American River College conducts, in cooperation with industry, a number of apprenticeship programs. An apprenticeship program is a formal system of occupational training from one to five years, that combines paid employment, on-the-job training and job related college instruction in order to develop skilled workers.

Apprenticeship programs are a cooperative effort between employers, the Department of Labor (DOL) and/or the Division of Apprenticeship Standards (DAS), and the college.

Enrollment in an apprenticeship course is limited to registered apprentices. Information on admission to apprenticeship status can be obtained from the local trade in which you are interested, or from the office of the Dean of Technical Education.

### Union Contacts

<table>
<thead>
<tr>
<th>ASSOCIATE VP</th>
<th>DEAN WORKFORCE DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Frank Kobayashi</td>
<td>Raquel Arata</td>
</tr>
<tr>
<td>Worforce Development Office</td>
<td><a href="mailto:KongB@arc.losrios.edu">KongB@arc.losrios.edu</a></td>
</tr>
</tbody>
</table>

### Associate Degrees

#### A.A. in Carpenter Apprenticeship

This program concentrates on training apprentices to the specific levels required for the construction industry and has been approved by the State of California Department of Apprenticeship Standards. Training emphasis includes safety, blueprint reading, residential and commercial construction processes, building codes, estimation, and various carpentry topics.

#### Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARPT 107</td>
<td>Rigging</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 110</td>
<td>Foundations and Floors</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 112</td>
<td>Structural Framing</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 114</td>
<td>Form Detailing, Construction &amp; Erection</td>
<td>1</td>
</tr>
<tr>
<td>CARPT 120</td>
<td>Exterior Finish</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 122</td>
<td>Interior Finish</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 124</td>
<td>Commercial Door Hardware</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 130</td>
<td>Layout/Leveling Construction Site Practice</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 140</td>
<td>Interior Systems</td>
<td>1.3</td>
</tr>
<tr>
<td>CARPT 142</td>
<td>Engineered Structural Systems</td>
<td>1</td>
</tr>
<tr>
<td>CARPT 150</td>
<td>Concrete - Precast and Prestressed</td>
<td>1</td>
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</tbody>
</table>
COURSE CODE | COURSE TITLE | UNITS
---|---|---
CARPT 155 | Commercial Concrete | 1.5
CARPT 160 | Blueprint Reading-Residential | 1.3
CARPT 162 | Blueprint Reading-Commercial | 1.3
CARPT 170 | Roof Framing | 1
CARPT 180 | Stair Building | 1
CARPT 190 | Introduction to Welding and Cutting | 1
A minimum of 16 units from the following: | | 16
CARPT 298 | Work Experience in Carpenters Apprenticeship (1 - 4) | 
Total Units: | | 37.9

The Carpenter Apprenticeship Associate in Arts (A.A.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the carpenter’s tools of the trade.
- analyze, interpret, and apply national building codes relating to carpentry.
- analyze and interpret residential and commercial construction blueprints.
- evaluate, layout, and construct various systems such as floor, wall, roof, and concrete form.
- evaluate and layout a building site using architectural drawings.
- calculate elevations by using an engineer’s rod and various leveling devices.
- estimate and order material for construction projects.
- identify and select appropriate materials for each phase of construction.
- develop interpersonal skills with customers, co-workers, and different trades-workers.
- plan projects with given information such as blueprints, specifications, and contract documents.

Career Information

Upon completion of the Carpenter Apprenticeship degree, students may find employment in the following sectors: government, residential and commercial construction and maintenance, utilities, and facilities management. Students may also further their career as a licensed contractor.

A.A. in Drywall/Lathing Apprenticeship

The Drywall/Lathing Apprenticeship degree concentrates on training apprentices to the specific levels required for the construction industry and has been approved by the State of California Department of Apprenticeship Standards. Training emphasis includes safety, metal framing, blueprint reading, exterior/interior wall finishes, welding, residential and commercial construction process, building codes, estimation, and various construction topics.

Degree Requirements

| COURSE CODE | COURSE TITLE | UNITS |
---|---|---|

...
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>DRLTH 100</td>
<td>Introduction to the Trade</td>
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</tr>
<tr>
<td>DRLTH 102</td>
<td>Basic Applications</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 105</td>
<td>Mathematics for Drywall/Lathers</td>
<td>2</td>
</tr>
<tr>
<td>DRLTH 110</td>
<td>Residential Metal Framing</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 112</td>
<td>Doors, Windows, Exterior Systems/Building Documents</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 120</td>
<td>Blueprint Reading I</td>
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<tr>
<td>DRLTH 121</td>
<td>Blueprint Reading II</td>
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<tr>
<td>DRLTH 122</td>
<td>Blueprint Reading III</td>
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<tr>
<td>DRLTH 130</td>
<td>Welding I</td>
<td>1.5</td>
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<tr>
<td>DRLTH 131</td>
<td>Welding II</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 140</td>
<td>Exterior/Advanced Fire Control System and Partitions</td>
<td>1.5</td>
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<tr>
<td>DRLTH 142</td>
<td>Exterior Systems and Trims</td>
<td>1.5</td>
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<tr>
<td>DRLTH 150</td>
<td>Interior Metal Lathing System, Sound Control</td>
<td>1.5</td>
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<tr>
<td>DRLTH 160</td>
<td>Ceilings, Shaft Protection and Demountable Partitions</td>
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<tr>
<td>DRLTH 162</td>
<td>Arches, Furring and Advanced Systems</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 170</td>
<td>Advanced Construction Techniques</td>
<td>1.5</td>
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<td>A minimum of 16 units from the following:</td>
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<tr>
<td>DRLTH 298</td>
<td>Work Experience Drywall/Lathing Apprenticeship (1 - 4)</td>
<td></td>
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<tr>
<td></td>
<td>Total Units:</td>
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</table>

The Drywall/Lathing Apprenticeship Associate in Arts (A.A.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

Student Learning Outcomes
Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the drywall/lathing craftsman's tools of the trade.
- analyze, interpret, and apply national building codes relating to the drywall/lathing profession.
- analyze and interpret residential commercial construction blueprints.
- evaluate, layout, and construct various metal framing systems such as floor, wall, roof, and arches.
- calculate elevations using various leveling devices.
- identify and select appropriate material for each phase of construction.
- estimate and order material for construction projects.
- plan projects with given information such as blueprints, specifications, verbal and written information.

Career Information
Upon completion of the Drywall/Lathing Apprenticeship degree, students may find employment in the following sectors: government, residential and commercial construction and maintenance, utilities, and facilities management. Students may further their career as a licensed contractor.
A.A. in Electrical Apprenticeship

This program provides instruction in the installation, operation, and maintenance of the electrical distribution systems in commercial and industrial sites. Topics include safety training, AC and DC electrical theory, metering, electronics, use of electrical codes, raceways, conductors, grounding, motors, transformers, fire alarm systems, fiber optics, instrumentation, building automation and heating, ventilating and air conditioning (HVAC) systems.

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
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</thead>
<tbody>
<tr>
<td>ELECT 110</td>
<td>Electrical Apprenticeship I</td>
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<td>ELECT 111</td>
<td>Electrical Apprenticeship II</td>
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<tr>
<td>ELECT 120</td>
<td>Electrical Apprenticeship III</td>
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<tr>
<td>ELECT 121</td>
<td>Electrical Apprenticeship IV</td>
<td>3</td>
</tr>
<tr>
<td>ELECT 130</td>
<td>Electrical Apprenticeship V</td>
<td>3</td>
</tr>
<tr>
<td>ELECT 131</td>
<td>Electrical Apprenticeship VI</td>
<td>3.3</td>
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<td>ELECT 140</td>
<td>Electrical Apprenticeship VII</td>
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<td>ELECT 141</td>
<td>Electrical Apprenticeship VIII</td>
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<td>ELECT 150</td>
<td>Electrical Apprenticeship IX</td>
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<tr>
<td>ELECT 151</td>
<td>Electrical Apprenticeship X</td>
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<td>A minimum of 16 units from the following:</td>
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<tr>
<td>ELECT 298</td>
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<tr>
<td>Total Units:</td>
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</table>

The Electrical Apprenticeship Associate in Arts (A.A.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- apply commercial and industrial safety procedures on job sites.
- analyze, interpret and apply national, state and local electrical codes.
- apply mathematics in calculating AC and DC series, parallel, and combination circuits.
- identify different wiring methods for conductors, cables, and conduits.
- analyze functions of blueprints, specifications, schedules, addenda and revisions in construction.
- describe the function, operation and characteristics of a system and individual components of the system such as burglar alarms, fire alarms, information transport, HVAC, etc.
- describe functions of instrumentation in industrial process control systems.

Career Information

Upon completion of the electrical program, students may find employment in the following industry sectors: government, commercial and industrial construction and maintenance, utilities, and facilities management. Students may further their career as a licensed contractor.
A.A. in Ironworkers Apprenticeship

This program includes training for Field Ironworkers and Reinforcing Ironworkers, provided in major ironworker components to meet Division of Apprenticeship Standards (DAS) guidelines.

### Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IW 100</td>
<td>Orientation and History of the Trade</td>
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</tr>
<tr>
<td>IW 110</td>
<td>Mixed Base</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 120</td>
<td>Rigging</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 130</td>
<td>Reinforcing I</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 131</td>
<td>Reinforcing II/Post Tensioning</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 140</td>
<td>Precast Concrete and Metal Buildings</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 150</td>
<td>Welding I</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 151</td>
<td>Welding II</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 152</td>
<td>Welding III</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 160</td>
<td>Lead Hazard</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 170</td>
<td>Structural I</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 171</td>
<td>Structural II</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 180</td>
<td>Architectural/Ornamental I</td>
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<tr>
<td>IW 183</td>
<td>The History of Ironworkers</td>
<td>2.5</td>
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<tr>
<td></td>
<td>A minimum of 16 units from the following:</td>
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</tr>
<tr>
<td>IW 298</td>
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<tr>
<td></td>
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</table>

The Ironworkers Apprenticeship Associate in Arts (A.A.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

### Student Learning Outcomes

Upon completion of this program, the student will be able to:

- demonstrate safely working in a field construction environment.
- analyze and interpret blueprints.
- interpret and apply welding codes.
- demonstrate proper selection, use, care, preparation, and handling of fiber lines, steel cables, wire ropes, chains, slings, cranes, ladders, scaffolds, and helicopter rigging.
- define, identify, interpret, and analyze uniform building codes (UBC), classifications, plans, schedules, charts, and specifications commonly used in the ironworker trade.
- describe and apply reinforcing techniques and principles to concrete structures using steel, bar supports, bar splicing, and welding.
- perform proper structural steel erection on bridges, overpasses, and large buildings.
- weld various ferrous metals using common welding processes and safety guidelines.
- set cable tensions and pre-stress reinforcing steel to industry standards.
A.A. in Sheet Metal Apprenticeship

The Sheet Metal Apprenticeship certificate concentrates on training apprentices to the specific levels required for the construction industry and has been approved by the State of California Department of Apprenticeship Standards. Training emphasis includes safety, blueprint reading, residential and commercial processes, building codes, estimation, and various sheet metal topics.

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHME 100</td>
<td>Sheet Metal Apprenticeship I</td>
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</tr>
<tr>
<td>SHME 101</td>
<td>Sheet Metal Apprenticeship II</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 110</td>
<td>Sheet Metal Apprenticeship III</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 111</td>
<td>Sheet Metal Apprenticeship IV</td>
<td>3.3</td>
</tr>
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<td>SHME 120</td>
<td>Sheet Metal Apprenticeship V</td>
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</tr>
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<td>SHME 121</td>
<td>Sheet Metal Apprenticeship VI</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 130</td>
<td>Sheet Metal Apprenticeship VII</td>
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</tr>
<tr>
<td>SHME 131</td>
<td>Sheet Metal Apprenticeship VIII</td>
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</tr>
<tr>
<td>SHME 140</td>
<td>Sheet Metal Apprenticeship IX</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 141</td>
<td>Sheet Metal Apprenticeship X</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 150</td>
<td>Sheet Metal Welding I</td>
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<tr>
<td>SHME 151</td>
<td>Sheet Metal Welding II</td>
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<td>A minimum of 16 units from the following:</td>
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<tr>
<td>SHME 298</td>
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<td></td>
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<td>Total Units:</td>
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</tbody>
</table>

The Sheet Metal Apprenticeship Associate in Arts (A.A.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the sheet metal worker's tools of the trade.
- analyze, interpret, and apply national building codes relating to sheet metal construction.
- analyze and interpret residential and commercial construction blueprints.
- acquire skills and knowledge to make a successful transition to a journey-level position in the sheet metal worker trade.
- demonstrate the ability to apply mathematical concepts to the sheet metal trade.
- demonstrate proficiency in the principles, concepts and applications in metal fabrication methods.

Career Information

Upon completion of the Sheet Metal Apprenticeship certificate, students may find employment in the following sectors: government, residential and commercial construction and maintenance, utilities, and facilities management. Students may further their career as a licensed contractor.
A.A. in Sheet Metal Service Technician Apprenticeship

The Sheet Metal Service Technician Apprenticeship Associate of Arts concentrates on training apprentices to the specific levels required for the construction and the heating, ventilation, and air conditioning (HVAC) industries. This program has been approved by the State of California Department of Apprenticeship Standards. Training emphasis includes safety, blueprint reading, residential and commercial processes, building codes, estimation, and various sheet metal topics. It includes the servicing, start-up, and balancing of HVAC systems.

### Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHME 100</td>
<td>Sheet Metal Apprenticeship I</td>
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<tr>
<td>SHME 101</td>
<td>Sheet Metal Apprenticeship II</td>
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</tr>
<tr>
<td>SHME 110</td>
<td>Sheet Metal Apprenticeship III</td>
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<td>SHME 111</td>
<td>Sheet Metal Apprenticeship IV</td>
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<td>Sheet Metal Service Technician Apprenticeship I</td>
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<td>SMTEC 101</td>
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<td>Sheet Metal Service Technician Apprenticeship IV</td>
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<td>SMTEC 131</td>
<td>Sheet Metal Service Technician Apprenticeship VIII</td>
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<td>SMTEC 140</td>
<td>Sheet Metal Service Technician Apprenticeship IX</td>
<td>2.5</td>
</tr>
<tr>
<td>SMTEC 141</td>
<td>Sheet Metal Service Technician Apprenticeship X</td>
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A minimum of 16 units from the following:

| SHME 298 | Work Experience in Sheet Metal Apprenticeship (1 - 4) | 16  |

Total Units: 54.2

The Sheet Metal Service Technician Apprenticeship Associate in Arts (A.A.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

### Student Learning Outcomes

Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the sheet metal worker's tools of the trade.
- analyze, interpret, and apply national building codes relating to sheet metal and mechanical construction.
- analyze and interpret residential and commercial construction blueprints.
- demonstrate the proper start-up and balancing of different HVAC systems.
- demonstrate troubleshooting techniques on various HVAC systems.

### Career Information

Upon completion of the Sheet Metal Service Technician Apprenticeship certificate, students may find employment in the following sectors: government,
Certificates of Achievement

Carpenter Apprenticeship Certificate

This program concentrates on training apprentices to the specific levels required for the construction industry and has been approved by the State of California Department of Apprenticeship Standards. It includes safety, blueprint reading, residential and commercial construction processes, building codes, estimation, and various carpentry topics.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARPT 107</td>
<td>Rigging</td>
<td>1.5</td>
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<tr>
<td>CARPT 110</td>
<td>Foundations and Floors</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 112</td>
<td>Structural Framing</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 114</td>
<td>Form Detailing, Construction &amp; Erection</td>
<td>1</td>
</tr>
<tr>
<td>CARPT 120</td>
<td>Exterior Finish</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 122</td>
<td>Interior Finish</td>
<td>1.5</td>
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<tr>
<td>CARPT 124</td>
<td>Commercial Door Hardware</td>
<td>1.5</td>
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<td>CARPT 130</td>
<td>Layout/Leveling Construction Site Practice</td>
<td>1.5</td>
</tr>
<tr>
<td>CARPT 140</td>
<td>Interior Systems</td>
<td>1.3</td>
</tr>
<tr>
<td>CARPT 142</td>
<td>Engineered Structural Systems</td>
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<tr>
<td>CARPT 150</td>
<td>Concrete - Precast and Prestressed</td>
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<td>CARPT 155</td>
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<td>CARPT 160</td>
<td>Blueprint Reading-Residential</td>
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<tr>
<td>CARPT 162</td>
<td>Blueprint Reading-Commercial</td>
<td>1.3</td>
</tr>
<tr>
<td>CARPT 170</td>
<td>Roof Framing</td>
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</tr>
<tr>
<td>CARPT 180</td>
<td>Stair Building</td>
<td>1</td>
</tr>
<tr>
<td>CARPT 190</td>
<td>Introduction to Welding and Cutting</td>
<td>1</td>
</tr>
<tr>
<td>CARPT 298</td>
<td>Work Experience in Carpenters Apprenticeship (1 - 4)</td>
<td>16</td>
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</tbody>
</table>

A minimum of 16 units from the following:

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARPT 298</td>
<td>Work Experience in Carpenters Apprenticeship (1 - 4)</td>
<td>16</td>
</tr>
</tbody>
</table>

Total Units: 37.9

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the carpenter’s tools of the trade.
- analyze, interpret, and apply national building codes relating to carpentry.
- analyze and interpret residential and commercial construction blueprints.
- evaluate, layout, and construct various systems such as floor, wall, roof, and concrete form.
- evaluate and layout a building site using architectural and other related drawings.
- calculate elevations by using an engineer's rod and various leveling devices.
- estimate and order material for construction projects.
- identify and select appropriate materials for each phase of construction.

Career Information
Upon completion of the Carpenter Apprenticeship certificate, students may find employment in the following sectors: government, residential and commercial construction and maintenance, utilities, and facilities management.

Drywall/Lathing Apprenticeship Certificate
The Drywall/Lathing Apprenticeship certificate concentrates on training apprentices to the specific levels required for the construction industry and has been approved by the State of California Department of Apprenticeship Standards. Training emphasis includes safety, metal framing, blueprint reading, exterior/interior wall finishes, welding, residential and commercial construction process, building codes, estimation, and various construction topics.

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRLTH 100</td>
<td>Introduction to the Trade</td>
<td>2</td>
</tr>
<tr>
<td>DRLTH 102</td>
<td>Basic Applications</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 105</td>
<td>Mathematics for Drywall/Lathers</td>
<td>2</td>
</tr>
<tr>
<td>DRLTH 110</td>
<td>Residential Metal Framing</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 112</td>
<td>Doors, Windows, Exterior Systems/Building Documents</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 120</td>
<td>Blueprint Reading I</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 121</td>
<td>Blueprint Reading II</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 122</td>
<td>Blueprint Reading III</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 130</td>
<td>Welding I</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 131</td>
<td>Welding II</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 140</td>
<td>Exterior/Advanced Fire Control System and Partitions</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 142</td>
<td>Exterior Systems and Trims</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 150</td>
<td>Interior Metal Lathing System, Sound Control</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 160</td>
<td>Ceilings, Shaft Protection and Demountable Partitions</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 162</td>
<td>Arches, Furring and Advanced Systems</td>
<td>1.5</td>
</tr>
<tr>
<td>DRLTH 170</td>
<td>Advanced Construction Techniques</td>
<td>1.5</td>
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<tr>
<td>DRLTH 298</td>
<td>Work Experience Drywall/Lathing Apprenticeship (1 - 4)</td>
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<td>Total Units:</td>
<td>41</td>
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Student Learning Outcomes
Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the drywall/lathing craftsman's tools of the trade.
• analyze, interpret, and apply national building codes relating to the drywall/lathing profession.
• analyze and interpret residential commercial construction blueprints.
• evaluate, layout, and construct various metal framing systems such as floor, wall, roof, and arches.
• calculate elevations using various leveling devices.
• identify and select appropriate material for each phase of construction.
• estimate and order material for construction projects.
• plan projects with given information such as blueprints, specifications, verbal and written information.

Career Information
Upon completion of the Drywall/Lathing Apprenticeship certificate, students may find employment in the following sectors: government, residential and commercial construction and maintenance, utilities, and facilities management.

Electrical Apprenticeship Certificate

This program provides instruction in the installation, operation, and maintenance of the electrical distribution systems in commercial and industrial sites. Topics include safety training, AC and DC electrical theory, metering, electronics, use of electrical codes, raceways, conductors, grounding, motors, transformers, fire alarm systems, fiber optics, instrumentation, building automation and heating, ventilating and air conditioning (HVAC) systems.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECT 110</td>
<td>Electrical Apprenticeship I</td>
<td>5</td>
</tr>
<tr>
<td>ELECT 111</td>
<td>Electrical Apprenticeship II</td>
<td>3</td>
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<tr>
<td>ELECT 120</td>
<td>Electrical Apprenticeship III</td>
<td>3</td>
</tr>
<tr>
<td>ELECT 121</td>
<td>Electrical Apprenticeship IV</td>
<td>3</td>
</tr>
<tr>
<td>ELECT 130</td>
<td>Electrical Apprenticeship V</td>
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<tr>
<td>ELECT 131</td>
<td>Electrical Apprenticeship VI</td>
<td>3.3</td>
</tr>
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<td>ELECT 140</td>
<td>Electrical Apprenticeship VII</td>
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<td>ELECT 141</td>
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<td>ELECT 150</td>
<td>Electrical Apprenticeship IX</td>
<td>3</td>
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<td>ELECT 151</td>
<td>Electrical Apprenticeship X</td>
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<td>A minimum of 16 units from the following:</td>
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<tr>
<td>ELECT 298</td>
<td>Work Experience in Electricians Apprenticeship (1 - 4)</td>
<td></td>
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<tr>
<td></td>
<td>Total Units:</td>
<td>48.6</td>
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</table>

Student Learning Outcomes

Upon completion of this program, the student will be able to:

• apply commercial and industrial safety procedures on job sites.
• analyze, interpret and apply national, state and local electrical codes.
• apply mathematics in calculating AC and DC series, parallel, and combination circuits.
• identify different wiring methods for conductors, cables, and conduits.
• analyze functions of blueprints, specifications, schedules, addenda and revisions in construction.
• describe the function, operation and characteristics of a system and individual components of the system such as burglar alarms, fire alarms, information transport, HVAC, etc.
• describe the functions of instrumentation in industrial process control systems.

Career Information
Upon completion of the electrical program, students may find employment in the following sectors: government, commercial and industrial construction and maintenance, utilities, and facilities management.

Electrical Residential Apprenticeship Certificate
This is a three year, six semester certificated Electrical Residential Apprenticeship Program. The program concentrates on training apprentices to the specific levels required for residential and light commercial construction sites and has been approved by the State of California Department of Apprenticeship Standards.

Certificate Requirements

Ironworkers Apprenticeship Certificate
This program includes training for Field Ironworkers and Reinforcing Ironworkers, provided in major ironworker components to meet Division of Apprenticeship Standards (DAS) guidelines.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IW 100</td>
<td>Orientation and History of the Trade</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 110</td>
<td>Mixed Base</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 120</td>
<td>Rigging</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 130</td>
<td>Reinforcing I</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 131</td>
<td>Reinforcing II/Post Tensioning</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 140</td>
<td>Precast Concrete and Metal Buildings</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 150</td>
<td>Welding I</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 151</td>
<td>Welding II</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 152</td>
<td>Welding III</td>
<td>1.5</td>
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<tr>
<td>IW 160</td>
<td>Lead Hazard</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 170</td>
<td>Structural I</td>
<td>1.5</td>
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<tr>
<td>IW 171</td>
<td>Structural II</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 180</td>
<td>Architectural/Ornamental I</td>
<td>1.5</td>
</tr>
<tr>
<td>IW 183</td>
<td>The History of Ironworkers</td>
<td>2.5</td>
</tr>
<tr>
<td>IW 298</td>
<td>Work Experience in Ironworkers Apprenticeship (1 - 4)</td>
<td></td>
</tr>
</tbody>
</table>

A minimum of 16 units from the following:

IW 298        | Work Experience in Ironworkers Apprenticeship (1 - 4) | 16    |

Total Units: 38
Student Learning Outcomes
Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- analyze and interpret blueprints.
- interpret and apply welding codes.
- demonstrate proper selection, use, care, preparation, and handling of fiber lines, steel cables, wire ropes, chains, slings, cranes, ladders, scaffolds, and helicopter rigging.
- define, identify, interpret, and analyze universal building codes (UBC), classifications, plans, schedules, charts, and specifications commonly used in the ironworker trade.
- describe and apply reinforcing techniques and principles to concrete structures using steel, bar supports, bar splicing, and welding.
- perform proper structural steel erection on bridges, overpasses, and large buildings.
- weld various ferrous metals using common welding processes and safety guidelines.
- set cable tensions and pre-stress reinforcing steel to industry standards.

Mill and Cabinet Maker Apprenticeship Certificate
This program trains apprentices on the specific levels required for the construction industry and has been approved by the State of California Department of Apprenticeship Standards. It includes safety, blueprint reading, construction processes, building codes, estimation, and various mill and cabinet carpentry topics.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARPT 270</td>
<td>Mill Cabinet Safety and Tool Skills (1.5)</td>
<td></td>
</tr>
<tr>
<td>CARPT 271</td>
<td>The Mill Cabinet Apprentice and the Trade (1.5)</td>
<td></td>
</tr>
<tr>
<td>CARPT 272</td>
<td>Math for the Trades (2)</td>
<td></td>
</tr>
<tr>
<td>CARPT 273</td>
<td>Basic Cabinet Making (1.5)</td>
<td></td>
</tr>
<tr>
<td>CARPT 274</td>
<td>Basic Blueprint Reading Mill Cabinet (1.5)</td>
<td></td>
</tr>
<tr>
<td>CARPT 275</td>
<td>Machinery Maintenance for Mill Cabinet (1.5)</td>
<td></td>
</tr>
<tr>
<td>CARPT 276</td>
<td>Cabinet Hardware Installation (1.5)</td>
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</tr>
<tr>
<td>CARPT 277</td>
<td>Sanding, Stains, and Finish Preparation (1.5)</td>
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<tr>
<td>CARPT 278</td>
<td>Advanced Machinery Operation (1.5)</td>
<td></td>
</tr>
<tr>
<td>CARPT 279</td>
<td>Advanced Blueprint Reading for Mill Cabinet (1.5)</td>
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</tr>
<tr>
<td>CARPT 280</td>
<td>Advanced Cabinet Making (1.5)</td>
<td></td>
</tr>
<tr>
<td>CARPT 281</td>
<td>Veneers, Laminate, and Finishing (1.5)</td>
<td></td>
</tr>
<tr>
<td>CARPT 282</td>
<td>CAD Basics for Mill Cabinetry (1.5)</td>
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<tr>
<td>CARPT 283</td>
<td>Introduction to CNC (1.5)</td>
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<tr>
<td>CARPT 284</td>
<td>Solid Surface Material, Fabrication, and Installation (1.5)</td>
<td></td>
</tr>
</tbody>
</table>
COURSE CODE | COURSE TITLE | UNITS
--- | --- | ---
CARPT 285 | Advanced Project for Mill Cabinet (1.5) | |
A minimum of 16 units from the following: | |
CARPT 298 | Work Experience in Carpenters Apprenticeship (1 - 4) | |
Total Units: | | 37

Enrollment Eligibility
To be eligible for enrollment in the program, the student must meet the following criteria:

- Must be a state registered Mill and Cabinet apprentice.

Student Learning Outcomes
Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the mill and cabinet carpenter’s tools of the trade.
- analyze, interpret, and apply national building codes relating to mill and cabinet carpentry.
- analyze and interpret residential and commercial construction blueprints.
- identify and select appropriate materials for each phase of construction.
- construct and complete an advanced project demonstrating journeymen-level skills.
- apply design elements and principles to create functional and attractive cabinets.

Career Information
Mill and cabinet maker technicians are in high demand. The industry is not able to hire the amount of certified employees needed to fill the workforce and meet the needs of the industry. Students that are in this apprenticeship program are currently working in the mill and cabinet maker industry.

Pre-Apprenticeship Certificate
This program prepares students for entry into an apprenticeship program in the commercial and industrial building and construction industries. Topics include Leadership in Energy and Environmental Design (LEED) processes, green technologies, green building techniques, infrastructure, and transportation projects.

Certificate Requirements
| COURSE CODE | COURSE TITLE | UNITS |
--- | --- | ---
PREAP 111 | Infrastructure Pre-Apprenticeship | 7 |
PREAP 141 | Green Technology Pre-Apprenticeship | 7 |
FITNS 101 | Green Technology Workforce Wellness | 1 |
FITNS 102 | Infrastructure Workforce Wellness | 1 |
Total Units: | | 16

Student Learning Outcomes
Upon completion of this program, the student will be able to:
• describe basic skills required for the construction of roads, bridges, levees, and rail.

• describe the Leadership in Energy and Environmental Design (LEED) rating process.

• identify green alternatives to conventional building practices and describe the pros and cons of those alternatives.

• apply proper lifting/movement techniques applicable to green technology workforce occupations.

• determine the validity of fitness and health information using the scientific method and the relationship between scientific research and established knowledge.

• implement a personal fitness plan using proper strength and cardiovascular training.

Residential/Commercial Electrician Trainee Certificate

This program provides instruction in the installation, operation, and maintenance of the electrical distribution systems in residential and commercial sites. Topics include safety training, AC/DC electrical theory, metering, electronics, use of electrical codes, raceways, conductors, grounding, motors, transformers, fire alarm systems, fiber optics, and Heating, Ventilation, and Air Conditioning (HVAC) systems. It complies with state regulations to become an electrician trainee.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELTRN 110</td>
<td>Electrician Trainee I</td>
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</tr>
<tr>
<td>ELTRN 111</td>
<td>Electrician Trainee II</td>
<td>4</td>
</tr>
<tr>
<td>ELTRN 120</td>
<td>Electrician Trainee III</td>
<td>4</td>
</tr>
<tr>
<td>ELTRN 121</td>
<td>Electrician Trainee IV</td>
<td>4</td>
</tr>
<tr>
<td>ELTRN 130</td>
<td>Electrician Trainee V</td>
<td>4</td>
</tr>
<tr>
<td>ELTRN 131</td>
<td>Electrician Trainee VI</td>
<td>4</td>
</tr>
<tr>
<td>ELTRN 180</td>
<td>Electrical Workers State Certification Preparation</td>
<td>4.5</td>
</tr>
<tr>
<td>Total Units:</td>
<td></td>
<td>28.5</td>
</tr>
</tbody>
</table>

Student Learning Outcomes

Upon completion of this program, the student will be able to:

• apply residential and commercial safety procedures on job-sites.

• analyze, interpret, and apply national, state, and local electrical codes.

• apply electrical mathematics in calculating AC/DC series, parallel, and combination circuits.

• identify different wiring methods for conductors, cables, and conduits.

• analyze functions of blueprints, specifications, schedules, addenda, and revisions in construction.

• describe the function, operation, and characteristics of a system and individual components of the system such as burglar alarms, fire alarms, information transport, HVAC, etc.

Career Information

Upon completion of the Residential/Commercial Electrician Trainee program, students may find employment in the following industry sectors: government, residential and commercial construction and maintenance, utilities, and facilities management.
Sheet Metal Apprenticeship Certificate

The Sheet Metal Apprenticeship certificate concentrates on training apprentices to the specific levels required for the construction industry and has been approved by the State of California Department of Apprenticeship Standards. Training emphasis includes safety, blueprint reading, residential and commercial processes, building codes, estimation, and various sheet metal topics.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHME 100</td>
<td>Sheet Metal Apprenticeship I</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 101</td>
<td>Sheet Metal Apprenticeship II</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 110</td>
<td>Sheet Metal Apprenticeship III</td>
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</tr>
<tr>
<td>SHME 111</td>
<td>Sheet Metal Apprenticeship IV</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 120</td>
<td>Sheet Metal Apprenticeship V</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 121</td>
<td>Sheet Metal Apprenticeship VI</td>
<td>3.3</td>
</tr>
<tr>
<td>SHME 130</td>
<td>Sheet Metal Apprenticeship VII</td>
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<tr>
<td>SHME 131</td>
<td>Sheet Metal Apprenticeship VIII</td>
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</tr>
<tr>
<td>SHME 140</td>
<td>Sheet Metal Apprenticeship IX</td>
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</tr>
<tr>
<td>SHME 141</td>
<td>Sheet Metal Apprenticeship X</td>
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</tr>
<tr>
<td>SHME 150</td>
<td>Sheet Metal Welding I</td>
<td>2.5</td>
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<tr>
<td>SHME 151</td>
<td>Sheet Metal Welding II</td>
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<tr>
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<td>A minimum of 16 units from the following:</td>
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</tr>
<tr>
<td>SHME 298</td>
<td>Work Experience in Sheet Metal Apprenticeship (1 - 4)</td>
<td></td>
</tr>
</tbody>
</table>

Total Units: 54

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the sheet metal worker's tools of the trade.
- analyze, interpret, and apply national building codes relating to sheet metal construction.
- analyze and interpret residential and commercial construction blueprints.
- acquire skills and knowledge to make a successful transition to a journey-level position in the sheet metal worker trade.
- demonstrate the ability to apply mathematical concepts to the sheet metal trade.
- demonstrate proficiency in the principles, concepts and applications in metal fabrication methods.

Career Information

Upon completion of the Sheet Metal Apprenticeship certificate, students may find employment in the following sectors: government, residential and commercial construction and maintenance, utilities, and facilities management.
Sheet Metal Residential Apprenticeship Certificate

This is a two year, four semester certificated Sheet Metal Residential Apprenticeship Program. The program concentrates on training apprentices to the specific levels required for residential and light commercial construction sites and has been approved by the State of California Department of Apprenticeship Standards.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMRA 100</td>
<td>Sheet Metal Residential Apprenticeship I</td>
<td>3</td>
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<tr>
<td>SMRA 101</td>
<td>Sheet Metal Residential Apprenticeship II</td>
<td>3</td>
</tr>
<tr>
<td>SMRA 110</td>
<td>Sheet Metal Residential Apprenticeship III</td>
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</tr>
<tr>
<td>SMRA 111</td>
<td>Sheet Metal Residential Apprenticeship IV</td>
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<td>A minimum of 16 units from the following:</td>
<td>16</td>
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<tr>
<td>SHME 298</td>
<td>Work Experience in Sheet Metal Apprenticeship (1-4)</td>
<td></td>
</tr>
<tr>
<td>Total Units:</td>
<td></td>
<td>28</td>
</tr>
</tbody>
</table>

Enrollment Eligibility

To be eligible for enrollment in the program, the student must meet the following criteria:

- Must be a Registered Sheet Metal Residential Apprentice

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- apply safety procedures on residential job-sites.
- analyze and interpret residential construction blueprints.
- apply construction mathematics in calculating pattern development of sheet metal products.
- identify various metals, gages, fasteners, and sealants used in sheet metal fabrication.
- design and size a residential duct system.
- demonstrate proper soldering on sheet metal fabrication.

Career Information

Upon completion of the Sheet Metal Residential Apprenticeship program, students may find employment in the following industry sectors: government, residential, and light commercial construction and maintenance.

Sheet Metal Service Technician Apprenticeship Certificate

The Sheet Metal Service Technician Apprenticeship certificate concentrates on training apprentices to the specific levels required for the construction and the heating, ventilation, and air conditioning (HVAC) industries. This program has been approved by the State of California Department of Apprenticeship Standards. Training emphasis includes safety, blueprint reading, residential and commercial processes, building codes, estimation, and various sheet metal topics. It includes the servicing, start-up, and balancing of HVAC systems.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
</table>
| Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
SHME 100  
Sheet Metal Apprenticeship I  
SHME 101  
Sheet Metal Apprenticeship II  
SHME 110  
Sheet Metal Apprenticeship III  
SHME 111  
Sheet Metal Apprenticeship IV  
SMTEC 100  
Sheet Metal Service Technician Apprenticeship I  
SMTEC 101  
Sheet Metal Service Technician Apprenticeship II  
SMTEC 110  
Sheet Metal Service Technician Apprenticeship III  
SMTEC 111  
Sheet Metal Service Technician Apprenticeship IV  
SMTEC 120  
Sheet Metal Service Technician Apprenticeship V  
SMTEC 121  
Sheet Metal Service Technician Apprenticeship VI  
SMTEC 130  
Sheet Metal Service Technician Apprenticeship VII  
SMTEC 131  
Sheet Metal Service Technician Apprenticeship VIII  
SMTEC 140  
Sheet Metal Service Technician Apprenticeship IX  
SMTEC 141  
Sheet Metal Service Technician Apprenticeship X  

A minimum of 16 units from the following:

SHME 298  
Work Experience in Sheet Metal Apprenticeship (1 - 4)

Total Units: 54.2

Student Learning Outcomes
Upon completion of this program, the student will be able to:

- demonstrate safe working practices in a field construction environment.
- demonstrate proper selection, use, care, preparation, and handling of the sheet metal worker's tools of the trade.
- analyze, interpret, and apply national building codes relating to sheet metal and mechanical construction.
- analyze and interpret residential and commercial construction blueprints.
- demonstrate the proper start-up and balancing of different HVAC systems.
- demonstrate troubleshooting techniques on various HVAC systems.

Career Information
Upon completion of the Sheet Metal Service Technician Apprenticeship certificate, students may find employment in the following sectors: government, residential and commercial construction and maintenance, HVAC servicing, utilities, facilities management, and central plant operations.

Certificates

Green Technology Pre-Apprenticeship Certificate
This certificate prepares students for entry into an apprenticeship program in the commercial and industrial building and construction industries. Topics include green building practices, construction job site safety requirements, construction mathematics, and apprenticeship entry requirements.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FITNS101</td>
<td>Green Technology Workforce Wellness</td>
<td>1</td>
</tr>
</tbody>
</table>
## Green Technology Pre-Apprenticeship Certificate

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREAP 141</td>
<td>Green Technology Pre-Apprenticeship</td>
<td>7</td>
</tr>
</tbody>
</table>

Total Units: 8

1This course replaces FITNS 358

**Student Learning Outcomes**

Upon completion of this program, the student will be able to:

- explain safety regulations and safe working conditions for apprenticeship training.
- identify construction practices used by different building trades such as sheet metal workers, electricians, plumbers, pipe-fitters, and carpenters.
- describe the life cycle phases of a building and impacts on the green environment over its life cycle.

## Infrastructure Pre-Apprenticeship Certificate

This certificate prepares students for entry into an apprenticeship program in the infrastructure industries such as bridge, levee, and road construction. Topics include bridge construction practices, construction job site safety requirements, construction mathematics, and apprenticeship entry requirements.

**Certificate Requirements**

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FITNS 102</td>
<td>Infrastructure Workforce Wellness</td>
<td>1</td>
</tr>
<tr>
<td>PREAP 111</td>
<td>Infrastructure Pre-Apprenticeship</td>
<td>7</td>
</tr>
</tbody>
</table>

Total Units: 8

**Student Learning Outcomes**

Upon completion of this program, the student will be able to:

- explain safety regulations and safe working conditions for apprenticeship training.
- identify construction practices used by different building trades such as carpenters, bricklayers, pile-drivers, cement masons, laborers, operating engineers, and surveyors.
- describe the construction processes involved in a typical bridge building.

## Utilities Worker Pre-Apprenticeship Certificate

This certificate prepares students for entry into an apprenticeship program in the utility industry. Topics include job-site safety requirements, electrical and gas principles, blueprint reading, electrical power distribution, utility pole climbing, and apprenticeship preparation.

**Certificate Requirements**

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREAP 122</td>
<td>Pre-Apprenticeship for Utility Workers</td>
<td>8</td>
</tr>
<tr>
<td>MATH 145</td>
<td>Mathematics for the Trades</td>
<td>1.5</td>
</tr>
<tr>
<td>FITNS 100</td>
<td>Utility Workforce Wellness</td>
<td>1</td>
</tr>
</tbody>
</table>
Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Apprenticeship (APPRT)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Carpentry (CARPT)</strong></td>
<td></td>
</tr>
<tr>
<td>CARPT 101</td>
<td>Aerial Lift Safety, Construction Math, and the Apprentice</td>
<td>1.5</td>
</tr>
<tr>
<td>Units:</td>
<td>24 hours LEC; 12 hours LAB</td>
<td></td>
</tr>
<tr>
<td>Hours:</td>
<td>None.</td>
<td></td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Must be a registered carpenter apprentice.</td>
<td></td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This course introduces the beginning carpenter apprentice to industry safety procedures for aerial lift use, and hand and power tool safety and maintenance. It also covers construction math, financial literacy, and the role and responsibilities of the apprentice.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain allowable loads for various types of aerial lifts.
- describe load capacity.
- list requirements for pre-shift inspection of aerial lifts.
- describe aerial lift operator responsibilities.
- describe safe aerial lift use.
- explain the meaning of discrimination.
- describe the different types of discrimination.
- demonstrate knowledge of the importance of financial literacy.

Career Information
This program provides opportunities for entry into the utility industry where there is high demand for trained entry level workers.

Apprenticeship (APPRT)

Carpentry (CARPT)

1.5

Units: 1.5

Hours: 24 hours LEC; 12 hours LAB

Prerequisite: Must be a registered carpenter apprentice.

Enrollment Limitation: None.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain allowable loads for various types of aerial lifts.
- describe load capacity.
- list requirements for pre-shift inspection of aerial lifts.
- describe aerial lift operator responsibilities.
- describe safe aerial lift use.
- explain the meaning of discrimination.
- describe the different types of discrimination.
- demonstrate knowledge of the importance of financial literacy.

Total Units: 10.5

Upon completion of this program, the student will be able to:

- explain electrical fundamentals such as Ohm's and Watt's Law.
- define terms and vocabulary used in the utility industry.
- explain electrical and gas distribution for the utility industry.
- identify safety laws, regulations, and safe working conditions for apprenticeship.
- describe effective conflict resolution methods.
- describe the functions of transformers, electrical generators, and electrical equipment.

Career Information
This program provides opportunities for entry into the utility industry where there is high demand for trained entry level workers.
- describe the responsibilities of the apprentice as required by Joint Apprenticeship and Training Committee (JATC) and other governing agencies.
- calculate area, volume, and circumference.
- apply multiplication and division of fractions to construction tasks.
- convert fractions, decimals, inches, feet, fractions of inches, and non-metric to metric units.
- identify safe use and basic maintenance of hand and power tools.
- identify safe use and basic maintenance of heavy equipment.

**CARPT 106 Introduction to Apprenticeship**

*Units:* 1.5  
*Hours:* 22 hours LEC; 15 hours LAB  
*Prerequisite:* None.  
*Enrollment Limitation:* Registered Carpenter Apprentice  

This course is an introduction to apprenticeship, tools, safety, and construction job sites in the commercial and industrial building sectors.  

**Student Learning Outcomes**  
Upon completion of this course, the student will be able to:  
- describe the hazards on a construction job site.  
- demonstrate the proper safe use of a worm-drive saw.  
- identify the conduct that characterizes workplace discrimination and harassment.  
- demonstrate the proper use of personal fall protection equipment and anchor points.  
- measure and layout different objects with a measuring tape.  
- determine the perimeter, area, and volume of rectangular, triangular, and circular objects.

**CARPT 107 Rigging**

*Units:* 1.5  
*Hours:* 22 hours LEC; 15 hours LAB  
*Prerequisite:* None.  
*Enrollment Limitation:* Registered Carpenter Apprentice  

This course familiarizes apprentices with the equipment and the procedures to safely rig and hoist various loads on the job-site. Topics include tying knots, splicing rope, calculating loads, hand signals for cranes, and inspecting rigging hardware.  

**Student Learning Outcomes**  
Upon completion of this course, the student will be able to:  
- describe a basic rigging operation.  
- calculate the working load limit for a specific wire rope.  
- inspect wire rope using industry standard criteria.
select the proper type sling for a specific rigging operation.

identify the construction and purpose of shackles, hooks, eye-bolts, turnbuckles, sheaves, wedge sockets, wire rope clips, rigging beams, master links, chain falls, and come-alongs.

identify various common knots, bends, hitches, and splices.

calculate the center of gravity and the weight of a load on a sling.

calculate the stress loads on the slings.

identify standard types of cranes used in rigging.

CARPT 108 Modular System Installer Safety

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered carpentry modular systems installer apprentice.

This course is an introduction to apprenticeship, tools, safety, and construction job sites in the commercial and industrial building sectors. It also covers discrimination and harassment on the jobsite.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify safe use and basic maintenance of hand and power tools.
- apply OSHA regulations.
- explain the meaning of discrimination and harassment.
- describe how hearing loss occurs and how to protect hearing.
- describe the importance of fall protection and falling object protection.
- identify modular components.
- describe the responsibilities of the apprentice as required by Joint Apprenticeship and Training Committee (JATC) and other governing agencies.

CARPT 109 Introduction to Office Modular Systems Installation

Units: 1.5
Hours: 18 hours LEC; 18 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered carpentry modular systems installer apprentice.

This course introduces the installation of modular systems including major manufacturers of modular systems, applicable math, blueprints, specifications, and the creation of a realistic installation mockup. It also covers site logistics, layout of components, and personal financial literacy.

Student Learning Outcomes
Upon completion of this course, the student will be able to:
• use power and hand tools to safely assemble modular systems.
• use manufacturers’ catalogs to identify various components of modular systems.
• identify modular components for efficient installation.
• demonstrate the ability to add and subtract fractions and mixed numbers.
• interpret blueprint drawings and specifications.
• create a system mock-up.
• identify personal financial responsibility.

CARPT 110 Foundations and Floors

<table>
<thead>
<tr>
<th>Units:</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>22 hours LEC; 15 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Carpenter Apprentice.</td>
</tr>
</tbody>
</table>

This course covers layout, forming, framing, joist, sub-flooring, and foundation construction.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• identify appropriate types of forms for concrete foundations.
• apply joist span tables.
• analyze building and green code requirements for construction.
• evaluate, lay out, and construct a floor joist system.

CARPT 111 Modular Systems Applications

<table>
<thead>
<tr>
<th>Units:</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>15 hours LEC; 21 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered carpentry modular systems installer apprentice.</td>
</tr>
</tbody>
</table>

This course introduces the modular system installer apprentice to proper tool and equipment applications required while assembling and disassembling modular office furniture systems. It also covers personal financial literacy.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• apply safe use of hand and power tools.
• demonstrate the proper application of hand and power tools used during assembly and disassembly of modular components.
• identify and install the custom perimeter trim products.
• create a personal monthly spending plan/budget.
• explain the use of credit and credit scores.

CARPT 112 Structural Framing

<table>
<thead>
<tr>
<th>Units:</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>22 hours LEC; 15 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Carpenter Apprentice.</td>
</tr>
</tbody>
</table>

This course covers basic framing systems and layout of walls, ceilings, and stairwells with wood as well as metal and alternative “green” materials such as manufactured panels.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• build a framed wall with door and window openings.
• identify and list the uses of the appropriate materials in framing.
• evaluate and list the building code requirements for framing buildings.
• measure, cut, and assemble all components in Western Platform frame construction.
• build and install corners and wall intersections.
• assemble, plumb, and brace walls.
• layout and install ceiling joists, backing, and blocking and define their functions.
• identify different “green” building materials and techniques.

CARPT 114 Form Detailing, Construction & Erection

<table>
<thead>
<tr>
<th>Units:</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>9 hours LEC; 27 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Carpenter Apprentice.</td>
</tr>
</tbody>
</table>

This course covers planning and building of form work, construction and erection of various concrete forms, and construction materials and methods. New building materials such as recycled and alternative materials are explored.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• identify and list appropriate materials for the construction of concrete forms.
• describe the purpose of three or more types of forms and their uses.
• draft a concrete form detail drawing and specify the function of the concrete form.
• build a concrete construction form involving bucks, block-outs, and inserts.
**CARPT 115 Floor to Ceiling Wall System Construction**

**Units:** 1  
**Hours:** 11 hours LEC; 25 hours LAB  
**Prerequisite:** None.  
**Enrollment Limitation:** Must be a registered carpentry modular systems installer apprentice.

This course introduces the modular system installer apprentice to floor to ceiling modular wall construction. It also covers blueprint reading and understanding manufacturers' system components and parts.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- construct modular system walls and panels.
- construct modular system doors and windows.
- apply proper layout of walls.
- interpret blueprints for modular walls.
- identify manufacturers' components and parts.
- apply manufacturers' installation specifications.

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**CARPT 120 Exterior Finish**

**Units:** 1.5  
**Hours:** 22 hours LEC; 15 hours LAB  
**Prerequisite:** None.  
**Enrollment Limitation:** Must be a registered Carpenter Apprentice.

This course covers exterior design, materials, finishes, and methods of application in exterior building construction. Topics include an overview of the hazards of Volatile Organic Compounds (VOCs) and pathogens.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- assess and select the various types of exterior caulking and their uses including the use of VOC free materials.
- justify caulking choices for exterior applications.
- identify and list appropriate exterior materials and alternative materials that are VOC free.
- identify and determine the uses of exterior finish hand tools.
- research the function and application of exterior sheathing, insulation, and weatherproofing materials appropriate to local conditions.
- install an exterior door frame and door.
- identify and describe the application of six styles of windows.
CARPT 122 Interior Finish

This course covers interior designs, materials, and methods of application in building construction. Topics include techniques of indoor air quality practices in order to reduce Volatile Organic Compounds (VOCs) and pathogens.

Upon completion of this course, the student will be able to:

- identify interior materials and “green” practices that reduce poor indoor air quality.
- build a mockup using appropriate materials and installation methods.
- interpret information on finish materials and tasks from blueprints, schedules, and specifications.
- evaluate and perform tasks using power equipment used in interior trim in a safe manner.
- install interior door frames, doors, and trim.
- build laminated plastic materials.
- analyze the appropriate CalGreen codes that regulate and promote good indoor air quality practices.

CARPT 124 Commercial Door Hardware

This course covers the basic skills necessary to successfully install commercial door hardware. Topics include selecting hardware, hanging and adjusting a door and installing locks, closers, rim devices, door holders, and various accessories. It also covers codes that govern doors and hardware in commercial buildings.

Upon completion of this course, the student will be able to:

- demonstrate the installation of flush bolts and coordinators so the doors close in proper order.
- demonstrate the installation of door stops at a predetermined angle without damage to door or jamb.
- demonstrate with given mortise lockset, a cylinder lockset and instructions for each, correctly change the hand of each lockset to given standards.
- demonstrate the installation and preparation of a door with a given cylinder lockset so it latches securely and locks the door.
- describe the function of a commercial collection of hardware and correctly identify each piece.
CARPT 125 Fine Furnishings, Drapery, and Window Coverings

This course introduces the modular system installer apprentice to high-end and custom furniture, wall installations, draperies, and window coverings. It also covers tool selection, skills for proper installation, and manufacturers' specifications.

Upon completion of this course, the student will be able to:

- construct custom counters and desks.
- use the proper fasteners for hollow and solid walls.
- apply proper installation techniques for window coverings.
- construct custom solid wood casegoods and furniture.
- assemble and install demountable partition walls.
- describe manufacturers' specifications.

CARPT 130 Layout/Leveling Construction Site Practice

This course covers the use of leveling devices. It includes reading and interpreting an engineer's rod, horizontal and vertical setting circles, and vernier scaling. Additional topics include construction layout of horizontal and vertical angles, and Leadership in Energy and Environmental Design (LEED) practices for erosion control.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- set up and adjust a theodolite instrument, laser, and other leveling devices for proper use.
- evaluate and lay out a building site using architectural drawings.
- identify the parts of a tripod and theodolite instrument.
- measure horizontal distances with a theodolite instrument.
- calculate elevations by using an engineer's rod and various leveling devices.
- lay out horizontal and vertical angles with accuracy.
- identify erosion control measures that prevent water runoff.
CARPT 131 Introduction to Working Drawings, Construction Math and Fire Stop Installation

This course introduces Insulator Apprentices to construction math, basic blueprint reading, and fire stop installation. It also covers safe use and maintenance of hand tools.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify print production and reproduction methods.
- define plan detail views and pictorial drawings and their uses.
- calculate area, volume, and circumference.
- apply multiplication and division of fractions to common insulator tasks.
- convert fractions, decimals, inches, feet, fractions of inches, and non-metric to metric units.
- describe the test standards and the rating systems for fire stopping.
- identify the purpose of proper installation of access doors.
- identify safe use and basic maintenance of hand tools.

CARPT 132 Residential Blueprint Reading and Forklift Safety

This course introduces Insulator Apprentices to residential blueprint terminology and interpretation. Forklift safety is also included.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the purpose, printing, modifications, and assembly of blueprints.
- interpret abbreviations, schedules, and symbols on prints.
- list the different types of orthographic and pictorial drawings.
- explain the basic use and safe operation of a forklift.

CARPT 133 Residential Insulation and Weatherization

1.5 Units:
24 hours LEC; 12 hours LAB
None.
Must be a registered Insulator Apprentice.

This course introduces Insulator Apprentices to residential blueprint terminology and interpretation. Forklift safety is also included.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the purpose, printing, modifications, and assembly of blueprints.
- interpret abbreviations, schedules, and symbols on prints.
- list the different types of orthographic and pictorial drawings.
- explain the basic use and safe operation of a forklift.
This course introduces the Insulator Apprentice to insulation and weatherization installation. Topics include environmental impact on traditional construction and organizations that provide guidelines and certification for residential insulation and weatherization.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- define the required components of residential insulation and weatherization.
- define the term "R-value" (resistance to heat flow).
- state the benefits of R-value and weatherization.
- describe the impact of typical traditional construction on the environment.
- list the organizations that provide guidelines and certification for residential insulation and weatherization.

CARPT 134 Commercial Blueprint Reading and Mobile Tower Scaffolds

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Insulator Apprentice. |

This course introduces Insulator Apprentices to commercial blueprint terminology and interpretation. It also covers the erection of and safe practices for welded frame mobile and rolling tower scaffolds.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the purpose, printing, modifications, and assembly of blueprints.
- interpret abbreviations, schedules, and symbols on commercial and structural prints.
- list the different types of orthographic and pictorial drawings.
- interpret dimensions on structural prints.
- list criteria for welded frame and rolling tower scaffold.
- calculate contributory leg loads.
- list requirements for platform construction.
- explain the safe use and erection of welded frame and rolling tower scaffolds, materials, fall protection, and falling object protection.
- describe safe scaffold access and egress.

CARPT 135 Commercial and Industrial Insulation and Aerial Lift

| Units: | 1.5 |

This course introduces the Insulator Apprentice to insulation and weatherization installation. Topics include environmental impact on traditional construction and organizations that provide guidelines and certification for residential insulation and weatherization.

Student Learning Outcomes
Upon completion of this course, the student will be able to:
This course introduces the Insulator Apprentice to commercial and industrial insulation installation. It also covers the rules and regulations governing the safe use of aerial lifts.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list the required components of commercial and industrial insulation.
- state the benefits of (resistance to heat flow) R-value
- describe the impact of typical traditional construction on the environment.
- list the organizations that provide guidelines and certification for commercial and industrial insulation.
- describe the characteristics of self-propelled and manually-propelled aerial lifts and work platforms.
- demonstrate a pre-shift inspection of an aerial lift.

CARPT 136 Energy Conservation Codes and Standards

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- interpret energy conservation codes and standards.
- list the required components of green building.
- state the benefits of green building to the environment.
- describe the impact of typical traditional construction on the environment.
- identify Green Advantage certification requirements.
- interpret CalGreen building code requirements.

CARPT 137 Modular Systems Construction I

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- None.
This course introduces the modular system installer apprentices to safe and productive ways to handle modular components on a job site using the proper equipment. It also covers the proper way to lift and move modular components, protection of office equipment, basic furniture assembly, and manufacturers’ specifications.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- identify the proper equipment for moving different components.
- apply safe and ergonomic movements of material.
- apply proper floor protection during unloading and staging operations.
- identify the various hardware elements in furniture assembly.

### CARPT 138 Modular System Construction II

| Units: | 1 |
| Hours: | 14 hours LEC; 22 hours LAB |
| Prerequisite: | None. |

This course introduces the modular system installer apprentices to advanced modular system construction with a focus on panelized furniture and cubicle partitions including electrical diagrams. It also covers forklift operation and safety per regulations mandated by the Occupational Safety and Health Administration (OSHA).

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- assemble modular cubicle walls.
- properly disassemble modular cubicle walls.
- use proper handling and storage techniques of modular cubicle components.
- assemble panelized furniture.
- properly disassemble panelized furniture.
- use proper handling and storage techniques of panelized furniture.
- interpret electrical connection diagrams.
- operate a forklift per OSHA regulations.

### CARPT 140 Interior Systems

| Units: | 1.30 |
| Hours: | 18 hours LEC; 16 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Carpenter Apprentice. |

This course is a comprehensive study of materials, work processes, and the proper use of tools necessary to install gypsum wallboard and interior metal studs. Topics include green practices used in construction.
Upon completion of this course, the student will be able to:

- identify the different compositions of gypsum materials used in the construction of specific wallboard products including "green" practices of disposal.
- evaluate and demonstrate proper handling and storage techniques for wallboard, and metal studs.
- select the appropriate fastener used for metal stud and wallboard construction.
- demonstrate the proper use of tools and equipment used in metal stud and wallboard construction.
- evaluate proper and practical cutting and fitting techniques when installing metal studs and gypsum wallboard.
- formulate proper layout, cutting, and material installation procedures for the installation of braced and unbraced soffits.
- build a T-bar ceiling system from a plan.

CARPT 141 Suspended Framing Ceiling Systems

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Acoustical Apprentice.

This course introduces the acoustical apprentice to the installation of suspended framing ceiling systems and situations which require special installation techniques. It also covers industry standards and manufacturers' recommendations for proper installation of engineered ceilings, and proper tool selection and safety.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify the custom perimeter trim products.
- identify the use of reference points for the installation of suspended framing.
- explain the method for attaching trim to the ceiling system.
- perform pre-shift inspections for tools, equipment, and work area.
- identify metal ceiling systems components.
- demonstrate suspended framing systems-specific installation techniques.

CARPT 142 Engineered Structural Systems

Units: 1
Hours: 9 hours LEC; 27 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Carpenter Apprentice.

This course covers heavy timber construction in dams, bridges, and trusses. Topics include lamination and the proper disposal and recycling of materials.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list lamination processes and uses.
- identify three or more truss designs and select appropriate design for a project.
- safely operate heavy timber construction tools.
- demonstrate the proper use of hand signals to direct crane operations and explain the meaning of each signal.
- interpret a set of engineered nailing and fastening schedules and explain the purpose of such schedules.
- identify disposal of post-building materials codes.
- install a wood and wood-metal truss and its engineered manufactured components following a set of structural blueprints.

CARPT 144 Introduction to Grid Ceiling Installation

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Acoustical Installer Apprentice. |

This course introduces the Acoustical Apprentice to the installation of grid ceilings. It also covers rolling scaffold and tool safety.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify common grid ceiling components.
- interpret prints and specifications to determine the related electrical and mechanical features and layout.
- demonstrate an understanding of the standards and codes that apply to acoustical ceilings.
- identify the tools needed to install an acoustical ceiling.
- demonstrate the ability to lay out a grid ceiling.
- describe the installation process for exposed grid and concealed grid systems.
- explain the safe use of welded frame and rolling tower scaffolds, including materials, fall protection, and falling object protection.
- calculate contributory leg loads.
- list requirements for platform construction.

CARPT 145 Specialty Ceiling Systems

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Acoustical Installer Apprentice. |

This course introduces the Acoustical Apprentice to the installation of special ceiling systems. It also covers aerial lift use and safety.
Upon completion of this course, the student will be able to:

- identify special ceiling systems components.
- interpret prints and specifications to determine the related electrical and mechanical features and layout.
- demonstrate an understanding of the standards and codes that apply to specialty ceilings.
- identify the tools needed to install a specialty ceiling.
- demonstrate the ability to lay out a specialty ceiling.
- describe the installation process for exposed and concealed specialty systems.
- describe the characteristics of self-propelled and manually-propelled aerial lifts and work platforms.
- demonstrate a pre-shift inspection of an aerial lift.

CARPT 146 Integrated Ceilings and Special Techniques

<table>
<thead>
<tr>
<th>Units:</th>
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</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Acoustical Apprentice.</td>
</tr>
</tbody>
</table>

This course introduces the Acoustical Apprentice to the installation of integrated ceiling systems and situations which require special installation techniques. It also covers industry standards and manufacturers’ recommendations for proper installation of engineered ceiling and proper tool selection and safety.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- assess and perform specific installation techniques.
- apply the proper installation procedure for each system.
- explain reference points for the installation of curved trim and methods for attaching trim to the ceiling system.
- construct metal ceiling system components.
- identify the custom perimeter trim products.
- describe the tools needed for installing ceilings using special techniques.

CARPT 147 Advanced Grid Ceilings

<table>
<thead>
<tr>
<th>Units:</th>
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</thead>
<tbody>
<tr>
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<td>24 hours LEC; 12 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Acoustical Apprentice.</td>
</tr>
</tbody>
</table>

This course introduces the acoustical apprentice to advanced techniques in suspended framing and grid ceiling systems. It also covers industry standards, manufacturers’ recommendations for proper installation of engineered ceilings, and proper tool selection and safety.
Upon completion of this course, the student will be able to:

- explain the method for attaching data grid ceiling systems.
- demonstrate specific installation techniques.
- identify perimeter trim products.
- use reference points for the installation of lineal systems.
- identify special tools needed for grid ceiling installation.
- explain the installation procedure used for each specialty system.
- identify reference points used to install building perimeter systems.
- read and write pre-shift inspections for equipment and work area.

CARPT 148 Access Floor Systems

<table>
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<tr>
<th>Units:</th>
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</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Acoustical Installer apprentice.</td>
</tr>
</tbody>
</table>

This course is an introduction to the installation of Access Floor Systems. It also covers hand tool ergonomics, safety, and maintenance.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify the components and materials used for Access Floor Systems.
- explain how to inspect the job site, prepare the existing floor, and layout and level the access floor.
- describe tools used for layout and leveling and identify the proper testing equipment required.
- explain how to install stringer system reinforced perimeter locations, bridge obstructions, and additional bracing.
- describe the process of installing access floor panels, cutting panels, and framing around obstructions.
- explain the procedures used for installing handrails and stairs.
- describe the installation of low-profile wire management floors.
- list the uses, benefits, and code requirements of access floors.

CARPT 150 Concrete - Precast and Prestressed

<table>
<thead>
<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>9 hours LEC; 27 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Carpenter Apprentice.</td>
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</tbody>
</table>
This course covers the use and placement of concrete in residential and commercial construction. Topics include mixing, testing, aggregate, curing, and construction designs, as well as precast and prestressed concrete, materials, forms, molds, handling, lifting devices, and the proper disposal and recycling of materials.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- describe the advantages and disadvantages of precast and prestressed concrete methods.
- evaluate and proportion concrete components to achieve a required slump.
- perform and compare pull-pressure tests on bolts embedded at different depths and in different locations.
- analyze a basic set of bridge plans and tilt-up wall plans.
- calculate, layout, and construct a girder wall form with a given set of blueprints.
- define the requirements in lifting and bracing tilt-up wall panels.

**CARPT 155 Commercial Concrete**

**Units:** 1.5  
**Hours:** 23 hours LEC; 12 hours LAB  
**Prerequisite:** None.  
**Enrollment Limitation:** Must be a registered Carpenter Apprentice

This course covers concepts and practices of commercial concrete construction. Topics include layout and construction of bolt patterns, concrete columns, and gang forms, as well as the types and methods used to safely build, shore, and place column caps and concrete decks.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- translate a set of commercial prints and lay out job grid lines.
- construct a bolt pattern and place it at the proper location and elevation.
- build, set, and brace a round fiber form column and square wood at the correct location.
- assemble, set, and brace a wall using composite metal or plywood panels.
- erect, line, and brace a section of Aluma-wall with taper ties and strongbacks.
- identify the components of a traditional wood-shore deck system, including Ellis shores, stringers, joists, and deck plywood.
- construct a wood shore deck with column caps included.
- assemble a steel post shoring system and set it to the correct elevation.
- identify the safety hazards of silica and the corrective measures to mitigate the danger.
- calculate the amount of concrete needed for various forms.
- exhibit safe work practices in the stripping and storing of forms.

**CARPT 160 Blueprint Reading-Residential**

**Student Learning Outcomes**

This course covers the use and placement of concrete in residential and commercial construction. Topics include mixing, testing, aggregate, curing, and construction designs, as well as precast and prestressed concrete, materials, forms, molds, handling, lifting devices, and the proper disposal and recycling of materials.

Upon completion of this course, the student will be able to:

- describe the advantages and disadvantages of precast and prestressed concrete methods.
- evaluate and proportion concrete components to achieve a required slump.
- perform and compare pull-pressure tests on bolts embedded at different depths and in different locations.
- analyze a basic set of bridge plans and tilt-up wall plans.
- calculate, layout, and construct a girder wall form with a given set of blueprints.
- define the requirements in lifting and bracing tilt-up wall panels.
This course covers residential blueprints. Topics include "green" practices, conventions, lines, symbols, measurements, and specifications used for residential construction.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- identify the symbols and terms used in plot, foundation, floor, elevation, detail, mechanical and electrical plans.
- interpret technical information given on schedules and written specifications.
- construct building layout and offset construction lines.
- list appropriate steps to complete building permit application.
- project building layout lines from given lot lines.
- demonstrate use of an architect and engineer scale ruler.
- identify different "green" practices for residential construction.
- identify Leadership in Energy and Environmental Design (LEED) and other organization requirements for certification.
- calculate elevations from information obtained from residential plot and foundation plans.

**CARPT 162 Blueprint Reading-Commercial**

This course covers commercial and industrial blueprints. Topics include conventions, lines, symbols, measurements, and specifications used for commercial and industrial construction. CalGreen codes are also covered.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- compare graphic (blueprint) information with written (specifications) information.
- locate relevant codes in the Construction Safety Orders.
- identify and explain commercial and industrial architectural symbols.
- sketch different architectural lines used on blueprints following given legend.
- extract the information necessary to construct a Photovoltaic support structure using a set of blueprints.
- estimate the quantity and cost of material needed to construct parts of the building.
- extract the information necessary to construct a section of a building using a set of blueprints.
CARPT 163 Modular System Blueprint Reading

Units: 1
Hours: 13 hours LEC; 23 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered carpentry modular systems installer apprentice.

This course is an introduction to blueprint reading, project specifications, and layout for modular systems. It also covers union trust fund benefits.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify different lines and symbols used on print drawings.
- demonstrate proper layout of wall locations for modular systems.
- utilize a laser and target to perform elevation readings.
- identify safety hazards of working with a laser layout device.
- understand the union benefit package.

CARPT 164 Acoustical Blueprint Reading

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered carpentry acoustical apprentice.

This course introduces the acoustical apprentice to advanced specialized blueprint reading. It also covers basic construction documents, project scheduling, and labor cost estimation.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the purpose, printing, modifications, and assembly of acoustical blueprints.
- identify the various lines, pictorial drawings, views, symbols, and other characteristics that may be found on acoustical blueprints.
- describe the importance of a construction schedule and daily job log and organize labor in conjunction with the construction schedule.
- calculate the progress of a project in terms of completion.
- estimate the labor hours needed to complete various types of work.
- bisect lines and angles for layout purposes.
- layout segmented arches using different methods and procedures.

CARPT 170 Roof Framing

Units: 1
This course covers roof framing, layout, and construction. Topics include industry terminology, technical information, and construction materials and methods, all which are used in planning and building several types of roofs. Industry standards and codes are also covered.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- layout rafters for various types of roofs.
- identify five or more roof designs.
- analyze drawings of different roof types.
- calculate and construct a gable, hip, and intersecting roof.
- identify the components of a roof systems.
- explain the functions of different truss designs.
- identify the codes and standards that affect roof construction.

CARPT 180 Stair Building

Upon completion of this course, the student will be able to:

- estimate the cost and materials for various types of stairs.
- determine the dimensions of stair rise and run.
- calculate and layout risers and treads on a stair stringer with a framing square fitted with stair gauges.
- evaluate, locate, and construct landings and platforms.
- calculate and layout form work for a self-supporting concrete stair.
- calculate layout, cut and assemble risers and treads for the quarter-turn winder stair.
- select appropriate UBC codes necessary to design and construct a stairway.

CARPT 181 Tools of the Trade and Installation of Hardwood Floors

This course covers types, designs, nomenclature, and Uniform Building Code (UBC) requirements for building stairs. Topics include mathematical calculations and layout procedures for constructing stairs, landings, newels, and handrails.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- estimate the cost and materials for various types of stairs.
- determine the dimensions of stair rise and run.
- calculate and layout risers and treads on a stair stringer with a framing square fitted with stair gauges.
- evaluate, locate, and construct landings and platforms.
- calculate and layout form work for a self-supporting concrete stair.
- calculate layout, cut and assemble risers and treads for the quarter-turn winder stair.
- select appropriate UBC codes necessary to design and construct a stairway.
This course introduces Hardwood Floor Layer Apprentices to the installation of hardwood floors per industry standards. It covers tool and equipment identification, safety, and proper maintenance procedures.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- identify the proper tools and equipment needed for the installation of various hardwood floors.
- practice safe use of tools and equipment.
- apply proper tool and equipment maintenance techniques.
- use tools and equipment to properly install hardwood floors.

**CARPT 182 Finishing and Repairing Floors**

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<thead>
<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Hardwood Floor Layer Apprentice.</td>
</tr>
</tbody>
</table>

This course introduces Hardwood Floor Layer Apprentices to the process of finishing and repairing hardwood floors per industry standards. It also covers installation of athletic and parquet flooring.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- apply hardwood floor finishing techniques.
- demonstrate proper floor repair processes.
- identify materials needed for athletic flooring and parquet flooring.
- apply athletic flooring installation techniques.
- apply parquet flooring installation techniques.
- identify appropriate baseboard and trim for flooring.

**CARPT 190 Introduction to Welding and Cutting**

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<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>9 hours LEC; 27 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Carpenter Apprentice.</td>
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</tbody>
</table>

This course covers welding methods, brazing, and flame cutting. Topics include thermo-forming and thermo-setting plastics applicable to the building construction industry.
Upon completion of this course, the student will be able to:

- explain basic theory in safety and welding techniques used for each welding process.
- setup and operate oxyacetylene and arc welding equipment properly.
- produce neat and strong welds on metals using oxyacetylene and arc welding equipment.
- analyze and perform methods of joining and welding plastic materials.
- produce welds to meet industry standards in the carpenter's profession.

CARPT 210 The Acoustical Apprentice, Safety, and the Trade

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered carpentry acoustical apprentice. |

This course introduces the acoustical apprentice to fall protection, tool safety and maintenance, and scaffold safety and maintenance. It also covers Occupational Safety and Health Administration (OSHA) 10, First Aid and CPR certifications.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain allowable loads for various types of scaffold.
- explain the safe use of scaffolds and materials.
- list requirements for platform construction.
- identify and safely demonstrate use of hand and power tools.
- identify the components of a personal fall protection system (PFPS) and a personal fall arrest system (PFAS).
- explain the rules and regulations of PFPS and PFAS.
- apply CPR and First Aid.
- define OSHA safety regulations.

CARPT 211 Acoustical Installer Safety

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered carpentry acoustical apprentice. |

This course introduces the beginning acoustical apprentice to safe work practices in the use of rolling scaffold systems, lasers, and hand and power tools. It also covers the necessary skills to obtain a welded frame scaffold qualification card from the United Brotherhood of Carpenters (UBC).
Upon completion of this course, the student will be able to:

- interpret Occupational Safety and Health Administration (OSHA) regulations for scaffold, lasers, and tools.
- safely use power and hand tools.
- identify welded frame scaffold components.
- describe the use of welded scaffold.
- explain the method for cutting trim.
- explain the use of top locks on rolling scaffold.
- demonstrate pre-shift inspections for scaffold equipment.
- describe laser safety.
- perform hand tool inspection.

CARPT 212 Infection Control Risk Assessment and Hospital Code for Acoustical Installers

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<tr>
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<tbody>
<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Acoustical Installer Apprentice.</td>
</tr>
</tbody>
</table>

This course introduces the acoustical installer apprentice to the safety procedures for hospital work Infection Control Risk Assessment (ICRA). It also covers applicable building codes of acoustical ceiling systems used in hospitals.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain how local and state building codes are developed for the State of California
- define the additional installation requirements for acoustical ceilings in buildings deemed for essential services
- install an acoustical ceiling conforming with the regulations of the Office of Statewide Health Planning and Development
- describe how to read load charts
- list requirements for inspection of equipment
- list criteria for contamination from hospital remodels
- describe secondary infections that are contracted during hospital stays

CARPT 213 Acoustical Exterior Systems

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<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
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</table>

This course introduces the acoustical apprentice to the installation of acoustical exterior systems. It also covers industry standards and manufacturers' recommendations for proper installation and safety for exterior systems.
Upon completion of this course, the student will be able to:

- demonstrate proper installation techniques.
- explain the installation procedure used for each system.
- identify custom perimeter trim products.
- use reference points for the installation of trim.
- identify metal ceiling systems components.
- identify special tools needed exterior acoustical systems.
- perform pre-shift inspections for equipment and work area.

CARPT 215 Acoustical Specialty Systems

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<tr>
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<tbody>
<tr>
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<td>Prerequisite:</td>
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<td>Enrollment Limitation:</td>
<td>Must be a registered Acoustical Installer Apprentice.</td>
</tr>
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</table>

This course introduces the Acoustical Apprentice to the installation of advanced and specialty ceiling systems. It also covers hand and power tool safety and aerial lift safety.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify custom perimeter trim products.
- use reference points for the installation of fabric trim.
- explain the method for attaching sound panels to the ceiling system.
- use reference points for the installation of curved trim.
- install Z-clips.
- interpret OSHA regulations for aerial lifts.

CARPT 220 Millwright Safety and Tool Skills

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</tr>
<tr>
<td>Prerequisite:</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Millwright apprentice.</td>
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</tbody>
</table>

This course is an introduction to the safety rules and regulations required to work on job sites. It also provides Millwright 16-hour Safety certification.

Student Learning Outcomes

Upon completion of this course, the student will be able to:
• employ personal protective equipment.

• understand basic safety practices with hand and power tools, scaffold and fall protection use, fire protection, respiratory protection, and confined spaces as required by the Occupational Safety and Health Administration's regulations.

• identify hazards of construction like asbestos and chemicals use.

CARPT 221 The Millwright Apprentice and the Trade

Units: 2
Hours: 36 hours LEC
Prerequisite: None.
Enrollment Limitation: Must be a registered Millwright apprentice.

This course informs Millwright apprentices about the structure of their union, as well as their responsibilities and rights. It also covers union history and the development of a proper work ethic.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• identify and explain the roles and responsibilities of union officers.

• describe the responsibilities of the apprentice as required by Joint Apprenticeship and Training Committee (JATC) and other governing agencies.

• maintain the responsibilities required by the local union's constitution.

• identify the characteristics of a proper work ethic.

CARPT 222 Millwright Math Applications and Fall Protection

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Millwright apprentice.

This course reviews math applications needed by Millwright apprentices and introduces the United Brotherhood of Carpenters (UBC) Fall Protection certification.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• add, subtract, multiply, and divide whole numbers, fractions, and decimals.

• convert fractions, decimals, inches, feet, fractions of inches, and non-metric to metric units.

• calculate area, volume, ratio, proportion, and circumference.

• demonstrate basic layout methods for establishing a right angle.

• identify and explain the components of a Personal Fall Arrest System (PFAS), methods of restraint, and the complications from suspension trauma.

• explain the requirements of a guardrail system.

• describe fall protection anchorage points for scaffolding.
CARPT 223 Cutting and Welding I

This course introduces the safe use of hand and power tools to perform shielded metal arc welding (SMAW), oxy-fuel welding, and plasma cutting. It also covers proper ergonomics.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify common hazards in welding and cutting and the proper methods to eliminate them.
- explain the appropriate applications for each type of welding and associated equipment and tools.
- discuss the electrode classification system and the electrode folder components.
- properly use various electrode holders.
- demonstrate the proper usage of an inverter and rectifier.
- explain the different processes for cutting steel.

CARPT 224 Materials of Construction

This course introduces, at a basic level, the hardware Millwrights encounter on the job site. It also covers different seals, structural materials, and appropriate application.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe threads and threaded fasteners.
- identify and explain various types of threaded fasteners and appropriate applications for each.
- identify and explain various unthreaded fasteners and alignment hardware, as well as appropriate applications for each.
- describe commonly used seals and their usage.
- outline external and internal retaining rings and explain the proper usage of each.
- identify the characteristics of a variety of shapes of structural materials and appropriate applications of each.
CARPT 225 Layout Procedures for Millwrights

Units: 1
Hours: 22 hours LEC; 14 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Millwright Apprentice.

This course introduces the Millwright Carpentry Apprentice to layout procedures using applied blueprint techniques. It also covers the safe use of lift trucks and rough terrain lift practices.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify layout tolerances as specified in plans.
- calculate and lay out angles using appropriate methods.
- locate and transfer benchmarks and establish elevations.
- identify the factors and equipment that contribute to lift truck stability.
- demonstrate standard hand signals and safe operations used for lift truck operations.
- apply safe practices for industrial and rough terrain lifts.

CARPT 226 Precision Optical Instruments

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Millwright Apprentice.

This course introduces the Millwright Apprentice to the precision optical instruments currently used by contractors for shaft alignment. It also covers General Electric (GE) turbine familiarization as well as blueprint reading.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain how to set up and calibrate optical instruments.
- identify and troubleshoot optical instruments.
- analyze faulty readings from optical instruments.
- list the required components of GE turbines.
- identify the information provided on mechanical prints.
- identify the characteristics and uses of assembly prints.

CARPT 227 Blueprint Reading and Aerial Lift

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB

This course introduces the Millwright Apprentice to the precision optical instruments currently used by contractors for shaft alignment. It also covers General Electric (GE) turbine familiarization as well as blueprint reading.
This course introduces Millwright apprentices to blueprint terminology and interpretation. It also covers the rules and regulations governing the safe use of aerial lifts.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- explain the purpose, printing, modifications, and assembly of blueprints.
- identify the various lines, pictorial drawings, and views that may be found on blueprints.
- interpret mechanical blueprints and welding symbols.
- describe the characteristics of self-propelled and manually-propelled aerial lifts and work platforms.
- perform a pre-shift inspection of an aerial lift.

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**CARPT 228 Millwright Rigging**

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<tr>
<th>Units</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>35 hours LEC; 5 hours LAB</td>
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</table>

**Prerequisite:** None.

**Enrollment Limitation:** Must be a registered Millwright apprentice.

This course introduces the Millwright Apprentice to rigging. It addresses the safety regulations and practices related to rigging and rigging hardware.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- describe the purpose of rigging and the components used.
- identify and demonstrate various types of knots, and state the limitations of each.
- describe the selection of rigging equipment and hardware to perform safe rigging practices.
- demonstrate safe rigging practices, including hand and voice signals.
- list and describe the different types of cranes used for rigging operations.
- describe the safety limits of equipment used in rigging.
- explain the rigger's responsibility for safety on the job site.
- describe basic chain construction and design.

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**CARPT 229 Cutting and Welding II**

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<th>Units</th>
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<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
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</table>

**Prerequisite:** None.

**Enrollment Limitation:** Must be a registered Millwright apprentice.
This course expands on CARPT 223 and furthers the Millwright apprentice's knowledge of shielded metal arc welding (SMAW) procedures and welding equipment. It also covers the safe use of welding and cutting with plasma and carbon arc equipment, as well as the American Welding Society (AWS) requirements for welding 2G, 3G, and 4G, horizontal, vertical, and overhead groove joints with SMAW.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify and explain the SMAW process, components, and safety issues.
- identify and explain the specifications and usage of electrodes.
- identify and explain carbon arc welding and cutting processes, components, and safety issues.
- identify and explain plasma welding and cutting processes, components, and safety issues.
- analyze and interpret weld bead examples.
- prepare a one-inch-thick groove joint that meets AWS standards.
- perform the AWS 3G unlimited thickness practice test with SMAW.

CARPT 230 Monorails
Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Millwright apprentice.

This course introduces Millwright apprentices to various types of monorails, the materials, safety hazards, and the safe use of hand and power tools on job sites.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe the types, applications, and components of monorails.
- identify basic truss designs.
- explain the layout and fabrication of a monorail system.
- describe the methods for connecting support steel.
- identify the different types of fasteners used in support steel.
- describe an overhead monorail path layout.

CARPT 231 Conveyors for Millwrights
Units: 1
Hours: 16 hours LEC; 20 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Millwright Apprentice.

This course introduces the Millwright Apprentice to various types of conveyor systems including the major components and applications. It covers the
methods and components used to install conveyor systems per industry standards.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify various types of conveyor systems and their installation procedures.
- describe common applications of conveyor systems.
- identify basic truss designs.
- describe the major components of a conveyor system.
- explain the layout and fabrication of header steel and methods for connecting and attaching support steel.
- construct an overhead conveyor system path.

CARPT 232 Machinery Installation

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Millwright Apprentice. |

This course introduces the Millwright Apprentice to the proper installation of machinery per industry standards.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- apply proper site preparation and layout.
- identify and calculate anchoring devices.
- identify reference points.
- install machinery safely and effectively at the proper elevation.
- describe safety hazards during installation and during maintenance operations.

CARPT 233 Machinery Maintenance for Millwrights

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Millwright Apprentice. |

This course covers the basics of millwright machinery maintenance, troubleshooting, and repair.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- select and operate various millwright equipment.
- apply maintenance recordkeeping and reports.
apply maintenance techniques for millwright machinery.

describe possible safety hazards associated with maintenance tasks.

calculate wear on components to determine if replacement is needed.

identify resources for manufacturers' specifications on scheduled maintenance and pre-startup requirements.

CARPT 234 Precision Tools for Millwrights

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Millwright Apprentice. |

This course introduces Millwright Apprentices to precision tools, accurate measurements for layout, leveling practices, and alignment per manufacturer and industry standards.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify various precision tools and describe their proper use and maintenance.
- demonstrate setup and use of laser alignment tools and optical instruments.
- demonstrate the proper use of an inside and outside micrometer.
- explain the process of testing and setting up precision tools for accuracy.
- calculate conversions for alignment.

CARPT 235 Turbines

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Millwright Apprentice. |

This course introduces Millwright Apprentices to hydro, gas, and steam turbines. It covers proper assembly, installation, and maintenance per manufacturer and industry standards.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify basic mechanical principals for power generation.
- list efficient hydroelectric power facilities and types of power generation.
- distinguish alternative energy sources, such as wind, nuclear, and tidal power.
- demonstrate proper procedure for working on turbines.
- identify causes of rotation in a steam turbine.
CARPT 236 Cutting and Welding III

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Millwright Apprentice.

This course expands on CARPT 229 and furthers the Millwright Apprentice's knowledge of shielded Flux Core Arc Welding (FCAW) procedures and welding equipment. It also covers the safe use of welding and cutting with plasma and carbon arc equipment, as well as the American Welding Society (AWS) requirements for welding 3G and 4G, horizontal, vertical, and overhead groove joints with FCAW.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list and define the FCAW process, components, and safety issues.
- identify and explain the specifications and usage of electrodes.
- identify and explain arc welding and cutting processes, components, and safety issues.
- prepare a one-inch-thick vertical groove joint that meets AWS standards.
- produce the AWS 3G and 4G unlimited thickness practice test with FCAW.

CARPT 240 Piledriver Safety and Tools

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Piledriver apprentice.

This course introduces Piledriver apprentices to the ergonomics, safety, and maintenance of hand and power tools. It also covers hazard recognition in fall protection.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify and safely demonstrate hand tools usage.
- identify and safely demonstrate power tools usage.
- perform a hand and power tool safety check prior to use.
- identify the components of a personal fall protection system (PFPS) and a personal fall arrest system (PFAS).
- explain the rules and regulations of PFPS and PFAS.

CARPT 241 Pile Driver Math Applications
This course covers mathematical processes in the construction trade with specific focus on the pile driving industry. It also covers personal financial responsibilities.

Upon completion of this course, the student will be able to:

- apply mathematics such as addition, subtraction, multiplication, and division with whole numbers, fractions, and decimals.
- convert fractions, decimals, inches, feet, fractions of inches, and non-metric to metric units.
- calculate area, volume, ratios, proportion, and circumference.
- demonstrate basic layout methods for establishing a right angle.
- apply personal financial responsibilities including credit scores, budgets creation, and credit building.

CARPT 242 Piledriver Rigging

Upon completion of this course, the student will be able to:

- describe the purpose of rigging and the components used.
- identify and demonstrate various types of knots and state the limitations of each.
- explain the selection of rigging equipment and hardware to perform safe rigging practices.
- demonstrate safe rigging practices, including hand and voice signals.
- list and describe the different types of cranes used for rigging operations.
- describe the safety limits of equipment used in rigging.
- explain the riggers responsibility for safety on the job site.
- describe basic chain construction and design.

CARPT 243 Form Detailing, Construction, and Erection for Pile Drivers

This course addresses the safety regulations and practices related to rigging and rigging hardware. It exceeds the requirements of OSHA Subpart CC, ANSI A10.42.2000 “Qualified Rigger,” and ANSI B30.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify and demonstrate various types of knots and state the limitations of each.
- explain the selection of rigging equipment and hardware to perform safe rigging practices.
- demonstrate safe rigging practices, including hand and voice signals.
- list and describe the different types of cranes used for rigging operations.
- describe the safety limits of equipment used in rigging.
- explain the riggers responsibility for safety on the job site.
- describe basic chain construction and design.
This course introduces the Pile Driver Apprentice to planning and building of form work, construction and erection of various concrete forms, and the materials and methods used. It also covers new building materials such as recycled and alternative materials.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- identify and list appropriate materials for the construction of concrete forms.
- describe the purpose of three or more types of forms and their uses.
- draft a concrete form detail drawing and specify the function of the concrete form.
- build a concrete construction form involving bucks, block-outs, and inserts.
- calculate concrete quantities for model forms.

**CARPT 244 Welding I: Introduction to SMAW**

This course introduces the Pile Driver Apprentice to the safety procedures while performing Shielded Metal Arc Welding (SMAW). It also covers equipment identification and welding consumables.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- identify appropriate personal protection equipment including proper clothing.
- identify common hazards and the proper performance methods in welding and cutting.
- explain the appropriate applications of SMAW welding, and the associated equipment, consumables, and tools.
- describe the electrode classification system and the electrode folder components.
- explain the different processes for cutting steel.

**CARPT 245 Introduction to Land and Water Pile Driving**

This course introduces the Pile Driver Apprentice to pile driving practices on land and in water. Topics covered include safety, pile driving equipment, aerial lifts, cranes, and booms.
Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify hazards and safe practices for pile driving on land or water.
- identify pile driving equipment and accessories.
- list pile driving equipment used in land and water applications.
- identify booms and cranes and their uses.
- apply aerial lift safety practices and proper operation techniques.

CARPT 246 Welding II: SMAW Flat Position and Forklift Certification

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<tr>
<td>Hours:</td>
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<tr>
<td>Prerequisite:</td>
<td>Must be a registered Piledriver apprentice.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>None.</td>
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</table>

This course expands on CARPT 244 and the Piledriver apprentice's knowledge of the appropriate safety procedures when using shielded metal arc welding (SMAW) and oxy-fuel cutting and the associated components. This course focuses on welding groove joints, flat V-groove (1G), and horizontal V-groove (2G). It also provides certification as a Power Industrial Truck Operator.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe safety issues and the personal protective equipment used with shielded metal arc welding and oxy-fuel welding and cutting processes.
- describe electrode use and classification.
- demonstrate a knowledge of the types of electrode classifications and joint configurations and the welding techniques used.
- interpret weld bead examples.
- identify hazards associated with welding and cutting and power industrial truck operation.
- demonstrate an understanding of safely operating a power industrial truck and the factors that contribute to lift truck stability.

CARPT 247 Advanced Land and Water Pile Driving

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<thead>
<tr>
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<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC; 18 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>Must be a registered Pile Driver Apprentice.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>None.</td>
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</tbody>
</table>

This course introduces the Pile Driver Apprentice to advanced pile driving practices on land and in water. Topics covered include understanding pile driving equipment, cranes and booms, rigs, accessories, and pile driving hammers.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list pile driving rig applications and safe practices.
- explain the advantages and disadvantages of using various cranes or booms.
- describe the similarities and differences of tieback walls and bulkheads.
- define pile driving accessories and their appropriate uses.

CARPT 248 Wharfage and Marine Structures

Units: 1

Hours: 18 hours LEC; 18 hours LAB

Prerequisite: Must be a registered Pile Driver Apprentice.

Enrollment Limitation: None.

This course introduces the Pile Driver Apprentice to pile driving practices used in bridge erection, and the construction of wharf and marine structures. Topics include various types of lumber and heavy timber, their selection, proper application, natural defects, and basic repair work.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify wharf and marine structures.
- explain bridge erection applications.
- identify lumber and heavy timber grades used in bridge, wharf, and marine construction.
- list natural occurring defects in lumber and heavy timber.
- explain force loads and timber orientation.
- apply proper fastening and joining techniques.
- describe basic repair work.

CARPT 249 Welding III: Advanced SMAW

Units: 1.5

Hours: 24 hours LEC; 12 hours LAB

Prerequisite: Must be a registered Pile Driver Apprentice.

Enrollment Limitation: None.

This course expands on CARPT 246 and the Pile Driver Apprentice’s knowledge of the appropriate safety procedures when using Shielded Metal Arc Welding (SMAW) and oxy-fuel cutting and the associated components. This course focuses on welding vertical groove joints (3G). It also covers American Welding Society (AWS) requirements for achieving a welder certification in 3G with SMAW.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe hazards and the personal protective equipment used with SMAW and oxy-fuel welding and cutting processes.
- define specific electrode classifications.
- demonstrate knowledge of oxy-fuel cutting applications.
- examine weld beads for accuracy.
- prepare a one-inch vertical joint groove meeting AWS requirements.
- practice the AWS 3G unlimited thickness test using the SMAW process.

CARPT 250 Introduction to Structural Blueprints & Layout Instruments

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<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Piledriver apprentice.</td>
</tr>
</tbody>
</table>

This course introduces Piledriver apprentices to structural blueprint reading and layout.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the purpose, printing, modifications, and assembly of structural blueprints.
- identify the various lines, pictorial drawings, views, and other characteristics that may be found on structural blueprints.
- interpret structural blueprints and symbols.
- explain and perform basic math in the ship builder's method.
- set up and use an automatic builder's level.

CARPT 251 Advanced Structural Blueprints and Bridge Building

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<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Pile Driver Apprentice.</td>
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</table>

This course introduces Pile Driver Apprentices to advanced structural blueprint reading and bridge building. Topics include bridge building practices, safety, pre-stressing, post-tensioning, and steel reinforcement of concrete. Basic concrete testing is also covered.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- interpret structural blueprint symbols, pictorial drawings, and specification details.
- explain steel reinforcement, pre-stressing, and post-tensioning reinforcement.
- list the major types of concrete bridges, including their design features and components.
- describe construction processes including cast-in-place, precast, segmental, cantilever, caisson, and cofferdam.
- identify safe practices for working both on land and over water.
- conduct basic concrete testing.
CARPT 252 Falsework, Shoring, and Heavy Timber Framing

This course introduces Piledriver apprentices to the construction of advanced concrete forms for bridges and shoring with the use of heavy timbers for support, known as falsework. It also covers the various building materials used to create formwork for elaborate decorative architectural designs.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify and explain the purpose, components, and construction of concrete falsework.
- name the structural components that can be fabricated from formwork and concrete.
- describe channel safety guidelines followed on the job site when doing falsework.
- identify and explain form hardware and its general purpose.
- identify the most commonly used types of form ties.
- compare the five methods contractors can use to control the related costs of formwork.
- explain why support steel elements and heavy timbers are used in concrete shoring and falsework.

CARPT 253 Advanced Formwork

This course introduces Piledriver apprentices to the construction of advanced concrete forms used in all types of installations.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify and explain the purpose, components, and construction of concrete formwork.
- name the structural components that can be fabricated from formwork and concrete.
- describe channel safety guidelines followed on the job site.
- identify and explain form hardware and its general purpose.
- identify the most commonly used types of form ties.
- compare the five methods contractors can use to control the related costs of formwork.
- explain why support steel elements such as rebar are used in concrete.
This course expands the Piledriver apprentice's knowledge of the appropriate safety procedures when using shielded metal arc welding (SMAW) and oxy-fuel cutting and the associated components. It covers the American Welding Society (AWS) requirements for 4G certification, overhead groove joints with SMAW.

Upon completion of this course, the student will be able to:

- identify and explain the SMAW process, components, safety issues, and appropriate protective personal equipment (PPE).
- identify and explain the specifications, classifications, and usage of electrodes.
- describe the hazards associated with overhead welding.
- analyze and interpret weld bead examples.
- perform the AWS 4G practice test with SMAW.

CARPT 255 Welding V: FCAW 3G Certification

This course expands on CARPT 254 and furthers the Piledriver apprentice's knowledge of appropriate safety procedures when using flux core arc welding (FCAW) and oxy-fuel cutting and the associated components. It covers the American Welding Society (AWS) requirements for 3G certification, vertical groove joints with FCAW.

Upon completion of this course, the student will be able to:

- identify and explain the entire FCAW process, components, safety issues, and appropriate protective personal equipment (PPE).
- identify and explain the specifications, classifications, and usage of electrodes.
- describe the hazards associated with vertical welding.
- analyze and interpret weld bead examples.
- perform the AWS 3G practice test with FCAW.

CARPT 256 Welding VI: FCAW 4G Certification

This course expands the Piledriver apprentice's knowledge of the appropriate safety procedures when using shielded metal arc welding (SMAW) and oxy-fuel cutting and the associated components. It covers the American Welding Society (AWS) requirements for 4G certification, overhead groove joints with SMAW.

Upon completion of this course, the student will be able to:

- identify and explain the SMAW process, components, safety issues, and appropriate protective personal equipment (PPE).
- identify and explain the specifications, classifications, and usage of electrodes.
- describe the hazards associated with overhead welding.
- analyze and interpret weld bead examples.
- perform the AWS 4G practice test with SMAW.
This course expands on CARPT 255 and the Pile Driver Apprentice's knowledge of the appropriate safety procedures when using Flux Core Arc Welding (FCAW) and oxy-fuel cutting and the associated components. This course focuses on welding vertical groove joints (4G). It also covers American Welding Society (AWS) requirements for achieving a welder certification in 4G with FCAW.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe hazards and the personal protective equipment used with FCAW and oxy-fuel welding and cutting processes.
- define specific electrode classifications.
- demonstrate knowledge of oxy-fuel cutting applications.
- examine weld bead examples.
- prepare overhead groove joints meeting AWS requirements.
- practice the AWS 4G unlimited thickness test using the FCAW process.

CARPT 260 Introduction to Scaffolds and Confined Space

This course introduces Scaffold Erector apprentices to the appropriate safety procedures when using scaffolds and working in a confined space. It also covers the proper use and maintenance of hand tools.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain allowable loads for various types of scaffolds.
- calculate contributory leg loads.
- describe the requirements for platform construction.
- list the criteria for supported scaffold systems.
- describe the assembly and disassembly of scaffolds.
- compare the responsibilities of a competent person versus a qualified person.
- explain the safe use of scaffolds, materials, and proper means of access and egress.
- describe the importance of fall protection and falling object protection.
- explain the atmospheric hazards in a confined space and methods to monitor and adjust the oxygen content.
This course introduces the Scaffold Erector apprentice to the industry safety procedures when assembling welded frame and rolling scaffolds.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain allowable loads for welded frame and rolling tower scaffold.
- calculate contributory leg loads.
- list requirements for platform construction.
- list criteria for welded frame and rolling tower scaffold.
- describe safe scaffold access and egress.
- compare the responsibilities of a competent person versus a qualified person.
- explain the safe use of welded frame and rolling tower scaffolds and materials.
- describe the importance of fall protection and falling object protection.
- explain the importance of building scaffolds on suitable surfaces.
- identify allowable height-to-base ratios.

CARPT 262 System Scaffold

This course introduces the Scaffold Erector apprentice to industry safety procedures when erecting system scaffold, rolling scaffold, and supported scaffold.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain allowable loads for various types of scaffolds.
- calculate contributory leg loads.
- list requirements for platform construction.
- list criteria for supported scaffolds.
- describe safe scaffold access and egress.
- compare the responsibilities of a competent person versus a qualified person.
- explain the safe use of scaffolds and materials.
- describe the importance of fall protection and falling object protection.
- identify the main parts of the scaffold stair unit.
- explain the differences between safe access for users and erectors.
CARPT 263 Hazard Awareness for Scaffold Erectors

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<tr>
<td>Hours:</td>
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<td>Prerequisite:</td>
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<td>Enrollment Limitation:</td>
<td>Must be a registered Scaffold Erector Apprentice.</td>
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</tbody>
</table>

This course introduces the Scaffold Erector Apprentice to hazards of erecting and dismantling scaffolds. It also covers aerial lift rules and regulations per industry standards.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- identify hazards and safety precautions in the scaffold industry.
- list and define types of hazards and preventative safety precautions.
- interpret Occupational Safety and Health Administration (OSHA) regulations for aerial lifts.
- identify the characteristics and uses of aerial lifts.
- describe equipment in accordance with pre-shift inspection standards.

CARPT 264 Suspended Scaffolds and Shoring Systems

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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
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<td>Prerequisite:</td>
<td>None.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Scaffold Erector Apprentice.</td>
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</table>

This course introduces the Scaffold Erector Apprentice to the safety procedures and industry rules and regulations for suspended scaffolds.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- list the advantages and disadvantages of suspended scaffolds.
- describe the different types of suspended scaffolds and suspension equipment and devices.
- explain and identify the requirements for outrigger beams and anchorage connections.
- identify hazards and precautions for welding from suspended scaffolds.
- explain and describe platform requirements, load capabilities and fall protection for suspended scaffolds.

CARPT 265 Tube and Clamp Scaffold

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<tr>
<td>Hours:</td>
<td>20 hours LEC; 16 hours LAB</td>
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</table>
This course introduces the Scaffold Erector Apprentice to the safety procedures and industry rules and regulations for erecting tube and clamp scaffold systems.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain allowable loads and safe access for users and erectors.
- calculate contributory leg loads.
- demonstrate knowledge of the importance of fall protection and falling object protection.
- demonstrate the safe use of scaffold materials.
- list requirements and criteria for tube and clamp scaffold erection.

CARPT 266 Blueprint Reading for Scaffold Erectors

1.5 Units
24 hours LEC; 12 hours LAB
None. Prerequisite
Must be a registered Scaffold Erector Apprentice.

This course introduces the Scaffold Erector Apprentice to scaffold blueprint reading.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify print production and reproduction methods.
- define detail views and describe their uses.
- interpret blueprint symbols.
- construct a perpendicular line using the shipbuilders' method.
- interpret dimensions on scaffold shop blueprints.
- demonstrate the ability to manually revise blueprints.

CARPT 268 Welding II

1.5 Units
24 hours LEC; 12 hours LAB
None. Prerequisite
Must be a registered Scaffold Erector apprentice.

This course introduces the Scaffold Erector apprentice to light gauge welding using shielded metal arc welding (SMAW) and flux core arc welding (FCAW). It also covers safety, ergonomics, the safe use of hand and power tools, and tool maintenance.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify welding hazards and safety methods to eliminate them.
- describe various bell resources used with the different kinds of welding and cutting.
- explain the electrode classification system.
- demonstrate the proper use various electrode holders.
- identify the different types of welding machines.
- identify the function of a rectifier and an inverter.
- explain different types of electrode folders and components.
- explain different types of welding.

**CARPT 270 Mill Cabinet Safety and Tool Skills**

**Units:**
1.5

**Hours:**
- 24 hours LEC; 12 hours LAB

**Prerequisite:**
None.

**Enrollment Limitation:**
Must be a registered Mill Cabinet Apprentice.

This course introduces Mill Cabinet Apprentices to materials, safety hazards, and the safe use of hand and power tools on job sites.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- identify, select, maintain, and safely operate hand and power tools.
- avoid unsafe conditions and acts, and observe safety laws and regulations.
- discuss, explain, and describe the production process.
- obtain forklift operation and safety certification.

**CARPT 271 The Mill Cabinet Apprentice and the Trade**

**Units:**
1.5

**Hours:**
- 24 hours LEC; 12 hours LAB

**Prerequisite:**
Must be a registered Mill Cabinet Apprentice.

**Enrollment Limitation:**
None.

This course covers the history of Mill Cabinet Apprentice and the trade. Topics include wages and benefits, workers’ compensation, personal finances, job placement, collective bargaining, working conditions, and labor-management relations as they pertain to unions, contractors, and cooperatives.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- analyze federal and state laws governing carpenters apprenticeship.
- evaluate the requirements of a job.
• identify unacceptable and acceptable working conditions.
• define terms and titles common to the construction industry.
• describe and list labor, management, contractors, and cooperatives within the area.
• understand personal financial responsibility.

CARPT 272 Math for the Trades

| Units: | 2 |
| Hours: | 36 hours LEC |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Mill Cabinet Apprentice. |

This course covers mathematics applications in the mill cabinet trade with specific focus on mathematical processes related to the production requirements of the industry.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• apply mathematics such as addition, subtraction, multiplication, and division with whole numbers.
• convert fractions, decimals, inches, feet, fractions of inches, and non-metric to metric units.
• calculate perimeter, arc, volume, and weight measurements.
• calculate angles, degrees, and basic percentages.

CARPT 273 Basic Cabinet Making

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Must be a registered Mill Cabinet Apprentice. |

This course introduces Mill Cabinet Apprentices to basic cabinetry building procedures per industry standards.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• identify need, function, and process for cabinet making.
• explain and describe the production and function of various cabinet styles.
• apply design elements and principles to create functional and attractive cabinets.
• select appropriate materials and production procedures for joint strength.

CARPT 274 Basic Blueprint Reading Mill Cabinet
This course introduces Mill Cabinet Apprentices to blueprint terminology and interpretation.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- explain the purpose, printing, modifications, and assembly of blueprints.
- identify and describe the types of construction drawings and documents.
- interpret abbreviations, schedules and symbols on prints.
- convert English and metric measurements.

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**CARPT 275 Machinery Maintenance for Mill Cabinet**

This course covers the basics of mill cabinet machinery maintenance, troubleshooting, and repair.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- operate hand and portable power saws.
- select, maintain, and operate stationary power equipment.
- explain the sequence of steps to square work pieces and operate a portable power plane.
- apply maintenance techniques for mill cabinet machinery.

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**CARPT 276 Cabinet Hardware Installation**

This course introduces new Mill Cabinet Apprentices to basic cabinetry hardware installation procedures.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- select and identify knobs and pulls for function and appearance.
- explain various methods for mounting cabinetry hardware.
- describe and select nails, screws, and fasteners used in cabinetry installation.

CARPT 277 Sanding, Stains, and Finish Preparation

| Units:     | 1.5 |
| Hours:     | 24 hours LEC; 12 hours LAB |
| Prerequisite: | Must be a registered Mill Cabinet Apprentice. |
| Enrollment Limitation: |

This course introduces the Mill Cabinet Apprentice to the processes of surface preparation for the staining and finishing of solid wood and veneered cabinetry.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- select abrasive materials for smoothing surfaces.
- operate portable and stationary power sanding machines.
- inspect material surfaces to determine if abrading is necessary and apply the appropriate process for surface defects such as dents, cracks, and voids.
- identify coatings for finishing wood surfaces and wood products.

CARPT 278 Advanced Machinery Operation

| Units:     | 1.5 |
| Hours:     | 24 hours LEC; 12 hours LAB |
| Prerequisite: | Must be a registered Mill Cabinet Apprentice. |
| Enrollment Limitation: |

This course introduces new Mill Cabinet Apprentices to advanced machinery operation procedures.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- choose, maintain, and operate various saw blades, stationary power equipment, portable power planes, joiners, portable routers and Computer Numerical Control (CNC) machines.
- select, operate, and install shaper cutters, spindle shapers, and router bits.
- identify and select various machines and hand tools including shaping contours and decorative surfaces.

CARPT 279 Advanced Blueprint Reading for Mill Cabinet

| Units:     | 1.5 |
| Hours:     | 24 hours LEC; 12 hours LAB |
| Prerequisite: | Must be a registered Mill Cabinet Apprentice. |
| Enrollment Limitation: |

This course introduces Mill Cabinet Apprentices to advanced blueprint terminology and interpretation.
Upon completion of this course, the student will be able to:

- describe the information found on a site plan and floor plan.
- explain how prints are designated in a set and list the information and specifications.
- explain the purpose of codes and regulations in the construction industry.
- describe what the Americans with Disabilities Act (ADA) is and how it impacts the mill cabinet industry.

CARPT 280 Advanced Cabinet Making

<table>
<thead>
<tr>
<th>Units:</th>
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</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Mill Cabinet Apprentice.</td>
</tr>
</tbody>
</table>

This course introduces Mill Cabinet Apprentices to advanced cabinetry building procedures.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- draw isometric, cabinet oblique, and perspective sketches.
- describe specifications and mock-up design analysis.
- identify the effects computers have on producing working drawings and cabinet making.
- create square- or profiled-edge frames and select joints for assembly.
- identify applications for panel components.

CARPT 281 Veneers, Laminate, and Finishing

<table>
<thead>
<tr>
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<tr>
<td>Hours:</td>
<td>24 hours LEC; 12 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Must be a registered Mill Cabinet Apprentice.</td>
</tr>
</tbody>
</table>

This course introduces the Mill Cabinet Apprentice to the processes of surface preparation for the finishing of laminate, and veneered cabinetry.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe and apply the techniques of veneer and laminate application.
- identify the effects of different stains and paints on different type of veneers and the importance of specifications.
- use a router to trim edges using different bits.
- create square- or profiled-edge frames and select joints for assembly.
- explain the activities leading to a finished product.
CARPT 282 CAD Basics for Mill Cabinetry

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Mill Cabinet Apprentice.

This course introduces the Mill Cabinet Apprentice to computer-aided design and drafting using AutoCAD, Cabinet Vision, and Alphacam software systems.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- use AutoCAD drawing tools and methods to construct accurate 2D drawings.
- create and manage drawing layers, control object properties, and edit and modify files.
- construct and edit polylines and splines.
- use editing tools and grip editing to modify geometry.
- use inquiry commands to obtain drawing information.

CARPT 283 Introduction to CNC

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Mill Cabinet Apprentice.

This course introduces the Mill Cabinet Apprentice to the operation processes, maintenance, and tooling of Computer Numeric Controlled (CNC) machines.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- use AutoCAD’s precision drawing tools and methods to program CNC machines.
- control, manage, and operate CNC machines.
- construct mill project components.
- use lockout tagout procedures to retool CNC machines.
- use inquiry commands to obtain desired milling.

CARPT 284 Solid Surface Material, Fabrication, and Installation

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.

1.5
Units:
24 hours LEC; 12 hours LAB
None.
Must be a registered Mill Cabinet Apprentice.

This course introduces the Mill Cabinet Apprentice to computer-aided design and drafting using AutoCAD, Cabinet Vision, and Alphacam software systems.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- use AutoCAD drawing tools and methods to construct accurate 2D drawings.
- create and manage drawing layers, control object properties, and edit and modify files.
- construct and edit polylines and splines.
- use editing tools and grip editing to modify geometry.
- use inquiry commands to obtain drawing information.
This course introduces the Mill Cabinet Apprentice to constructing counter tops and back splashes, and finishing products according to industry standards.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify the major solid surface manufacturers and their products.
- successfully fabricate an L-shape solid surface counter top.
- demonstrate the safe use of tools and equipment necessary for constructing solid surface products.
- explain why planning is important in fabricating and installing solid surfaces.
- identify patterns and understand how they are used to transfer vital information.
- successfully repair cabinet surfaces.

CARPT 285 Advanced Project for Mill Cabinet

| Units: | 1.5 |
| Hours: | 24 hours LEC; 12 hours LAB |
| Prerequisite: | None. |

This course introduces the Mill Cabinet Apprentice to advanced cabinetry building procedures per industry standards.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- interpret shop drawings.
- identify material quantities using information contained on plans.
- explain how to lay out a project and the purpose of specifications.
- locate and list information found in project drawings.
- construct and complete an advanced project demonstrating journeymen-level skills.

CARPT 298 Work Experience in Carpenters Apprenticeship

| Units: | 1 - 4 |
| Hours: | 75 - 300 hours LAB |
| Prerequisite: | Indentured in the carpenters apprenticeship program. |

This course provides students the opportunity to work in the carpenters apprenticeship program for the purpose of developing specific skills to meet the goals and objectives of the carpenters Joint Apprenticeship and Training Committee (J.A.T.C.). Students complete work experience hours at approved training sites. Students may take up to 16 units total across all Work Experience course offerings. This course may be repeated when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- demonstrate competencies for effective and competitive workforce performance in carpenters apprenticeship program.
- demonstrate mastery of specific job skills as written in learning objectives under the supervision of the carpenters Joint Apprenticeship and Training Committee (J.A.T.C.).

**Drywall/Lathers (DRLTH)**

**DRLTH 100 Introduction to the Trade**

<table>
<thead>
<tr>
<th>Units:</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>36 hours LEC</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Drywall/Lathing Apprentice</td>
</tr>
</tbody>
</table>

This course is an introduction to drywall/lathing apprenticeship, state and federal apprenticeship laws, apprenticeship record keeping, apprentice evaluation procedures, general safety, work ethic, sexual harassment issues, and basic tools of the trade.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- identify and interpret federal and state laws governing drywall/lathing apprentices.
- maintain an apprentice work record book.
- identify and avoid unsafe conditions and unsafe acts and observe safety laws and regulations.
- follow written and verbal directions.
- demonstrate proper procedures in administering first aid and CPR.
- describe drywall/lathing related organizations as they apply to the drywall/lathing apprenticeship.

**DRLTH 102 Basic Applications**

<table>
<thead>
<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>21 hours LEC; 18 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Drywall/Lathing Apprentice</td>
</tr>
</tbody>
</table>

This course is an introduction to basic gypsum wall covering and ceiling applications. It also includes taping installations, knot recognition, and application to rigging on construction job sites.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- identify different wall coverings.
- apply various knots to rigging situations.
- demonstrate basic gypsum wallboard coverings methods.
DRLTH 103 Drywall Lathing Trade Safety

Units: 1.5
Hours: 24 hours LEC; 12 hours LAB
Prerequisite: None.
Enrollment Limitation: Must be a registered Drywall-Lathing Apprentice.

This course covers trade safety for drywall lathing apprentices including hospital safety, rough terrain lift truck operation, and first aid and CPR.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list tools, materials, and equipment used in the trade.
- explain proper safety practices when working in hospitals.
- list criteria for contamination from hospital remodels.
- describe secondary infections contracted during hospital stays.
- explain medical emergency recognition.
- define the different illnesses in a medical emergency.
- explain allowable loads for various types of rough terrain lift truck capacities.
- list requirements for equipment inspection.
- demonstrate CPR in a simulated scenario.
- define first aid practices.

DRLTH 105 Mathematics for Drywall/Lathers

Units: 2
Hours: 36 hours LEC
Prerequisite: None.
Enrollment Limitation: Registered Drywall/Lathing Apprentice

This course covers mathematical applications for the drywall and lathing trades. Topics include whole numbers, fractions, decimals, ratios, proportions, percentages, angles and degrees, areas, and volumes.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- apply mathematics such as addition, subtraction, multiplication, and division with whole numbers, decimals, and fractions used in construction projects.
- convert measurement units used on construction job sites.
- calculate perimeter measurements, arc measurements, volume measurements, and weights.
DRLTH 110 Residential Metal Framing

<table>
<thead>
<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC; 27 hours LAB</td>
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<td>Prerequisite:</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Registered Drywall/Lathing Apprentice</td>
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</tbody>
</table>

This course covers basic residential metal framing. It includes framing of floors, walls, doors, windows, roofs, trusses, and stairs.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify and list the uses of appropriate materials in framing.
- build a framed floor.
- build a framed wall with door and window openings.
- build a roof and stair frames.

DRLTH 112 Doors, Windows, Exterior Systems/Building Documents

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Hours:</td>
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<td>Prerequisite:</td>
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<td>Registered Drywall/Lathing Apprentice</td>
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</tbody>
</table>

This course covers the hardware, installation, and framing of doors and windows and exterior wall covering systems. It also covers blueprints and building codes.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify and install door and window frames.
- identify and install various doors.
- identify and install door and window hardware.
- identify, select, and install exterior wall coverings.
- analyze and interpret residential blueprints and relevant building codes.

DRLTH 120 Blueprint Reading I

<table>
<thead>
<tr>
<th>Units:</th>
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<tr>
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<td>Prerequisite:</td>
<td>None.</td>
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</tbody>
</table>
This course covers job specifications, blueprint structure, and basic blueprint reading and interpretation. It also covers construction drawings and sketching.

Upon completion of this course, the student will be able to:

- identify the symbols and terms used in floor, elevation, and detail plans.
- interpret technical information given on schedules and specifications.
- construct building layouts from residential floor plans.
- identify the exterior wall finishes from residential plans.
- identify building codes that relate to plan interpretation.

DRLTH 121 Blueprint Reading II

<table>
<thead>
<tr>
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<tbody>
<tr>
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</table>

This course is a continuation of DRLTH 120. Topics include interpretation, problem solving, correlating specifications, prints, addenda, notes, sections, and mathematics used with blueprints.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- compare graphic (blueprint) information with written (specifications) information.
- identify structure and terminology used with specifications.
- identify and interpret various sections used on blueprints.
- apply calculations derived from details on blueprints.
- identify solutions for different given problems related to blueprint reading.

DRLTH 122 Blueprint Reading III

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<thead>
<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>21 hours LEC; 18 hours LAB</td>
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<td>Prerequisite:</td>
<td>None.</td>
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<td>Enrollment Limitation:</td>
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</table>

This course is a continuation of DRLTH 121. Topics include take-offs, material estimates, material requisition, job costs, and layout from blueprints.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify procedures for blueprint take-offs.
- estimate the quantity of materials needed to construct requested parts of the building.
DRLTH 130 Welding I

Some content that was previously extracted for this page.

- estimate cost of material from given take-offs.
- analyze a set of prints and abstract the information necessary to construct requested sections of the building.

### Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain basic theory in safety and welding techniques used for each welding process.
- demonstrate proper setup and operation of arc welding equipment.
- identify most commonly used welding electrode types and their basic uses.
- produce neat, strong welds on metals using arc welding equipment.
- demonstrate proper setup and operation of oxyacetylene equipment.

### DRLTH 131 Welding II

- 1.5 Units: 21 hours LEC; 18 hours LAB
- None. Prerequisite: Registered Drywall/Lathing Apprentice
- 1.5 Enrollment Limitation: This course is a continuation of DRLTH 130. Topics include safety, concepts, processes, symbols, and certification performance of welding.

### Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the basic theory of safety and welding techniques used for each welding process.
- identify welding polarities and related symbols.
- identify most commonly used welding electrode types and their classifications.
- produce strong welds on metals using shielded metal arc welding (SMAW) and flux core arc welding (FCAW).
- identify and compare SMAW and FCAW job site applications.
DRLTH 140 Exterior/Advanced Fire Control System and Partitions

This course covers safety, principles, theory, and application of advanced fire control systems. Topics include principles and applications of partitions and metal framing.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- interpret the theory and principles of advanced fire control systems.
- identify principles of partitions and metal soffits.
- layout and install different fire-stopping assemblies.
- layout and install different metal stud partitions used as fire control systems.

DRLTH 142 Exterior Systems and Trims

This course covers safety, principles, and application of exterior wall framing, coverings, and trims.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify the principles of exterior wall framing.
- identify the principles of exterior wall coverings and trims.
- measure, cut, and assemble exterior wall coverings for commercial and residential lathing systems.
- measure, cut, and assemble wall coverings for commercial and residential foam systems.
- apply exterior lathing trims for commercial and residential applications.

DRLTH 150 Interior Metal Lathing System, Sound Control

This course covers materials, principles, theory, and application of lath and plaster interior hollow walls and partitions. Topics include principles and application of sound control systems, an introduction to mathematics, and layout for building arches.
Student Learning Outcomes
Upon completion of this course, the student will be able to:

- interpret and apply the theory, materials, and principles of sound control systems.
- interpret and apply the theory, materials, and principles of lath, plaster hollow, and pre-fabricated walls.
- install interior lath wall coverings.
- describe the principles of solid lath and plaster partitions.
- interpret the principles and mathematics of arches.

DRLTH 160 Ceilings, Shaft Protection and Demountable Partitions

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<td>Enrollment Limitation:</td>
<td>None.</td>
</tr>
</tbody>
</table>

This course covers safety, materials, principles, theory, and installation of ceiling systems, demountable partitions, and shaft systems.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- interpret and apply the theory, materials, and principles of ceiling systems.
- interpret and apply the theory, materials, and principles of shaft systems.
- install a ceiling system per specifications.
- install a shaft system per specifications.
- describe and apply the principles of demountable partitions.

DRLTH 162 Arches, Furring and Advanced Systems

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<tr>
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<td>Enrollment Limitation:</td>
<td>None.</td>
</tr>
</tbody>
</table>

This course covers safety, materials, principles, theory, and installation of furring, arch systems, and fire retardant materials.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- interpret and apply the theory, materials, and principles of furring systems.
- interpret and apply the theory, materials, and principles of arch systems.
- build arch systems to given specifications.
- build lathing and drywall furring systems.
DRLTH 170 Advanced Construction Techniques

1.5
21 hours LEC; 18 hours LAB
None.
Registered Drywall/Lathing Apprentice

This course covers safety, materials, principles, and theory of advanced construction techniques. Topics also include following written and verbal directions, construction directly from blueprints, and research techniques.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe and apply the theory, materials, and principles of advanced construction techniques.
- interpret blueprint information and apply it to construction projects.
- interpret and follow written and verbal directions in drywall and lathing installations.
- install advanced lathing and drywall systems.

DRLTH 298 Work Experience Drywall/Lathing Apprenticeship

1 - 4
75 - 300 hours LAB
None.
Indentured in the drywall/lathing apprenticeship program.

This course provides students the opportunity to work in the drywall/lathing apprenticeship program for the purpose of developing specific skills to meet the goals and objectives of the drywall/lathing Joint Apprenticeship and Training Committee (J.A.T.C.). Students complete work experience hours at approved training sites. Students may take up to 16 units total across all Work Experience course offerings. This course may be repeated when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- demonstrate competencies for effective and competitive workforce performance in drywall/lathing apprenticeship program.
- demonstrate mastery of specific job skills as written in learning objectives under the supervision of the drywall/lathing Joint Apprenticeship and Training Committee (J.A.T.C.).

Electrical Apprenticeship (ELECT)

ELECT 110 Electrical Apprenticeship I

5

Units: select, apply, and install fire retardant materials.
This course is an introduction to electrical apprenticeship, electrical shop practices, basic electrical layout, tools of the trade, and construction materials. Topics include working with electrical related mathematics and basic electrical formulas.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify and avoid unsafe conditions and unsafe acts, and observe safety laws and regulations on construction jobsites
- apply electrical mathematics in fractions, basic trigonometric functions, square roots, Ohm's law, and power formulas
- identify and fabricate stubs, kicks, offsets, and bend saddles using electrical metallic tubing (EMT)
- apply the metric system and metrication conversions
- apply electrical mathematics in calculating resistance, current, voltage, and power in a DC series circuit
- demonstrate basic wiring devices to specified standards
- demonstrate basic operations of motor-operated personnel lifts
- identify basic electrical materials used on construction jobsites
- identify basic motorized hand tools used on jobsites

ELECT 111 Electrical Apprenticeship II

| Units: | 3 |
| Hours: | 36 hours LEC; 70 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Registered Electrical Apprentice |

This course covers DC theory, DC series and parallel circuits, DC combination circuits, principles of electromagnetism, and power generation. Topics include an introduction to the National Electrical Code (NEC) and basic blueprint reading.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- relate voltage, current, resistance, and power functions in DC series, parallel, and combination circuits
- define the principles of magnetism and electromagnetism
- list chapters and basic outline of the NEC
- analyze basic residential blueprints
- demonstrate wiring of loads in series and parallel
- demonstrate proper wiring of 3-way and 4-way switches to control a load
- develop a basic PLC program to control a motor control process
- apply the NEC to calculate cable tray fill
ELECT 120 Electrical Apprenticeship III

This course covers AC theory, AC generation, use of instruments, and phase and circuit calculations. Topics include codeology and how it applies to the National Electrical Code (NEC).

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- analyze and apply electrical mathematics to AC and DC generation and phase calculations
- apply electrical mathematics to inductance, capacitance, and reactance calculations
- analyze effects of reactance in electrical circuits
- demonstrate use of meters to confirm electrical calculations and to troubleshoot AC and DC circuits
- define the basic principles of codeology
- apply codeology principles to locate information in the NEC
- develop a basic PLC program to control a motor control process
- apply the NEC to calculate cable tray fill

ELECT 121 Electrical Apprenticeship IV

This course covers AC theory in series, parallel, and combination resistive-inductive (RL), resistive-capacitive (RC), inductive-capacitive (LC), and resistive-inductive-capacitive (RLC) circuits. Topics include conduit bending using a ratcheting and mechanical bender, transformer construction and installation, and applications of the National Electrical Code (NEC).

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- demonstrate proper conduit bends using a ratcheting and mechanical bender
- analyze residential and commercial blueprints and specifications
- analyze and identify transformer connections and installations
- analyze, identify, and evaluate electrical mathematics in RL, RC, LC, and RLC series, parallel, and combination circuits
- apply codeology principles to locate information in the NEC
- apply codeology principles to locate information in the NEC
- develop a basic PLC program to control a motor control process
ELECT 130 Electrical Apprenticeship V

Units: 3
Hours: 36 hours LEC; 70 hours LAB
Prerequisite: None.
Enrollment Limitation: Registered Electrical Apprentice

This course covers electrical safety-related work practices specified by the National Fire Protection Agency publication 70E (NFPA 70E). It covers industrial blueprint reading, conduit bending using electro-hydraulic benders, and introductions to motor control and semiconductors. Additional topics include applying the National Electrical Code (NEC) with emphasis on grounding and bonding.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe and apply the requirements of Occupational Safety and Health Administration (OSHA) and NFPA 70E work practices
- analyze and apply Kirchhoff's laws and power factor correction calculations
- demonstrate proper procedure for bending conduit using an electro-hydraulic bender
- analyze industrial blueprints, specifications, schedules, and details
- draw a basic 8-pin and 11-pin relay wiring layout and properly wire it in a simple motor control circuit
- describe how a simple semiconductor operates
- describe how transistors, zener diodes, silicon controlled rectifiers (SCR), triacs, diacs, and amplifiers function
- apply the NEC to grounding and bonding of electrical systems

ELECT 131 Electrical Apprenticeship VI

Units: 3.30
Hours: 36 hours LEC; 70 hours LAB
Prerequisite: None.
Enrollment Limitation: Registered Electrical Apprentice

This course covers advanced grounding topics, transformer operation and theory, and advanced industrial blueprint reading. Topics include applying the National Electrical Code (NEC) and emphasis of over-current protection, transformers and ground fault protection.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- Identify grounding system components
- Describe ground fault or short circuit conditions and implications
- Identify requirements for grounding separately derived systems
- Demonstrate proper procedures for earth testing
- Demonstrate proper terminations of a three-phase transformer
- Apply NEC tables to calculate over-current protection
- Demonstrate proper layout of an electrical room using blueprints, specifications, and the NEC
- Demonstrate an exothermic weld for a grounding system

ELECT 140 Electrical Apprenticeship VII

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Hours: 36 hours LEC; 70 hours LAB</td>
</tr>
<tr>
<td>Prerequisite: Registered Electrical Apprentice</td>
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</tbody>
</table>

This course covers lightning protection systems, AC and DC motors, motor control systems. Topics include advanced blueprints and electrical room layout, as well as building take-offs.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Identify different components of lightning protection systems
- Define principles of basic AC and DC motor theory
- Demonstrate proper three-phase motor termination
- Demonstrate proper wiring of 8-pin and 11-pin relay bases
- Analyze motor control diagrams
- Demonstrate proper wiring of motor control systems
- Analyze a complete electrical room layout based on blueprints
- Demonstrate a building take-off based on a set of blueprints

ELECT 141 Electrical Apprenticeship VIII

<table>
<thead>
<tr>
<th>Units: 3</th>
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<tbody>
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<td>Hours: 36 hours LEC; 70 hours LAB</td>
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<tr>
<td>Prerequisite: Registered Electrical Apprentice</td>
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</tbody>
</table>

This course covers AC motor speed controls, National Electrical Manufacturing Association (NEMA) standards, motor control troubleshooting, digital electronics, and programmable logic controllers (PLCs). Topics include use of the National Electrical Code (NEC) with cable trays, electric welders, phase converters, hazardous locations, and special occupancies.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe different components of a variable frequency drive (VFD)
- demonstrate proper wiring and basic programming of VFDs
• apply NEMA standards for sizing motor starters and controllers
• demonstrate proper troubleshooting techniques of motor control circuits
• describe the components of PLCs
• demonstrate proper wiring of PLCs
• develop a basic PLC program to control a motor control process
• apply the NEC to calculate cable tray fill

ELECT 150 Electrical Apprenticeship IX

<table>
<thead>
<tr>
<th>Units:</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>36 hours LEC; 70 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Electrical Apprentice</td>
</tr>
</tbody>
</table>

This course covers fire alarms, security, power quality, stewardship training, and photo-voltaic systems. It also includes preparation for the California Electrician Certification examination.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• identify the functions and parts of a fire alarm system
• explain the difference between a Class A and a Class B fire alarm circuit
• identify different types of smoke and heat detectors and signaling devices
• identify common power quality issues
• interpret data received from a Fluke 43B power quality analyzer
• identify the functions and parts of a security system
• describe functions, components, and installation methods of a typical residential photo-voltaic system
• interpret the National Electrical Code (NEC) and its use for state certification

ELECT 151 Electrical Apprenticeship X

<table>
<thead>
<tr>
<th>Units:</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>36 hours LEC; 70 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Electrical Apprentice</td>
</tr>
</tbody>
</table>

This course covers building automation, structured cabling systems, and an introduction to instrumentation used on industrial process controls. It also covers advanced programmable logic controllers (PLCs) used in motor control circuits.

Student Learning Outcomes
Upon completion of this course, the student will be able to:
• describe a building control network

• describe the physical components which make up a LonWorks network

• define terms associated with structured telecommunications wiring systems

• identify the elements of a structured telecommunications system

• define terms associated with instrumentation used in industrial process controls

• explain the benefits of the National Electrical Benefit Fund (NEBF)

• describe different methods of effective and ineffective leadership styles used on jobsites

• describe different models of effective and ineffective communications styles used on jobsites

ELECT 281 Green Technology High Efficiency Lighting

| Units: 2 |
| Hours: 27 hours LEC; 27 hours LAB |
| Prerequisite: None. |
| Enrollment Limitation: Must be a current California State Certified General Electrician. |

This course covers installing, troubleshooting, commissioning and maintaining advanced lighting controls, switching controls, dimming controls, occupancy sensors, photo-sensors and controllers, distribution relay systems, remote controlled circuit breakers, and wireless systems. Pass/No Pass only.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• install green technology lighting controls.

• commission green technology lighting controls.

• maintain and troubleshoot green technology high efficiency lighting controls.

• define and describe the green technology high efficiency light control systems used for energy management.

• identify the components of advanced lighting systems and use of their schematics.

• summarize the energy efficiency legislation that mandates the use of lighting controls.

• identify the energy savings potential of lighting controls.

• identify the appropriate applications for using lighting controls.

ELECT 298 Work Experience in Electricians Apprenticeship

| Units: 1 - 4 |
| Hours: 75 - 300 hours LAB |
| Prerequisite: Indentured in the electricians apprenticeship program. |
| Enrollment Limitation: AA/AS Area III(b) |
| General Education: AA/AS Area III(b) |

This course provides students the opportunity to work in the electricians apprenticeship program for the purpose of developing specific skills to meet the
goals and objectives of the electricians Joint Apprenticeship and Training Committee (J.A.T.C.). Students complete work experience hours at approved training sites. Students may take up to 16 units total across all Work Experience course offerings. This course may be repeated when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- demonstrate competencies for effective and competitive workforce performance in electricians apprenticeship program.
- demonstrate mastery of specific job skills as written in learning objectives under the supervision of the electricians Joint Apprenticeship and Training Committee (J.A.T.C.).

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**Electrical Residential Apprenticeship (ELRES)**

**Electrical Sound and Communication (ELSC)**

**Electrician Trainee (ELTRN)**

**ELTRN 110 Electrician Trainee I**

<table>
<thead>
<tr>
<th>Units:</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>63 hours LEC; 27 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>MATH 100, 104, or 132 with a grade of “C” or better</td>
</tr>
</tbody>
</table>

This course is an introduction to the Commercial/Residential Electrician Trainee Program. It includes safety procedures, Occupational Safety and Health Administration (OSHA) requirements, Environmental Protection Agency (EPA) requirements, basic rigging, basic electrical mathematics, Ohm’s Law, Direct Current (DC) theory, and construction related CPR and First Aid. This course meets the State of California requirement to obtain an electrician trainee license. This course was previously known as ELECT 210.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- analyze and avoid unsafe conditions and unsafe acts, and observe safety laws and regulations.
- explain the purpose of and demonstrate the safe use and care of both hand and power tools and equipment.
- define the more commonly used hand tools.
- demonstrate CPR and First Aid on adults for use on construction job sites.
- calculate electrical mathematics problems with fractions, basic trigonometric functions, Ohm’s Law, square roots, and power formulas.
- apply electrical mathematics in calculating resistance, current, and voltage in DC series, parallel, and combination circuits.
- integrate the metric system and metrification changes.

**ELTRN 111 Electrician Trainee II**

| Units:   | 4 |

| Hours: | None. |
| Prerequisite: | |
This course covers Alternating Current (AC) theory, including AC and Direct Current (DC) generation, phase, and circuit mathematical calculations. It also covers the use of meters in different applications of alternating current, and provides a basic introduction to electronics and application of the National Electrical Code (NEC) to jobsite electrical installations. This course meets the State of California requirement to obtain an electrician trainee license. This course was formerly known as ELECT 211.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- calculate voltage, current, resistance, and power in AC and DC generators and phase calculations.
- apply electrical mathematics in inductance, resistance, and capacitance calculations.
- apply electrical mathematics in calculating inductive and capacitive reactance in series, parallel, and series-parallel circuits.
- apply the principles of magnetism and electromagnetism to circuits.
- define functions, operations, and characteristics of different solid state components.
- identify and apply National Electrical Codes to job-site electrical installations.

ELTRN 120 Electrician Trainee III

This is the third course of the Commercial/Residential Electrician Trainee Program. Topics include conductors, cables, conduits, lighting systems, panelboard, switchboard, and overcurrent devices for residential and commercial installations. This course also covers reading blueprint drawings, making sketches, drawing architectural views, and identifying common blueprint scales and electrical symbols. This course as formerly known as ELECT 220.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list different types of conductors and insulators with basic application for each type.
- identify different wiring methods for conductors, cables, and conduits.
- calculate wire size based on the National Electrical Code (NEC) ampacity tables for given installations.
- identify conductor and cable fault types and causes.
- apply NEC requirements for selecting conduits.
- demonstrate procedures for fabricating conduit bends with hand benders and power benders.
- list the functions, operations, and characteristics of various lighting systems.
- list the functions, operations, and characteristics of overcurrent devices.
- list the functions, operations, and characteristics of panelboards and switchboards.
- recognize symbols for electrical blueprints.
- analyze functions of blueprints, specifications, schedules, addenda, and revisions in construction.
ELTRN 121 Electrician Trainee IV

This is the fourth course required for the Commercial/Residential Electrician Trainee Program. Topics include electrical grounding systems and lightning protection systems. It also includes jobsite personnel development and jobsite management. This course was formerly known as ELECT 221.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain terminology covering electrical grounding systems.
- identify different components of the grounded system.
- identify the different components of the grounding electrode system.
- calculate ground resistance using the fall-of-potential method of testing.
- identify the different components of a lightning protection system.
- list jobsite chain of command and scope of work performed by crafts.
- describe effective communication methods for jobsites.
- prepare basic documentation for jobsites.

ELTRN 130 Electrician Trainee V

This is the fifth course required for the Commercial/Residential Electrician Trainee Program. Topics include fundamentals of motors, motor controllers, process controllers, generators, and transformers. Topics also include testing of cables, generators, and motors. This course meets the State of California requirement to obtain an electrician trainee license. This course was formerly known as ELECT 230.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe the function, operation, and characteristics of various types of motors.
- describe the physical parts of most common motors.
- utilize the information on nameplates for the proper installation and operation of motors.
- demonstrate proper termination of single- and three-phase squirrel cage motors.
- describe the function, operation, and characteristics of motor controllers, circuits, and devices.
- describe the function, operation, and characteristics of motor switches and relays.
- demonstrate proper wiring of various motor control circuits.
• identify the function, operation, and characteristics of basic process control systems.

• describe the function, operation, and characteristics of Alternating Current (AC) and Direct Current (DC) generators.

• describe the function, operation, and characteristics of transformers.

• select a proper transformer depending on voltage, current, and power requirements.

• describe steps for various testing processes of cables, generators, and motors.

ELTRN 131 Electrician Trainee VI

4 Units:
63 hours LEC; 27 hours LAB
ELTRN 110 and 111 with grades of ‘C’ or better

This is the sixth course required for the Commercial/Residential Electrician Trainee Program. Topics include fire alarm systems, burglar alarm systems, and information transport systems (ITS). This course also covers basic electrical requirements for heating, air conditioning, and refrigeration systems. It meets the State of California requirement to obtain an electrician trainee license. This course was formerly known as ELECT 231.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• describe the function, operation, and characteristics of a fire alarm system and the individual components of the system.

• identify code requirements for fire alarm systems.

• select fire alarm cable and wiring method for various different jobsite conditions.

• demonstrate proper wiring of a basic fire alarm system.

• describe the function, operation, and characteristics of a burglar alarm system and individual components of the system.

• demonstrate proper wiring of a basic burglar alarm system.

• identify code requirements for burglar alarm systems.

• describe the function, operation, and characteristics of different information transport systems (ITS-voice, data, and video applications).

• demonstrate proper termination of various ITS connectors per industry standards.

• demonstrate proper installation techniques and termination procedure of fiber optic used in data communications.

• identify basic components of a heating, air conditioning, and refrigeration system.

ELTRN 180 Electrical Workers State Certification Preparation

4.5 Units:
81 hours LEC

None.

Completion of ELTRN 110 and 111.

This is a preparatory course for the Electricians' State Licensing Certification for California. It reviews basic electrical formulas and provides an in-depth review of the National Electrical Code (NEC) and safety. This course was formerly known as ELECT 280.
Iron Workers (IW)

IW 100 Orientation and History of the Trade

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- analyze the NEC for the State of California as it pertains to licensure.
- apply code requirements to installations and testing procedures.
- identify and describe code terminology.
- identify and correct code infractions.

Iron Workers (IW)

IW 101 OSHA 30 for Ironworkers

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- research the historical evolution of legislative laws responsible for the creation and maintenance of safe and healthful working environments.
- employ construction safety standards prescribed by OSHA and apply safe working practices and procedures relevant to iron work.
- discuss the reinforcing iron principle.
- describe the architectural and ornamental components of ironwork.
- discuss a broader understanding of Green Construction techniques.
- discuss honesty, integrity, and basic responsibilities.
- identify structural steel components of ironwork.
- demonstrate welding and burning techniques.
- discuss the history of the Ironworker trade.
- show various rigging methods.
This course provides the ironworker apprentice safety standards and regulations for construction project sites as required by the Occupational Safety and Health Administration (OSHA). Topics include general safety and health provisions, OSHA citation policies, fire protection and prevention, fall protection, personal protection equipment (PPE), safe handling and storage of materials, steel erection, and lifesaving practices and equipment.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- identify OSHA standards on the jobsite.
- use personal protection equipment properly.
- perform basic first aid and life saving procedures.
- perform proper fire protection and prevention practices.
- use cranes, hoists, elevators and conveyors safely.
- apply steel erection safety practices.

**IW 110 Mixed Base**

<table>
<thead>
<tr>
<th>Units:</th>
<th>1.5</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC; 27 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Ironworkers Apprentice</td>
</tr>
</tbody>
</table>

This course provides an overview of the type of construction blueprints commonly used with emphasis on function and interpretation. It offers a brief review of basic math skills and provides an opportunity to apply these skills in solving typical problems relevant to the Ironworker trade.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- demonstrate facility, accuracy, and speed in adding, subtracting, multiplying, and dividing whole numbers, fractions, and decimals.
- convert a fraction, a decimal, or a percent to either of the other two forms.
- solve typical problems of the construction trade with the appropriate mathematics.
- read linear measurements accurately with a fractional ruler, a decimal ruler, a metric ruler, and a micrometer.
- read measuring tools calibrated in the metric system and demonstrate the ability to convert between traditional and metric units.
- use blueprints and construction drawings to interpret the various types of drawings used in the Ironworker trade.

**IW 120 Rigging**

<table>
<thead>
<tr>
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<tr>
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</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Ironworkers Apprentice</td>
</tr>
</tbody>
</table>
This course introduces rigging applications such as wire rope, chains, slings, cranes, helicopters, ladders, and scaffolds. It also includes rigging safety, knot recognition and strength identification, and knot applications within rigging.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- identify, describe, and tie knots that are most widely used in the Ironworkers' trade.
- describe the various fibers used in making lines and identify characteristics of each.
- define common terms and identify parts and structure of various types of fiber lines and steel cables.
- demonstrate the proper use, care, preparation, and handling of fiber lines and steel cables.
- apply formulas and charts that determine the proper use, care, and selection of steel cable and fiber lines and their accessories.
- demonstrate the use of the various combinations of block and tackles, their components, and compute their mechanical advantage.
- identify various hoisting devices, their anchorage, and principal parts.
- apply common rigging techniques for scaffolds, ladders, and working supports.
- demonstrate the standard hand signals used in rigging.

IW 130 Reinforcing I

| Units: | 1.5 |
| Hours: | 18 hours LEC, 27 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Registered Ironworkers Apprentice |

This course introduces standard codes, code classifications, plans, schedules, charts, and specifications commonly used by Ironworkers. Topics include construction techniques used in reinforcing concrete members with steel, use of bar supports, placement of reinforcing iron, and general principles of bar splicing and welding. Post-tensioning and pre-stressing techniques are also introduced.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- use reinforcing concrete construction methods on foundations, floors, and roofs.
- identify the placement of reinforcing steel.
- use hand tools for the bending and shearing of reinforcing rods.
- tie reinforcing rods and calculate the proper spacing.
- research the placement of reinforcement rods in foundations, footings, floors, and roofs.
- identify bar sizes by color code and other structural symbols.
- demonstrate the unloading, handling, and storage of reinforcing bars.

IW 131 Reinforcing II/Post Tensioning

| Units: | 1.5 |
This course expands the interpretation of standard codes, code classifications, plans, schedules, charts, and specifications commonly used in the Ironworker trade. Construction techniques, use of bar supports, placement of reinforcing iron, general principles of bar splicing, and welding are presented in depth.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- discuss pre-stressing applications as they relate to structural members.
- identify appropriate materials necessary for post-tensioning systems.
- determine the use of bar supports and placement of reinforcing iron in building structures.
- differentiate wire, bar, and bonded tendons.
- demonstrate the special applications of post-tensioning systems.
- identify types of protective coatings for barrier cables.
- explain blueprint and other drawings related to post-tension.

IW 140 Precast Concrete and Metal Buildings

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list equipment commonly used in erecting precast concrete members and metal buildings and cite the advantages and disadvantages of each.
- define rigging arrangements, lifting devices, and picking points commonly used in hoisting precast concrete members into a structure.
- identify the five structure erection blueprint layouts used for the installation of precast concrete members.
- select appropriate equipment and handling procedures for hoisting precast concrete members and metal buildings.
- demonstrate correct safety procedures for transporting, unloading, and erecting precast concrete and metal buildings.
- demonstrate the use of shimming, bearing pads, temporary shoring, bracing, guying, and various leveling techniques.
- illustrate three groups of tolerances and the role of each to which precast concrete and metal buildings must conform.
- describe appropriate joint design and proper clearance plays in preset concrete installations.
- explain the importance of protecting precast concrete items from stain and damage during and after structural erection.
- discuss the history of metal roofing.
- assemble secondary framing systems.
• troubleshoot scaffold safety.

IW 150 Welding I

<table>
<thead>
<tr>
<th>Units:</th>
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<tr>
<td>Hours:</td>
<td>18 hours LEC, 27 hours LAB</td>
</tr>
</tbody>
</table>

Prerequisite: Registered Ironworkers Apprentice

This course introduces the structure of ferrous metals and their reaction to heat. It covers the equipment and materials used for shielded metal-arc welding including safety hazards, charts, key terms, electrodes, and welding current controls.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• describe and demonstrate the oxy-fuel cutting process.

• identify and mitigate potential safety hazards.

• select proper electrodes for a job.

• set up primary variables for successful welding.

• describe carbon arc gouging (CAC).

• define key electrical terms.

• define terms related to voltage, including constant, variable, voltage drop, open-circuit, arc voltage, and polarity.

• demonstrate the proper use of welding equipment and machines.

IW 151 Welding II

<table>
<thead>
<tr>
<th>Units:</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC, 27 hours LAB</td>
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</tbody>
</table>

Prerequisite: IW 150 with a grade of "C" or better

Enrollment Limitation: Registered Ironworkers Apprentice

This course continues the study of ferrous metals and their reactions to heat. Equipment and materials employed in the use of shielded metal-arc and gas shielded-arc are included in this course.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• demonstrate the arc welding process.

• describe the safety precautions for arc welding.

• identify weld symbols and special processes.

• differentiate between various flux core arc welding (FCAW) power source machines.

• set up the equipment for FCAW.
- troubleshoot FCAW problems.
- identify the characteristics of self-shielded flux core arc welding (FCAW-SS) electrodes.

**IW 152 Welding III**

<table>
<thead>
<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC; 27 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>IW 151 with a grade of &quot;C&quot; or better</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Ironworkers Apprentice</td>
</tr>
</tbody>
</table>

This course focuses on skill development in shielded metal arc and flux core arc welding on ferrous and non-ferrous metals. Vertical and overhead positions on all types of joints as they relate to structural stability are also covered.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- apply fusion-weld techniques to heavy gauge ferrous metals using low hydrogen electrodes and flux core wire electrodes.
- demonstrate the root and face bend welding test to American Welding Society standards.
- illustrate basic joint design and weld metallurgy.
- identify the uses and applications of ferrous and non-ferrous metals.
- select the proper procedure for the application of special metal techniques.

**IW 160 Lead Hazard**

<table>
<thead>
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<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC; 27 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Ironworkers apprentice.</td>
</tr>
</tbody>
</table>

This course describes the health effects caused by lead exposure. Topics include the Occupational Safety and Health Administration (OSHA) regulations, sampling methods, legal rights of workers, and the use of proper protective equipment and work methods.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- discuss the history of the use of lead, the modern day uses of lead, and the exposure risks to lead.
- describe how lead enters the body, as well as the short and long term health effects associated with lead exposure.
- identify government agencies that regulate occupational exposure to lead as well as the regulations written to protect workers.
- show the methods which can be used to allow identification of lead coatings on the job.
- explain the requirements under the hazard communication program; how to read, interpret, and use a material data safety sheet as well as basic labeling systems.
- discuss the laws that protect workers.
- identify protective equipment that is commonly worn on steel structure jobs where lead is present.
- demonstrate typical work methods to avoid or prevent lead exposure associated with steel structures, bridges, and demolition activities.
- identify factors on the job site that directly affect safety.
- recognize legal responsibilities in working with products containing lead.
- describe required respiratory protection and the corresponding protection factors.

**IW 170 Structural I**

| Units: | 1.5 |
| Hours: | 18 hours LEC; 27 hours LAB |
| Prerequisite: | None |
| Enrollment Limitation: | Registered Ironworkers Apprentice |

This course covers the theory and practice of blueprint reading, structural erection procedures, and proper steel structure construction.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- list various performance processes related to structural steel construction.
- discuss recommended building procedures related to structure steel construction.
- describe procedures for receiving and storing construction materials.
- explain blueprint and other drawings related to structural steel.
- identify open-web, long-span, and non-standard steel joists.
- perform job hazard analyses and describe procedures of safety meetings.

**IW 171 Structural II**

| Units: | 1.5 |
| Hours: | 18 hours LEC; 27 hours LAB |
| Prerequisite: | IW 170 with a grade of "C" or better |

This course addresses the theory and practice of blueprint reading related to structure construction. Structural erection procedures including the operation of mobile and tower cranes and proper construction of various steel structures are presented.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- describe the performance of various processes related to structural steel.
- demonstrate the recommended building procedures in structural steel construction.
- demonstrate the proper way to receive and store construction materials.
- describe the evolution and history of early cranes.
- define proper use and application of mobile and tower cranes in relation to structural steel construction.
• identify quadrants of crane operation.

• explain the requirements for working near power lines.

• demonstrate signaling procedures with tower, mobile, and telescoping cranes.

IW 180 Architectural/Ornamental I

<table>
<thead>
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<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC, 27 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Registered Ironworkers Apprentice</td>
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</tbody>
</table>

This course covers the procedures and practices employed by the Ironworker in architectural and ornamental iron-working. Topics include tools, anchors, fasteners, and various layout instruments. Additionally, constructing curtain wall systems, applying sealants, and glazing systems are covered.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• identify different types of hand tools, powder actuated tools, anchors, and fasteners.

• recognize various types of sealants and glazings.

• name the various types of layout equipment.

• construct a curtain wall.

• construct a window wall.

• install anchors and fasteners.

• prepare joints and apply various types of sealants and glazings.

• identify types of fence and guard rails.

• identify detention systems and install detention frames, doors, and hardware.

• review procedures for storefronts and entryways.

IW 183 The History of Ironworkers

<table>
<thead>
<tr>
<th>Units:</th>
<th>2.5</th>
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</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>45 hours LEC</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Ironworkers Apprentice</td>
</tr>
</tbody>
</table>

This course covers the history of iron-working and the Ironworker Union movement from its birth in 1896 to the present.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• list the key events leading up to and including the inception of the Ironworker Union.

• explain key events in the life of the Ironworker Union from its birth to the present time.
• describe the Union's influence going into the 21st century.

• describe the impact of World War II on the Ironworker Union.

IW 186 Architectural/Ornamental II

<table>
<thead>
<tr>
<th>Units:</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC; 27 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>IW 180 with a grade of &quot;C&quot; or better</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Ironworkers Apprentice</td>
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</tbody>
</table>

This course is a continuation of IW 180 and provides detailed information on knowledge, procedures, and practices employed by the ironworker in architectural and ornamental iron working. Topics include tools, anchors, fasteners, and various layout instruments. Additionally, constructing curtain wall systems, applying sealants, and glazing systems are covered. This course is not open to students who have taken IW 181.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• identify different types of hand tools, powder actuated tools, anchors, and fasteners.

• recognize various types of sealants and glazings.

• name the various types of layout equipment.

• construct a curtain wall.

• build an on-site test chamber to measure air and water infiltration of window and curtain wall systems.

• install anchors and fasteners.

• prepare joints and apply various types of sealants and glazings.

IW 298 Work Experience in Ironworkers Apprenticeship

<table>
<thead>
<tr>
<th>Units:</th>
<th>1 - 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>75 - 300 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
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<td>Enrollment Limitation:</td>
<td>Indentured in the ironworkers apprenticeship program.</td>
</tr>
<tr>
<td>General Education:</td>
<td>AA/AS Area III(b)</td>
</tr>
</tbody>
</table>

This course provides students the opportunity to work in the ironworkers apprenticeship program for the purpose of developing specific skills to meet the goals and objectives of the ironworkers Joint Apprenticeship and Training Committee (J.A.T.C.). Students complete work experience hours at approved training sites. Students may take up to 16 units total across all Work Experience course offerings. This course may be repeated when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• demonstrate competencies for effective and competitive workforce performance in ironworkers apprenticeship program.

• demonstrate mastery of specific job skills as written in learning objectives under the supervision of the ironworkers Joint Apprenticeship and Training Committee (J.A.T.C.).
Operating Engineers Apprenticeship (OE3)

OE3 101 Introduction to Operators

| Units:    | 8 |
| Hours:    | 120 hours LEC; 72 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Registered Operating Engineer Apprentice. |

This course introduces the skills and knowledge required to be a Construction Equipment Operator in the Operating Engineers Apprenticeship. Topics include an introduction to grade checking and the operation of a compactor, dozer, scraper, and backhoe.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- analyze and avoid unsafe conditions and acts while observing safety laws and regulations.
- demonstrate basic grade-setting skills.
- describe the starting and stopping procedures for a loader, bulldozer, scraper, and backhoe per manufacturers' recommendations.
- demonstrate the proper operation of equipment such as a loader, bulldozer, scraper, and backhoe per manufacturers' recommendations.
- recognize the hazards of underground construction in a typical construction job site.
- demonstrate the proper hand signals used on job sites with heavy equipment.

OE3 102 Introduction to Heavy Duty Repair

| Units:    | 8 |
| Hours:    | 120 hours LEC; 72 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Registered Operating Engineer Apprentice. |

This course is an introduction to the Heavy Equipment Operator in the Operating Engineers Apprenticeship. Topics include an introduction to electrical, pneumatic, hydraulic, and power train systems for heavy duty construction equipment. Additional topics include engines and safety.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- apply safety laws and regulations by analyzing and avoiding unsafe conditions and unsafe acts.
- solve electrical mathematical problems with Ohm's Law and power formulas.
- demonstrate basic skills in problem-solving as they apply to electrical system repair.
- describe the principles of hydraulics and pneumatics in heavy equipment.
- identify components of diesel engines used in common heavy equipment.
- identify components of power trains used in common heavy equipment.
- describe safety procedures for the setup, starting and stopping of oxyacetylene equipment.
• describe safety procedures when using shielded metal arc welding (SMAW).

OE3 103 Introduction to Crane Operators

<table>
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<tr>
<th>Units:</th>
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</thead>
<tbody>
<tr>
<td>Hours:</td>
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<tr>
<td>Enrollment Limitation:</td>
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</tr>
</tbody>
</table>

This course introduces the skills and knowledge to be a Crane Operator in the Operating Engineers Apprenticeship. Topics include rigging, crane operations, lubrication, booms, loading, and safety regulations.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• analyze and avoid unsafe conditions and acts while observing safety laws and regulations.

• demonstrate proper use of load charts with crane operations.

• explain the initial proper configuration of a crane.

• explain the proper procedures for load control and tag lines.

• explain the regulations governing cranes.

• demonstrate various hand signals used on job sites with cranes.

• explain the pre-operational steps with inspections and maintenance.

OE3 104 Introduction to Grade Setter

<table>
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<th>Units:</th>
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</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>120 hours LEC; 72 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Registered Operating Engineer Apprentice</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>None</td>
</tr>
</tbody>
</table>

This course introduces the skills and knowledge to be a Grade Setter in the Operating Engineers Apprenticeship. Topics include an introduction to grade checking and the operations of compactors, bulldozers, scrapers, and loaders.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• analyze and avoid unsafe conditions and acts while observing safety laws and regulations.

• demonstrate basic grade-setting skills.

• describe the starting and stopping procedures for a loader, bulldozer, scraper, and backhoe per manufacturers' recommendations.

• demonstrate the proper operation of equipment such as a loader, bulldozer, scraper, and backhoe per manufacturers' recommendations.

• recognize the hazards of underground construction in a typical construction job site.

• demonstrate the proper hand signals used on job sites with heavy equipment.
OE3 110 Introduction to Dredge Operation

This course introduces dredge operations. Topics include principles of dredging, water safety, knot tying, hand signals, and crane operations for dredging operations.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- summarize the principles of dredging.
- demonstrate the safe operation of a dredge per manufacturers' recommendations.
- calculate the load requirements for a crane operating with a dredge platform using load charts.
- recognize proper water safety procedures for given dredge platform.
- apply different hand signals used in dredge operations.

OE3 112 Seamanship I

This course covers seamanship as it is required for dredge operations. Topics include boat handling, use of nautical charts, piloting, signaling, buoy safety, and general water safety requirements for dredge operations.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe the hazards of weather, wind, waves, currents, tides and tidal currents, and how to deal with them.
- demonstrate the proper procedures to operate a vessel for dredging operations.
- use a nautical chart to locate a navigational course.
- identify buoy markers and their application for navigational purposes.
- demonstrate the different sound signals used in vessel operations.
This course is a continuation of OE3 112. Advanced topics include marine rescue, lifeboat seamanship, dredging material handling, shipboard fire suppression, and shore operations.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe the hazards of weather, wind, waves, currents, tides and tidal currents, and how to deal with them during rescue operations.
- explain the proper marine rescue methods during given scenarios.
- demonstrate the proper method to operate a lifeboat during rescue efforts.
- demonstrate the proper handling of shipboard fire suppression equipment.
- explain the proper management of dredge material in order to comply with federal and local code and regulations requirements.

OE3 120 Plant Operations

Units: 3
Hours: 41 hours LEC; 39 hours LAB
Prerequisite: OE3 112 with a grade of "C" or better
Enrollment Limitation: Registered Operating Engineer Apprentice.

This course covers the operation, maintenance, and troubleshooting of batch, crushing, screening, and washing plants in the construction industry. Topics include maintenance procedures, erecting and dismantling, and types of materials.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain plant safety requirements.
- list different materials commonly processed in batch plants.
- describe the operation of batch plants.
- demonstrate the proper procedures for lubricating and maintaining a batch plant.
- demonstrate the proper troubleshooting techniques used in a crushing plant.

OE3 121 Welding and Cutting

Units: 3
Hours: 41 hours LEC; 39 hours LAB
Prerequisite: None.
Enrollment Limitation: Registered Operating Engineer Apprentice.

This course covers welding and oxyacetylene used in batch, crushing, screening, and washing application plants. Topics include shop safety practices, proper selection of welding equipment, use of oxyacetylene equipment, and proper welding techniques.
Student Learning Outcomes
Upon completion of this course, the student will be able to:

- demonstrate proper safety procedures with each given welding and oxyacetylene equipment.
- operate a cutting torch per manufacturer specifications.
- demonstrate the correct technique to operate an electric arc welding machine per manufacturer specifications.
- explain the techniques and methods used as a process for Shielded Metal Arc Welding (SMAW).
- explain the techniques and methods used as a process for Flux-Cored Arc Welding (FCAW).
- repair typical equipment used in plant operations by welding.

OE3 130 Backhoe & Excavator Operations

| Units: | 3 |
| Hours: | 41 hours LEC; 39 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Registered Operating Engineer Apprentice |

This course covers the safe operation of a backhoe and/or excavator. Topics include trenching safety, hazards of underground construction, sloping, grade checking, and excavation for a manhole.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the proper safety procedures to setup a backhoe and/or excavator.
- demonstrate the proper grade checking for elevation purposes.
- demonstrate the correct technique to operate a backhoe and/or excavator.
- slope a trench according to OSHA requirements.
- identify the controls for the operation of a backhoe and/or excavator.

OE3 131 Grade Checking

| Units: | 3 |
| Hours: | 41 hours LEC; 39 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Registered Operating Engineer Apprentice |

This course covers grade checking for the construction equipment operator. Topics include grade setting terminology, stake marking, laser levelers, street section grading, Global Positioning System (GPS) devices, plan reading, metric conversions, and locating underground infrastructure.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the terminology used in grade checking.
- demonstrate the proper grade checking for elevation purposes.
• setup a laser level to establish cut or fill.
• explain stake markings and terminology.
• prepare the layout of a pad with given grade stakes and blueprints.

OE3 132 Scrapers

| Units: | 3 |
| Hours: | 41 hours LEC; 39 hours LAB |
| Prerequisite: | None |
| Enrollment Limitation: | Registered Operating Engineer Apprentice |

This course covers the operation of a scraper. Topics include equipment safety, grading, dumping and spreading, grade checking, and operation with a scraper.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• demonstrate proper safety procedures to operate a scraper.
• demonstrate the proper grade checking for elevation purposes.
• demonstrate the correct technique to dumping and spreading with a scraper.
• demonstrate the ejector, apron, and cutting edge of a scraper.
• identify the controls for the operation of a scraper.

OE3 133 Loaders

| Units: | 3 |
| Hours: | 41 hours LEC; 39 hours LAB |
| Prerequisite: | None |
| Enrollment Limitation: | Registered Operating Engineer Apprentice |

This course covers the safe operation of a loader. Topics include equipment safety, loading, transporting, stockpiling, and hand signals.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• explain the proper safety procedures to operate a loader.
• demonstrate the proper load balancing for a loader.
• demonstrate proper loading and hauling techniques of a loader.
• demonstrate the correct usage of hand signals for loaders.
• identify the controls for the operation of a loader.
OE3 134 Motor Grader
This course covers the operation of a motor grader. Topics include equipment safety, grading, mixing, compaction density, grade checking, and v-ditching.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the proper safety procedures to operate a motor grader.
- demonstrate the proper grade checking for elevation purposes.
- demonstrate the correct technique to mixing with required compaction density with a motor grader.
- demonstrate the operation of a global positioning system (GPS) with a motor grader.
- identify the controls for the operation of the motor grader.

OE3 135 Dozers
This course covers the operation of dozers. Topics include equipment safety, cutting, spreading, and grade checking.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain the proper safety procedures to operate a dozer.
- demonstrate the proper grade checking for elevation purposes.
- demonstrate the correct technique to cutting and spreading with a dozer.
- demonstrate the operation of a global positioning system (GPS) with the dozer.
- identify the controls for the operation of a dozer.

OE3 136 Directional Drilling
This course covers the operation, maintenance, and troubleshooting of directional boring machines. Topics include safety, tracker control, maintenance, and drilling fluids.
Student Learning Outcomes
Upon completion of this course, the student will be able to:

- explain directional drilling safety requirements.
- list different components of the tracker controller.
- describe the operation of the tracker control.
- demonstrate the procedures for lubricating and maintaining a directional drilling machine.
- demonstrate the calculations used with directional drilling machines such as hole volume, fluid to soil ratios and other given methods.

OE3 140 Boom Pumps

This course introduces boom pumps, such as those for overhead concrete pumping. Topics include safety, maintenance, components, controls, hand signals, and blockages.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list the various boom pumps with sizes and pumping capabilities.
- demonstrate the safe operation of a boom pump per manufacturers' recommendations.
- calculate the necessary mixes, additives, and slumps for the materials.
- explain potential hazards on a job site.
- apply different hand signals used in boom pumping operations.

OE3 141 Line Pumps

This course introduces line pumps, such as those for ground concrete pumping. Topics include safety, maintenance, components, controls, hand signals, and blockages.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list the various line pumps with sizes and pumping capabilities.
- demonstrate the safe operation of a line pump per manufacturers' recommendations.
- calculate the necessary mixes, additives, and slumps for the materials.
OE3 142 Advanced Boom Pumps

Units: 3
Hours: 41 hours LEC, 39 hours LAB
Prerequisite: OE3 140 with a grade of "C" or better
Enrollment Limitation: Registered Operating Engineer Apprentice.

This course covers advanced boom pumps such as those used for overhead concrete pumping. Topics include advanced safety, preventative maintenance, components, controls, hand signals, blockages, and troubleshooting procedures.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list the various boom pumps with sizes and pumping capabilities.
- demonstrate the safe operation of a boom pump per manufacturers' recommendations.
- calculate the necessary mixes, additives, and slumps for the materials.
- explain potential hazards on a job site.
- apply different hand signals used in boom pumping operations.
- demonstrate the troubleshooting of a boom pump with given schematic drawings.

OE3 143 Advanced Line Pumps

Units: 3
Hours: 41 hours LEC, 39 hours LAB
Prerequisite: OE3 141 with a grade of "C" or better
Enrollment Limitation: Registered Operating Engineer Apprentice.

This course covers advanced line pumps, such as those used for ground concrete pumping. Topics include advanced safety, preventative maintenance, components, controls, hand signals, blockages, and troubleshooting procedures.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- list the various line pumps with sizes and pumping capabilities.
- demonstrate the safe operation of a line pump per manufacturers' recommendations.
- calculate the necessary mixes, additives, and slumps for the materials.
- explain potential hazards on a job site.
- apply different hand signals used in line pumping operations.
- demonstrate the troubleshooting of a line pump with given schematic drawings.
OE3 160 Grade Setting I

Units: 3
Hours: 41 hours LEC; 39 hours LAB
Prerequisite: None.
Enrollment Limitation: Registered Operating Engineer Apprentice

This course introduces the skills and knowledge required to be a grade setter in the Operating Engineer Apprenticeship. Topics include surveying principles, plan reading, global positioning systems (GPS), cut/fill slope staking, street section grading, and pad layout.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- demonstrate the layout of a level pad according to the prints.
- demonstrate the proper grade checking for elevation purposes.
- demonstrate the layout for grading a street section.
- explain the markings on a grade stake for cut and fill markings.
- demonstrate the setup of a GPS file management for a Topcon system.

OE3 161 Grade Setting II

Units: 3
Hours: 41 hours LEC; 39 hours LAB
Prerequisite: OE3 160 with a grade of "C" or better
Enrollment Limitation: Registered Operating Engineer Apprentice

This course covers the advanced skills and knowledge required to be a grade setter in the Operating Engineer Apprenticeship. Topics include sloping pad layout, sidewalk, curb, and gutter grading, and catch point slope staking using global positioning systems (GPS) for Trimble systems.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- demonstrate the layout of a sloping pad according to the prints.
- demonstrate the proper grade checking for elevation purposes.
- demonstrate the layout for grading a sidewalk, curb, and gutter section.
- explain the markings on a grade stake for catch point slope staking.
- demonstrate the setup of a GPS file management for a Trimble system.

OE3 182 Heavy Duty Equipment Hydraulics

Units: 3
This course covers hydraulic systems of heavy duty equipment. Topics include pumps, actuators, hoses, schematic drawings, and similar systems.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- describe the fundamentals of hydraulics.
- apply and list Pascal's Laws of Hydraulics.
- define viscosity of hydraulic fluids.
- identify the different components of hydraulic systems in heavy duty equipment.
- diagnose a basic hydraulic system.

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**OE3 183 Engines**

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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>41 hours LEC, 39 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Registered Operating Engineer Apprentice.</td>
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</table>

This course covers the principles, operation, and diagnosis of heavy duty engines commonly used in construction equipment, such as earth moving equipment. Topics include fuel systems, specialty tool usage, and troubleshooting techniques.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- identify shop safety requirements.
- define and explain how compression ignition is used in diesel engines.
- explain the operating principles of the different components in heavy duty diesel engines.
- list the functions of the fuel injection system used in modern engines.
- demonstrate component analysis when troubleshooting a heavy duty diesel engine.

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**OE3 184 Power Trains**

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<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>41 hours LEC, 39 hours LAB</td>
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<td>Prerequisite:</td>
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</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Operating Engineer Apprentice.</td>
</tr>
</tbody>
</table>

This covers the principles, operation, and diagnosis of heavy duty power trains commonly used in construction equipment such as earth moving equipment. Topics include shop safety, transmissions, drive-lines, differentials, and troubleshooting techniques.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:
OE3 185 Equipment Welding

Units: 3
Hours: 41 hours LEC; 39 hours LAB
Prerequisite: None.
Enrollment Limitation: Registered Operating Engineer Apprentice.

This course covers welding and oxyacetylene processes used in heavy construction equipment, such as bulldozers, backhoes, or earth moving equipment. Topics include shop safety practices, proper selection of welding equipment, use of oxyacetylene equipment, and proper welding techniques.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- demonstrate proper safety procedures for welding and oxyacetylene equipment.
- demonstrate the correct technique to operate a cutting torch per manufacturer specifications.
- demonstrate the correct technique to operate an electric arc welding machine per manufacturer specifications.
- explain the techniques and methods used as a process for Shielded Metal Arc Welding (SMAW).
- explain the techniques and methods used as a process for Flux-Cored Arc Welding (FCAW).
- explain the basic concepts of metallurgy, inspection, testing, and distortion.

OE3 186 Lubrication Preventative Maintenance

Units: 3
Hours: 41 hours LEC; 39 hours LAB
Prerequisite: None.
Enrollment Limitation: Registered Operating Engineer Apprentice.

This course covers lubrication preventative maintenance for the construction lube technician. Topics include lubricants, air filters, engine oils, and manufacturer services on heavy construction equipment.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe the fundamentals of lubrication.
- perform manufacturer required preventative services.
- demonstrate specified engine oil replacement on earth moving equipment.
- demonstrate the inspection of equipment by manufacturer specifications.
• measure the different fluid levels in earth moving equipment.

OE3 187 Oils, Lubricants, and Coolants

This course covers oils, lubricants, and coolants for the construction lube technician. Topics include lubricants, engine oils, gear oils, transmission oils, grease, and coolants.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• describe the fundamentals of lubrication.

• select hydraulic oils per manufacturer specifications for heavy construction equipment.

• record properly services being done on heavy construction equipment.

• determine the different viscosity requirements for heavy construction equipment depending on environmental conditions.

OE3 188 Servicing and Inspections

This course covers servicing and inspection skills for the construction lube technician. Topics include minor repairs, performing services, and inspecting for prevention.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• perform inspections on heavy construction equipment for preventative measures.

• select hydraulic oils per manufacturer specifications for heavy construction equipment.

• record properly services being done on heavy construction equipment.

• perform minor repairs on heavy construction equipment.

• select oil samples and determine potential problems with heavy construction equipment.

OE3 298 Work Experience in Operating Engineers Apprenticeship

This course provides work experience in the field of operating engineers. The student will gain practical experience under the supervision of a registered operating engineer.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• perform various tasks under the guidance of a registered operating engineer.

• gain practical experience in the field of operating engineers.

• develop a professional network in the industry.

Units: 1 - 4
Hours: 75 - 300 LAB
This course provides students the opportunity to work in the operating engineers apprenticeship program for the purpose of developing specific skills to meet the goals and objectives of the operating engineers Joint Apprenticeship and Training Committee (J.A.T.C.). Students complete work experience hours at approved training sites. Students may take up to 16 units total across all Work Experience course offerings. This course may be repeated when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- demonstrate competencies for effective and competitive workforce performance in operating engineers apprenticeship program.
- demonstrate mastery of specific job skills as written in learning objectives under the supervision of the operating engineers Joint Apprenticeship and Training Committee (J.A.T.C.).

### Pre-Apprenticeship (PREAP)

#### PREAP 111 Infrastructure Pre-Apprenticeship

| Units: | 7 |
| Hours: | 77 hours LEC; 147 hours LAB |
| Prerequisite: | None. |
| Corequisite: | Concurrent enrollment in FITNS 102. |
| Enrollment Limitation: | Students must have a high school diploma or GED. |
| Advisory: | Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340. |

This course provides an introduction to infrastructure apprenticeships. It covers tools, equipment, materials, and techniques used for building roads, bridges, levees, and rail. Topics also include job safety, physical requirements for different job sites, employability skills for apprenticeship, and California apprenticeship laws. Field trips may be required.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- demonstrate job interview skills needed for the infrastructure apprenticeships.
- demonstrate the safe use and care of both hand and power tools.
- identify safety laws, regulations, and safe working conditions for apprenticeship training.
- demonstrate competency in basic infrastructure calculations.
- describe basic skills required for the construction of roads, bridges, levees, and rail.
- describe infrastructure construction materials and green building procedures.

#### PREAP 112 Infrastructure Pre-Apprenticeship I

| Units: | 3 |
| Hours: | 27 hours LEC; 81 hours LAB |
This course provides an introduction to infrastructure construction trades apprenticeships. It covers tools, and equipment used for building and maintaining the facilities and systems that create America's infrastructure. Topics also include OSHA/jobsite safety, the safe use of hand and power tools, applied construction math, and employability skills for apprenticeship. This course is not open to students who have completed PREAP 111. Field trips may be required.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- demonstrate the safe use and care of both hand and power tools.
- identify safety laws, regulations, and safe working conditions for apprenticeship training.
- demonstrate competency in basic construction calculations.
- build a small wood project based on written and verbal instructions.

**PREAP 113 Infrastructure Pre-Apprenticeship II**

<table>
<thead>
<tr>
<th>Units</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
<td>27 hours LEC; 81 hours LAB</td>
</tr>
<tr>
<td>Prerequisite</td>
<td>None.</td>
</tr>
</tbody>
</table>

This course provides an overview of the commercial and industrial construction trades with an emphasis on America's infrastructure. It covers materials and techniques that are used in the infrastructure trades to construct and maintain buildings and related facilities. Topics also include an introduction to construction drawings, material handling simulators, multi-craft skills, and California apprenticeship regulations. This course is not open to students who have completed PREAP 111. Field trips may be required.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- describe entry level skills required for the construction of roads, bridges, levees, and commercial buildings.
- identify construction tools, materials, and fasteners.
- identify the basic components within a set of construction drawings.
- demonstrate the ability to lay out a floor plan from a given drawing.
- measure the differences in elevation with a builder's level and with construction laser levels.

**PREAP 122 Pre-Apprenticeship for Utility Workers**

<table>
<thead>
<tr>
<th>Units</th>
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<tbody>
<tr>
<td>Hours</td>
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<tr>
<td>Prerequisite</td>
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</tr>
<tr>
<td>Corequisite</td>
<td>FITNS 358</td>
</tr>
<tr>
<td>Advisory</td>
<td>MATH 145</td>
</tr>
</tbody>
</table>

This course provides preparation for entry-level employment skills for the utility industry. Topics include safety, basic electrical fundamentals, gas principles, excavation, working at heights, industrial ergonomics, radio procedures, and knot tying. Field trips may be required.
Upon completion of this course, the student will be able to:

- explain the nature of electricity, resistance, basic circuit laws, and Ohms' law including alternating current
- identify the industry specific requirements of excavation
- define power generation and distribution processes
- measure circuit values using fundamental electrical laws and rules
- define terms and vocabulary uses in the utility industry
- explain gas distribution for the utility industry
- demonstrate effective conflict resolution skills
- calculate values of circuits with the aid of a calculator
- identify safety laws, regulations, and safe working conditions for the utility industry

**PREAP 141 Green Technology Pre-Apprenticeship**

<table>
<thead>
<tr>
<th>Units:</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>77 hours LEC; 147 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Concurrent enrollment in FITNS 101.</td>
</tr>
<tr>
<td>Corequisite:</td>
<td>Students must have a high school diploma or GED.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.</td>
</tr>
<tr>
<td>Advisory:</td>
<td></td>
</tr>
</tbody>
</table>

This course provides an introduction to Green Technology Pre-Apprenticeship. It covers tools, equipment, materials, and techniques used in the green fields such as electrical, plumbing, heating ventilation and air conditioning (HVAC), and carpentry. Topics include commercial and industrial building energy efficiency, building codes, sustainability, renewable energy, green building, distributed generation systems, utilities, and smart grids. Additional topics include construction drawings, safety training, construction math, and basic communication and employability skills. Field trips may be required.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- describe the major challenges to the green environment that are caused directly or indirectly by the built environment.
- identify decisions and actions in his/her personal and work life that impact the green environment.
- describe the life cycle phases of a building and the impacts on the green environment over its life cycle.
- identify green alternatives to conventional building practices and describe the positives and negatives of each alternative.
- describe the Leadership in Energy and Environmental Design (LEED) rating process.
- explain the role of Occupational Safety and Health Administration (OSHA) in job site safety.
- recognize and identify some of the basic hand tools and their proper uses in the construction trade.
- communicate effectively in on-the-job situations using verbal and written skills.
- identify renewable and non-renewable resources and energy.
- describe the importance of sustainable renewable energy sources.
PREAP 142 Green Technology Pre-Apprenticeship I

This course provides an introduction to Green Technology Pre-Apprenticeship. It covers tools, equipment, materials, and techniques used in the green fields such as electrical, plumbing, heating ventilation and air conditioning (HVAC), and carpentry. Topics include reducing consumer waste, water and other natural resources, recycling, renewable energy, and green building procedures and materials. Additional topics include construction drawings, safety training, construction math, and basic communication and employability skills. This course is not open to students who have completed PREAP 141. Field trips may be required.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe the major challenges to the green environment that are caused directly or indirectly by the built environment.
- calculate individual carbon footprints and identify ways to lessen them.
- recognize and identify some of the basic hand tools and their proper uses in the construction trade.
- identify renewable and non-renewable resources of energy.
- describe the importance of sustainable renewable energy sources.

PREAP 143 Green Technology Pre-apprenticeship II

This course provides an introduction to Green Technology Pre-Apprenticeship. It covers tools, equipment, materials, and techniques used in the green fields such as electrical, plumbing, heating ventilation and air conditioning (HVAC), and carpentry. Topics include commercial and industrial building energy efficiency, building codes, sustainability, distributed generation systems, utilities, and smart grids. Additional topics include safety training, and construction math. This course is not open to students who have completed PREAP 141. Field trips may be required.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- describe the life-cycle phases of a building and the impacts on the green environment over its life cycle.
- identify green alternatives to conventional building practices and describe the positives and negatives of each alternative.
- describe the Leadership in Energy and Environmental Design (LEED) rating process.
- list the benefits of the various sustainable construction systems.
SHME 100 Sheet Metal Apprenticeship I

This course is an introduction to the sheet metal apprenticeship program. Topics include job-site safety practices, basic drafting, basic job-site drawings, and industry terminology.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Analyze and avoid unsafe conditions and unsafe acts, and observe safety laws and regulations.
- Describe general Occupational Safety & Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements on construction job sites.
- Demonstrate cardiopulmonary resuscitation (CPR) and first aid on adults for use on construction job sites.
- Identify commonly-used hand tools in the sheet metal industry.
- Apply basic construction mathematics in calculating shapes, distances, formulas and various job site-related conditions.
- Demonstrate basic drafting skills and use of drafting tools.

SHME 101 Sheet Metal Apprenticeship II

This course is an introduction to sheet metal field installation with an emphasis in basic sheet metal layout, parallel and radial line development and an introduction to triangulation. Topics include soft soldering and drafting of sheet metal prior to fabrication.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Demonstrate drafting skills to specified drawings.
- Analyze drawing scales and convert to proper specified scale.
- Demonstrate proper soldering on sheet metal fabrication.
- Identify common symbols used on mechanical drawings.
- Identify and define plan view, elevation view and develop a profile in a sheet metal layout project.
- Demonstrate specified knowledge of triangulation to develop sheet metal fittings.
- Calculate area and volume of geometric shapes.
SHME 110 Sheet Metal Apprenticeship III

This course introduces basic layout skills for advanced pattern development. In addition topics include the basic bidding process, trigonometry for the sheet metal industry, fabrication of round fittings, and drafting of pictorial drawings.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Identify hidden job costs and assemble a simple bid.
- Draft and fabricate a simple duct offset.
- Develop isometric and oblique drawings.
- Apply mathematics to fabricate complex sheet metal fittings.
- Draft isometric and oblique drawings of specified shapes.
- Draft and fabricate round duct fittings.

SHME 111 Sheet Metal Apprenticeship IV

This course covers advanced pattern development, architectural sheet metal principles, flashing, and gutters. Topics include hoisting and rigging, as well as installation of fire and smoke dampers.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Demonstrate proper mitering of flashing and gutter products.
- Calculate proper water flow on architectural sheet metal products.
- Identify and demonstrate proper installation procedures for fire and smoke dampers.
- Demonstrate proper hand signals for cranes.
- Identify safe rigging practices.
- Demonstrate different knots commonly used for rigging.

SHME 120 Sheet Metal Apprenticeship V

This course introduces basic layout skills for advanced pattern development. In addition topics include the basic bidding process, trigonometry for the sheet metal industry, fabrication of round fittings, and drafting of pictorial drawings.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Identify hidden job costs and assemble a simple bid.
- Draft and fabricate a simple duct offset.
- Develop isometric and oblique drawings.
- Apply mathematics to fabricate complex sheet metal fittings.
- Draft isometric and oblique drawings of specified shapes.
- Draft and fabricate round duct fittings.
This course is an introduction to heating, ventilating, and air conditioning (HVAC) systems. It includes an overview of the properties of air, heating, and cooling. In addition, this course covers fans and duct systems, and measuring airflow in ductwork.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Identify HVAC components.
- Measure the moisture content of air and relative humidity using a sling psychrometer and a psychometric chart.
- Calculate ventilation requirements for a given space.
- Identify three forms of heat transfer.
- List the components of a cooling systems.
- Demonstrate the use of an air duct calculator to design a duct system.
- Define a British thermal unit (BTU).

SHME 121 Sheet Metal Apprenticeship VI

| Units: | 3.30 |
| Hours: | 40 hours LEC; 58 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Registered Sheet Metal Apprentice |

This course is an introduction to Occupational Safety and Health Administration (OSHA) regulations and a review of safe rigging practices. Topics include job specifications, blueprint reading, field measuring, and installation of package units and built-up systems.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Identify and avoid unsafe conditions and unsafe acts, and observe safety laws and regulations on construction job sites.
- Examine information in a job specification manual.
- Examine information in a heating, ventilating, and air conditioning (HVAC) unit instruction manual.
- Demonstrate proper layout of a roof curb and duct penetrations.
- Define the components in a central HVAC system.
- Construct a standing seam roof.

SHME 130 Sheet Metal Apprenticeship VII

| Units: | 3.30 |
| Hours: | 40 hours LEC; 58 hours LAB |
| Prerequisite: | None. |
| Enrollment Limitation: | Registered Sheet Metal Apprentice |
This course covers the design and construction of rooftop steel, advanced plans and specifications, and duct leakage detection. It includes basic electricity for sheet metal workers.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- Demonstrate advanced drafting skills to specified drawings.
- Calculate air system pressure, balancing and sizing to specified requirements.
- Assemble a shop fabrication order from given drawings, blueprints and specifications.
- Demonstrate troubleshooting methods for duct leakage testing.
- Demonstrate the drafting, layout and installation of roof top steel.

**SHME 131 Sheet Metal Apprenticeship VIII**

**Units:** 3.30  
**Hours:** 40 hours LEC; 58 hours LAB  
**Prerequisite:** Registered Sheet Metal Apprentice  
**Enrollment Limitation:** None.

This course covers testing, adjusting, and balancing of heating, ventilating, and air conditioning (HVAC) systems. Topics include advanced drafting elevation views of shaft duct systems and complete takeoff of a HVAC system with cost, quantity and weight.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- Calculate system pressures to specified tolerances in a HVAC system.
- Design a HVAC system to given specifications and blueprints.
- Demonstrate testing of a HVAC system to calculate specified air balance.
- Identify code violations in mechanical design based on the Uniform Mechanical Code (UMC).
- Calculate quantity, cost, and weight of a given HVAC system.

**SHME 140 Sheet Metal Apprenticeship IX**

**Units:** 3.30  
**Hours:** 40 hours LEC; 58 hours LAB  
**Prerequisite:** Registered Sheet Metal Apprentice  
**Enrollment Limitation:** None.

This course covers the installation of architectural metal, food service equipment, and commercial exhaust systems. It includes control wiring of these systems.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- Demonstrate proper installation of skylight, trim, flashing and proper use of sealant.
- Select proper approved sealants for food service.
- Demonstrate proper installation of an exhaust system and control wiring.
- Identify food service codes required for installation.
- Demonstrate proper control wiring for a heating, ventilating, and air conditioning (HVAC) system.
- Demonstrate troubleshooting skills and repair a thermostat for a HVAC system.

### SHME 141 Sheet Metal Apprenticeship X

<table>
<thead>
<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>40 hours LEC; 58 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Sheet Metal Apprentice</td>
</tr>
</tbody>
</table>

This course covers shop foreman duties, procedures, and leadership training. In addition, the testing, adjusting, and balancing of blow pipe systems are addressed.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- Identify and select Sheet Metal Air Conditioning Contractors’ National Association (SMACNA) standards for ducting and blow pipe systems.
- Identify code requirements for ducting and blow pipe systems.
- Demonstrate calculations for the proper balancing of a given blow pipe system.
- Identify and analyze shop foreman responsibilities and leadership qualities.
- Demonstrate proper use of an air velocity meter.
- Identify negative and positive blow pipe systems.

### SHME 150 Sheet Metal Welding I

<table>
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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>27 hours LEC; 54 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Registered Sheet Metal Apprentice</td>
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</tbody>
</table>

This course covers oxyacetylene cutting, shielded metal arc (SMAW) and gas tungsten arc (GTAW) welding processes typically used in the sheet metal industry. Topics include welding safety procedures and maintenance techniques.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- describe safety procedures for the setup, starting, and stopping of oxyacetylene equipment.
- demonstrate proper cutting of a given material with oxyacetylene equipment.
- describe safety procedures when using shielded metal arc welding (SMAW) and gas tungsten arc welding (GTAW) equipment.
• demonstrate proper beads in the overhead, vertical, and horizontal positions.

• interpret common welding symbols represented on blueprints.

SHME 151 Sheet Metal Welding II

<table>
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<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>27 hours LEC; 54 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Sheet Metal Apprentice</td>
</tr>
</tbody>
</table>

This course covers advanced shielded metal arc (SMAW) and gas tungsten arc (GTAW) welding processes typically used in the sheet metal industry. Topics include welding safety procedures and maintenance techniques.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• describe safety procedures when using shielded metal arc welding (SMAW) and gas tungsten arc welding (GTAW) equipment.

• demonstrate proper beads in the overhead, vertical, and horizontal positions for advanced applications.

• demonstrate proper procedures in the welding inspection process.

SHME 298 Work Experience in Sheet Metal Apprenticeship

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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>75 - 300 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>Indentured in the sheet metal apprenticeship program.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>None.</td>
</tr>
</tbody>
</table>

This course provides students the opportunity to work in the sheet metal apprenticeship program for the purpose of developing specific skills to meet the goals and objectives of the sheet metal Joint Apprenticeship and Training Committee (J.A.T.C.). Students complete work experience hours at approved training sites. Students may take up to 16 units total across all Work Experience course offerings. This course may be repeated when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• demonstrate competencies for effective and competitive workforce performance in sheet metal apprenticeship program.

• demonstrate mastery of specific job skills as written in learning objectives under the supervision of the sheet metal Joint Apprenticeship and Training Committee (J.A.T.C.).

Sheet Metal Residential Apprenticeship (SMRA)

SMRA 100 Sheet Metal Residential Apprenticeship I

| Units: | 3 |
This course is an introduction to sheet metal residential apprenticeship, residential and light commercial work, safety, tools, and materials. Topics include an introduction to basic sheet metal layout and fabrication.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Identify and interpret federal and state laws governing sheet metal residential apprentices.
- Identify and avoid unsafe conditions and unsafe acts, and observe safety laws and regulations.
- Demonstrate proper procedures in the use of powder-actuated tools.
- Identify various metals, gauges, fasteners, and sealants.
- Identify shop tools and common materials used in sheet metal fabrication.
- Demonstrate proper procedures in administering first aid and cardiopulmonary resuscitation (CPR).

SMRA 101 Sheet Metal Residential Apprenticeship II

This course covers trade-related mathematics, forklift training, sheet metal soldering, and basic reading of blueprints. Topics include basic layout of sheet metal elbows, offsets and triangulation.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Calculate area volume.
- Demonstrate proper safety procedures in the operation of a forklift.
- Demonstrate proper soldering on sheet metal fabrication.
- Fabricate a rectangular sheet metal elbow.
- Fabricate a radius sheet metal elbow.
- Fabricate a sheet metal offset.
- Identify common symbols used on mechanical blueprints.

SMRA 110 Sheet Metal Residential Apprenticeship III

This course is an introduction to sheet metal residential apprenticeship, residential and light commercial work, safety, tools, and materials. Topics include an introduction to basic sheet metal layout and fabrication.
This course covers servicing, troubleshooting and low voltage controls for residential heating and air conditioning (HVAC) equipment. Topics include residential architectural sheet metal and fabricating flashing, gutters and downspouts.

**Student Learning Outcomes**
At the completion of this course, the student will be able to:

- Demonstrate proper recovery of refrigerant.
- Analyze a residential HVAC 24-volt control circuit.
- Identify steps involved in troubleshooting residential HVAC equipment.
- Identify maintenance servicing procedures used on residential HVAC equipment.
- Fabricate flashing, gutters and downspouts used in residential buildings.

SMRA 111 Sheet Metal Residential Apprenticeship IV

**Units:** 3  
**Hours:** 40 hours LEC; 42 hours LAB  
**Prerequisite:** None  
**Enrollment Limitation:** Registered Sheet Metal Residential Apprentice  

This course covers advanced triangulation, draft and fabrication methods in residential heating, ventilation and air conditioning (HVAC) systems. Topics include servicing furnaces, air conditioners, and alternating-current (AC) control circuits. Additional topics include duct design and system sizing.

**Student Learning Outcomes**
Upon completion of this course, the student will be able to:

- Demonstrate layout of advanced project involving triangulation, drafting and fabrication.
- Describe components and function of furnaces used in residential job sites.
- Demonstrate safe troubleshooting of an AC circuit.
- Design and size a residential duct system.
- Demonstrate proper procedures for hoisting and rigging used on residential job sites.

Sheet Metal TAB Technician Apprenticeship (SMTAB)

Sheet Metal Technology (SMTEC)

SMTEC 100 Sheet Metal Service Technician Apprenticeship I

**Units:** 2.5  
**Hours:** 27 hours LEC; 54 hours LAB  
**Prerequisite:** None  
**Enrollment Limitation:** Registered Sheet Metal Apprentice
This course is an introduction to the Sheet Metal Service Technician Apprenticeship. Topics include environmental systems, basic refrigeration theory, balancing refrigeration systems, and field safety. It includes the testing, adjusting, and balancing of refrigeration systems.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- Demonstrate use of tools and instruments used by sheet metal service technicians.
- Recognize and practice safety precautions while working on refrigeration systems.
- Identify and define the refrigeration cycle components.
- Define and calculate the enthalpy necessary for refrigeration systems.
- Identify different types of compression refrigeration systems.
- Explain the basic refrigeration cycle.

SMTEC 101 Sheet Metal Service Technician Apprenticeship II

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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>27 hours LEC; 54 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<td>Enrollment Limitation:</td>
<td>Registered Sheet Metal Apprentice</td>
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</tbody>
</table>

This course covers diagnosing refrigeration systems, charging and recovery of small hermetic systems, and servicing small heating, ventilating, and air conditioning (HVAC) package units.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- Diagnose a refrigeration system on a small HVAC package unit.
- Demonstrate basic repair on a small HVAC package unit.
- Demonstrate charging a small hermetic system to specified levels.
- Demonstrate proper usage of piercing valves.
- Demonstrate proper recovery of refrigerant.

SMTEC 110 Sheet Metal Service Technician Apprenticeship III

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<tr>
<th>Units:</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<td>Enrollment Limitation:</td>
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</tbody>
</table>

This course covers basic electrical fundamentals and control circuits in package air conditioning units. Topics include basic motor principles, construction, and motor control circuits.

Student Learning Outcomes

Upon completion of this course, the student will be able to:
• Define principles of basic alternating current (AC) and direct current (DC) motor theory.

• Identify parts of a AC and DC motor.

• Describe basic motor design, construction and theory of operation.

• Analyze control diagrams in a package air conditioning unit.

• Define different applications and types of air conditioning package units.

• Demonstrate measuring for electricity with a voltage meter in an air conditioning package unit.

SMTEC 111 Sheet Metal Service Technician Apprenticeship IV

<table>
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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>27 hours LEC; 54 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
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</tbody>
</table>

This course covers hermetically sealed electric motors, motor control circuits and their protection. Topics include electrical schematics and diagrams relating to air conditioning equipment.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• Demonstrate wiring a basic hermetically sealed motor.

• Identify components and functions of a basic hermetically sealed motor.

• Demonstrate the servicing of a hermetically sealed motor.

• Demonstrate the charging and recovery of a hermetic system.

• Explain the cycle of a compression system.

• Calculate the overload protection for a motor.

SMTEC 120 Sheet Metal Service Technician Apprenticeship V

<table>
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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<td>Enrollment Limitation:</td>
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</table>

This course covers duct systems including design, selection, layout, and outlets. Topics include the properties of air, airflow, and heat in heating, ventilating, and air conditioning (HVAC) system design. Additionally, types of heating systems are covered.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• Define air and the properties associated with air.

• Measure the moisture content of air and relative humidity using a sling psychrometer and psychrometric chart.
• Define the three forms of heat transfer: radiation, conduction, and convection.

• Demonstrate the use of an air duct calculator to analyze an air duct system design.

• Calculate ventilation requirements for a given building space.

• Identify different types of heating systems and their applications.

SMTEC 121 Sheet Metal Service Technician Apprenticeship VI

| Units: 2.5 |
| Hours: 27 hours LEC; 54 hours LAB |
| Prerequisite: None |
| Enrollment Limitation: Registered Sheet Metal Apprentice |

This course covers chilled water systems, air cooled condensers, water cooled condensers, refrigerant lines and flow control devices. Topics include heat load calculations for cooling systems and heat pump operation, components, and controls.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• Explain heat transfer in condenser and evaporator coils.

• Identify the components in a heat pump system.

• Calculate the heat load for a cooling system.

• Describe how the reversing valve operates.

• Describe the various operating cycles of a heat pump system.

• Calculate the capacity of a refrigerant line.

• Identify different refrigerant flow control devices.

SMTEC 130 Sheet Metal Service Technician Apprenticeship VII

| Units: 2.5 |
| Hours: 27 hours LEC; 54 hours LAB |
| Prerequisite: None |
| Enrollment Limitation: Registered Sheet Metal Apprentice |

This course covers commercial systems such as walk-in freezers, ice makers, multi-zone systems and an introduction to computerized building management. Topics include constant volume air conditioning systems, and an introduction to pneumatic and electronic environmental system controls.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• Describe the operation and function of a constant air volume air conditioning system.

• Demonstrate the proper installation of a pneumatic control system in order to actuate a given control device.

• Demonstrate the proper wiring of an electrical control system in order to actuate a given control device.
• Summarize the applications of a computerized building management system.
• Describe the requirements for commercial refrigeration systems.
• Describe the various methods used in charging commercial refrigeration systems.
• Describe the defrost systems used in commercial refrigeration systems.

SMTEC 131 Sheet Metal Service Technician Apprenticeship VIII

<table>
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<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Enrollment Limitation:</td>
<td>Registered Sheet Metal Apprentice</td>
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</table>

This course covers variable air volume systems used in airflow regulation and their electronic control components. Topics include an introduction to the principles and components of direct digital controls (DDC) and energy management systems (EMS).

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• List and describe the most common DDC control devices for inputs and outputs.
• Identify and interpret commonly used DDC symbols used on drawings.
• Define logic and logic gates in DDC control systems.
• Measure a digital signal with the proper measurement instrument.
• Explain the basic logic and function of a analog to digital and digital to analog converter.
• Demonstrate the setup and balancing of a variable air volume system.

SMTEC 140 Sheet Metal Service Technician Apprenticeship IX

<table>
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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<tr>
<td>Enrollment Limitation:</td>
<td>Registered Sheet Metal Apprentice</td>
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</table>

This course covers the installation and application of direct digital control (DDC) systems in energy management systems (EMS). Topics include an introduction to blueprint reading for service technicians, and the testing and balancing of heating, ventilating, and air conditioning (HVAC) systems integrated with EMS.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

• Demonstrate the installation and programming of a direct digital system.
• Demonstrate the testing and balancing of an EMS integrated heating, ventilating, and air conditioning system.
• Analyze commercial blueprints, specifications, schedules and details.
This course covers commissioning of direct digital control (DDC) systems in energy management systems (EMS). Topics include demand controlled ventilation systems and advanced blueprint reading for service technicians.

Student Learning Outcomes
Upon completion of this course, the student will be able to:

- Program EMS software devices with given functions.
- Commission EMS devices and system.
- Explain the DDC integration requirements in order to have a properly operating system.
- Analyze industrial blueprints, specifications, schedules, and details to given requirements.

Faculty

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Web: Richard Stoker's Profile Page (/about/faculty-and-staff-directory/richard-stoker)