tr>
<tr>
<td>45 Topic: Gas Tungsten Arc Welding – Plate</td>
<td>Make multipass V-butt open-groove welds on mild steel plate in the 1G (flat) position</td>
</tr>
<tr>
<td>46 Topic: Gas Tungsten Arc Welding – Plate</td>
<td>Make multipass V-butt open-groove welds on mild steel plate in the 2G (horizontal) position using GTAW and carbon steel filler metal.</td>
</tr>
<tr>
<td>47 Topic: Gas Tungsten Arc Welding – Plate</td>
<td>Make multipass V-butt open-groove welds on mild steel plate in the 3G (vertical) position using GTAW and carbon steel filler metal.</td>
</tr>
<tr>
<td>48 Topic: Gas Tungsten Arc Welding – Plate</td>
<td>Make multipass V-butt open-groove welds on mild steel plate in the 4G (overhead) position using GTAW and carbon steel filler metal.</td>
</tr>
<tr>
<td>49 Topic: GMAW and FCAW – Equipment and Filler Metals</td>
<td>Explain Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW) safety.</td>
</tr>
<tr>
<td>50 Topic: GMAW and FCAW – Equipment and Filler Metals</td>
<td>Explain the characteristics of welding current and power supplies.</td>
</tr>
<tr>
<td>51 Topic: GMAW and FCAW – Equipment and Filler Metals</td>
<td>Identify and explain the use of GMAW and FCAW equipment: · Spray arc · Globular · Short circuiting · Pulse</td>
</tr>
</tbody>
</table>
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

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.
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  

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 (indeclined)

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  