

Department of Labor & Industries
Apprenticeship Section
PO Box 44530
Olympia WA 98504-4530



REQUEST FOR APPROVAL OF PROPOSED STANDARDS



TO: Washington State Apprenticeship & Training Council

FROM Schweitzer Engineering Laboratories

NAME OF PROGRAM STANDARDS

Check appropriate box:

Committee Plant OJT

OCCUPATION(S):	HOURS:	SOC #:
Industrial Maintenance Electrician	8000	47-2111.00
HVAC Service Technician	8000	49-9021.01

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Authorized Signatures:

Chair:	Approved by: Washington State Apprenticeship & Training Council
Secretary:	Secretary of Council
Date: <u>6/1/16</u>	Date:



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STANDARDS OF APPRENTICESHIP
adopted by

SCHWEITZER ENGINEERING LABORATORIES

(sponsor name)

<u>Occupational Objective(s):</u>	<u>SOC#</u>	<u>Term</u>
INDUSTRIAL MAINTENANCE ELECTRICIAN	47-2111.00	8000 HOURS
HVAC SERVICE TECHNICIAN	49-9021.01	8000 HOURS



APPROVED BY
Washington State Apprenticeship and Training Council
REGISTERED WITH
Apprenticeship Section of Specialty Compliance Services Division
Washington State Department Labor and Industries
Post Office Box 44530
Olympia, Washington 98504-4530

APPROVAL:

Initial Approval

Committee Amended

Standards Amended (review)

Standards Amended (administrative)

By: _____
Chair of Council

By: _____
Secretary of Council

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INTRODUCTORY STATEMENT

The director of the Department of Labor and Industries appointed the Washington State Apprenticeship and Training Council (WSATC) as the regulatory body responsible for developing, administering, and enforcing apprenticeship program standards (Standards) for the operation and success of apprenticeship and training programs in the State of Washington. Apprenticeship program sponsors function, administer, or relinquish authority only with the consent of the WSATC. Furthermore, only apprentices registered with the supervisor or recognized under the terms and conditions of a reciprocal agreement will be recognized by the WSATC. Parties signatory to these standards of apprenticeship declare their purpose and policy is to establish and sponsor an organized system of registered apprenticeship training and education.

These Standards are in conformity and are to be used in conjunction with the Apprenticeship Rules, chapter 296-05 WAC (Washington Administrative Code); Apprenticeship Act, chapter 49.04 RCW (Revised Code of Washington); The National Apprenticeship Act, 29 U.S.C. (United States Code) 50; Apprenticeship Programs, Title 29 Part 29 CFR (Code of Federal Regulations); and Equal Employment Opportunity in Apprenticeship and Training, Title 29 Part 30 CFR which govern employment and training in apprenticeable occupations. They are part of this apprenticeship agreement and bind all signers to compliance with all provisions of registered apprenticeship. Additional information may need to be maintained by the program sponsor that is supplemental to these apprenticeship standards. This information is for purposes of ensuring compliance with decisions of the WSATC and the apprenticeship laws identified above.

If approved by the council, such amendment/s and such changes as adopted by the council shall be binding to all parties. Program sponsors shall notify apprentices and employer training agents (if applicable) of changes when they are adopted by the council. If and when any part of these Standards becomes illegal, as pertains to federal and/or state law, that part and that part alone will become inoperative and null and void, and the Department of Labor and Industries (Department) may adopt language that will conform to applicable law. The remainder of the Standards will remain in full force and effect.

Sections of these standards identified as bold "insert text" fields are specific to the individual program standards and may be modified by a sponsor submitting a revised standard for approval by the WSATC. All other sections of the standards are boilerplate and may only be modified by the WSATC.

See WAC 296-05-003 for the definitions necessary for use with these Standards.

Sponsor Introductory Statement (Optional): **Recognizing the continuous advancements in industrial maintenance technologies and the challenge to increase customer satisfaction, this program establishes the necessary training that leads the successful apprentice to the status of the State Certified Journey Level worker in the specified occupation.**

To this end, the graduated apprentice will be able to demonstrate all competencies of this trade that exemplify the highest standards of the electronic relay manufacturing industry.

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Objectives of this program will be accomplished through the joint efforts of SEL and the Department of Labor and Industries.

I. GEOGRAPHIC AREA COVERED:

The sponsor has no authority to conduct training outside of the geographical area covered by these Standards. The sponsor may enter into an agreement [portability agreements – see WAC 296-05-303(4)(g)] with other sponsors for the use of apprentices by training agents that are working outside of their approved geographic area. Also, the WSATC may recognize and approve out-of-state apprenticeship programs and standards if certain conditions are met and the out-of-state sponsoring entity requests it (see WAC 296-05-327). Apprenticeship program sponsors will ensure compliance with the provisions of any agreement recognized by the WSATC.

The area covered by these standards shall be Schweitzer Engineering Laboratories Pullman, Washington.

II. MINIMUM QUALIFICATIONS:

Minimum qualifications must be clearly stated and applied in a nondiscriminatory manner [see WAC 296-05-316(17)].

Age: **Must be at least 18 years of age.**

Education: **High School diploma or High School Equivalency**

Physical: **Must be capable of learning and performing the essential tasks of the trade with reasonable accommodations.**

Testing: **None**

Other: **None**

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III. CONDUCT OF PROGRAM UNDER WASHINGTON EQUAL EMPLOYMENT OPPORTUNITY PLAN:

Sponsors with five (5) or more apprentices must adopt an Equal Employment Opportunity (EEO) Plan and Selection Procedures (see Part D of chapter 296-05 WAC and 29 CFR Part 30).

The recruitment, selection, employment and training of apprentices during their apprenticeship shall be without discrimination because of race, sex, color, religion, creed, national origin, age, sexual orientation, marital status, ~~veteran~~ military status, the

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presence of a disability or any other characteristic protected by law. The sponsor shall take positive action to provide equal opportunity in apprenticeship and will operate the apprenticeship program as required by the rules of the Washington State Apprenticeship and Training Council (chapter 296-05 WAC) and Title 29, Part 30 of the Code of Federal Regulations.

A. Selection Procedures:

Exempt per WAC 296-05-405(1)(a), Fewer than five (5) apprentices.

B. Equal Employment Opportunity Plan:

Exempt per WAC 296-05-405(1)(a), Fewer than five (5) apprentices.

Discrimination Complaints.

Any apprentice or applicant for apprenticeship who believes they have been discriminated against may file a complaint (WAC 296-05-443).

IV. TERM OF APPRENTICESHIP:

The minimum term of apprenticeship must not be less than 2000 hours of reasonably continuous employment in each occupation identified in these Standards. The term of apprenticeship must be stated in hours of employment [WAC 296-05-316(1)].

A. **The term of the Industrial Maintenance Electrician shall be eight thousand, (8,000) hours of reasonable continuous employment.**

B. **The term of the HVAC Service Technician shall be eight thousand, (8,000) hours of reasonable continuous employment.**

V. INITIAL PROBATIONARY PERIOD:

All apprentices are subject to an initial probationary period, stated in hours or months of employment for which they receive full credit toward completion of apprenticeship. Advance credit/standing will not reduce the initial probationary period. The initial probationary period [WAC 296-05-316(22)]:

1. Is the period following the apprentice's registration into the program and during which the apprentice's appeal rights are impaired. The initial probation must not exceed twenty percent (20%) of the term of apprenticeship or one year from date of registration, unless an exemption by the WSATC has been granted for longer probationary periods as specified by Civil Service or law.

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2. Is the period that the WSATC or the supervisor of apprenticeship may terminate an apprenticeship agreement at the written request by any affected party. The sponsor or the apprentice of the apprenticeship agreement may terminate the agreement without a hearing or stated cause. An appeal process is available to apprentices who have completed the initial probationary period.

The initial probationary period shall be the first 1,600 hours of reasonably continuous employment as a registered apprentice with this program.

VI. RATIO OF APPRENTICES TO JOURNEY LEVEL WORKERS:

Supervision is the necessary education, assistance, and control provided by a journey-level employee that is on the same job site at least seventy-five percent of each working day, unless otherwise approved by the WSATC. The sponsor will assure that apprentices are under the supervision of competent and qualified journey-level workers on the job who are responsible for the work being performed, to ensure safety and training in all phases of the work. Apprentices will work the same hours as journey-level workers, EXCEPT where such hours may interfere with related/supplemental instruction [WAC 296-05-316(5)].

1. **The ratio of apprentice Industrial Maintenance Electrician to journey-level workers shall be one (1) apprentice to one (1) journey-level worker on the job site.**
2. **The ratio of apprentice HVAC Service Technician to journey-level workers shall be one (1) apprentice to one (1) journey-level worker on the job site.**

VII. APPRENTICE WAGES AND WAGE PROGRESSION:

The apprentice will be paid a progressively increasing schedule of wages based on specified percentages of journey-level wage consistent with skills acquired [WAC 296-05-316(27)]. These may be indicated in hours or monthly periods set by the sponsor. The entry wage will not be less than the minimum wage prescribed by the Fair Labor Standards Act, where applicable, unless a higher wage is required by other applicable federal law, state law, respective regulations, or by collective bargaining agreement.

The sponsor may accelerate, by an evaluation process, the advancement of apprentices who demonstrate abilities and mastery of the occupation to the level for which they are qualified. When the apprentice is granted advanced standing the sponsor must notify the employer/training agent of the appropriate wage per the wage progression schedule specified in these Standards.

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A. Industrial Maintenance Electrician

Step	Number of hours/months	Percentage of journey-level rate
1	0000 – 1000 Hours	60%
2	1001 - 2000 Hours	65%
3	2001 – 3000 Hours	70%
4	3001 – 4000 Hours	75%
5	4001 – 5000 Hours	80%
6	5001 – 6000 Hours	85%
7	6001 – 7000 Hours	90%
8	7001 – 8000 Hours	95%

B. HVAC Service Technician

Step	Number of hours/months	Percentage of journey-level rate
1	0000 – 1000 Hours	60%
2	1001 - 2000 Hours	65%
3	2001 – 3000 Hours	70%
4	3001 – 4000 Hours	75%
5	4001 – 5000 Hours	80%
6	5001 – 6000 Hours	85%
7	6001 – 7000 Hours	90%
8	7001 – 8000 Hours	95%

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VIII. WORK PROCESSES:

The apprentice shall receive on the job instruction and experience as is necessary to become a qualified journey-level worker versed in the theory and practice of the occupation covered by these Standards. The following is a condensed schedule of work experience, which every apprentice shall follow as closely as conditions will permit.

Employers/training agents shall only use registered apprentices to perform the work processes as stated in this section. [WAC 296-05-303(5)(f)]

A. Industrial Maintenance Electrician APPROXIMATE HOURS

1. **Electrical Safety/Process500**
Familiarize the apprentice with the identification and use of the Electrical Safety Materials used in the craft. Including but not limited to standard PPE, JSA's, SOP's, National Electrical Code and SEL safety practices.

2. **Shop Work.....800**
Service and repair of equipment, layout and wiring of panels, tool room, electrical print review, trade specific tool training, trade scrapping and cleanup, miscellaneous.

3. **General Plant.....4500**
Placement of conduit and wire; installation of conduit, tray, and wire; installation and repair of lighting; installation and repair of motor and control equipment; testing and troubleshooting of electrical equipment; rigging; movement and placement of equipment; familiarization with electrical equipment and materials.

4. **Preventative Maintenance.....1000**
Cleaning and greasing of electrical equipment; testing electrical equipment, maintenance records, miscellaneous.

5. **Industrial building controls200**

6. **General commercial wiring.....1000**
Installation, layout and plan reading, including illumination, signage, and interface with HVAC controls.

Total Hours: 8000

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<u>B. HVAC Service Technician</u>	<u>APPROXIMATE HOURS</u>
1. Service of heating and air conditioning systems Servicing HVAC equipment including but not limited to roof top package units, split system, mini split, boiler, cooling tower, exhaust fans.	3500
2. Shop Work..... Service and repair of equipment, layout and duct sizing of HVAC systems, HVAC print review, trade specific tool training, movement and placement of equipment, familiarization with HVAC equipment and materials.	1000
3. Installation of heating, ventilation and air conditioning systems Installations including but not limited to roof top units, split systems, mini split, exhaust fans, boiler, RO systems.	500
4. Operation of hand and machine tools	500
5. Industrial building controls Training, familiarization with multiple building controls systems including but not limited to, standalone thermostats, Alerton, Carrier VVT systems controls.	1000
6. Special installation and specialty work..... Installation, layout and plan reading, duct sizing, signage, and interface with HVAC controls.	1000
7. Electrical Safety/Process Familiarize the apprentice with the identification and use of the Electrical Safety Materials used in the craft. Including but not limited to standard PPE, JSA's, SOP's, National Electrical Code and SEL safety practices.	500
Total Hours:	8000

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IX. RELATED/SUPPLEMENTAL INSTRUCTION:

The apprentice must attend related/supplemental instruction (RSI). Time spent in related/supplemental instruction shall not be considered as hours of work and the apprentice is not required to be paid for time spent in related/supplemental instruction.

The sponsor and training agent must provide for instruction of the apprentice during the related/supplemental instruction in safe and healthful work practices in compliance with the Washington Industrial Safety and Health Act, and applicable federal and state regulations.

Clock hours of actual attendance by the apprentice in related/supplemental instruction classes at the community/technical college or other approved training locations shall be reported to the Department on a quarterly basis. Such reports will clearly identify paid versus unpaid and supervised versus unsupervised RSI time for industrial insurance purposes.

For industrial insurance purposes, the WSATC will be considered as the employer should any supervised apprentice, not being paid to attend RSI, sustain an injury while participating in related/supplemental classroom activity, or other directly related activity outside the classroom. The activities must be at the direction of the instructor.

In case of failure on the part of any apprentice to fulfill the obligation to attend RSI, the sponsor has authority to take disciplinary action (see Administrative/Disciplinary Procedures section).

The methods of related/supplemental training must consist of one or more of the following (please indicate by checking those that apply):

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- () Supervised field trips
- () Approved training seminars (specify)
- (X) A combination of home study and approved correspondence courses (specify):
Lewis Clark State College, Lewiston Idaho.
- (X) State Community/Technical college: **Lewis Clark State College, Lewiston Idaho**
- () Private Technical/Vocational college
- () Training trust
- (X) Other (specify): **Additional classes/courses as approved by the Committee.**

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144 hours Minimum RSI hours per year defined per the following (see WAC 296-05-316(6)):

- (X) twelve-month period from date of registration.*
- () defined twelve-month school year: (insert month) through (insert month).
- () two-thousand hours of on the job training.

**If no selection is indicated above, the WSATC will define RSI hours per twelve-month period from date of registration.*

Additional Information:

None

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X. ADMINISTRATIVE/DISCIPLINARY PROCEDURES:

Sponsors may include in this section requirements and expectations of the apprentices and training agents and an explanation of disciplinary actions that may be imposed for noncompliance. The sponsor has the following disciplinary procedures that they may impose: Disciplinary Probation, Suspension, or Cancellation.

Disciplinary Probation: A time assessed when the apprentice's progress is not satisfactory. During this time the program sponsor may withhold periodic wage advancements, suspend or cancel the apprenticeship agreement, or take further disciplinary action. A disciplinary probation may only be assessed after the initial probation is completed. During the disciplinary probation, the apprentice has the right to file an appeal of the sponsor's action with the WSATC (as described in WAC 296-05-009).

Suspension: A suspension is a temporary interruption in progress of an individual's apprenticeship program that may result in the cancellation of the Apprenticeship Agreement. Could include temporarily not being allowed to work, go to school or take part in any activity related to the Apprenticeship Program until such time as the sponsor takes further action.

Cancellation: Refers to the termination of an apprenticeship agreement at the request of the apprentice, supervisor, or sponsor. [as described in WAC 296-05-316(22)].

A. General Procedures

1. **Failure to maintain employment with Schweitzer Engineering Laboratories will result in automatic cancellation of the apprenticeship agreement.**
2. **Apprentices will apply themselves on the job and in related training programs and continually strive to become a skilled worker.**

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3. Apprentices must complete the on-the-job training and complete the education learning and testing. If the Apprentice does not pass the course for any supplemental learning and testing period/module, the Apprentice Sponsor will meet to review the Apprentice's situation. At the point, the Sponsor will make the decision whether to implement procedures under Section X.C. Administrative/Disciplinary Procedures. The Apprentice will have the opportunity to present his/her case. The Sponsor will consider hardships (i.e. a death in the family) on a case by case basis with proper documentation.
4. If a student fails to pass the requirements of two testing periods/modules back to back, he/she will be removed from the Apprenticeship program.

B. Local Apprenticeship Committee Policies

1. A daily record of hours worked in each category of on the job training will be maintained by the apprentice and the apprentice's supervisor will "sign-off" the apprentice's record of hours worked in each category every week. Overtime hours worked shall be recorded as actual hours worked.
2. The progress of each apprentice will be reviewed and recorded at least monthly by the apprentice's supervisor. The supervisor shall make these records available to the apprenticeship committee.
3. The apprentice will meet with their supervisor and Management on a quarterly basis to review their progress.

C. Complaint and Appeal Procedures:

All registered programs must establish procedures explaining the program's complaint review process. Complaints that involve matters covered by a collective bargaining agreement are not subject to the complaint review procedures in this section.

Complaint (after initial probation completed) – WAC 296-05-009 and 296-05-316(22)

Prior to: 20 calendar days of intention of disciplinary action by a sponsor

- Sponsors must notify the apprentice in writing of action to be taken
- Must specify the reason(s) for discipline, suspension, or cancellation
- Decision will become effective immediately
- Written reason(s) for such action must be sent to the apprentice

Within: 30 calendar days request for reconsideration from the sponsor

- Apprentice to request sponsor to reconsider their action

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- Within: 30 calendar days of apprentice's request for reconsideration
- Sponsor must provide written notification of their final decision

If apprentice chooses to pursue the complaint further:

- Within: 30 calendar days of final action
- Apprentice must submit the complaint in writing to the Department
 - Must describe the controversy and provide any backup information
 - Apprentice must also provide this information to the local sponsor

- Within: 30 business days for supervisor to complete investigation
- If no settlement is agreed upon during investigation, then supervisor must issue a written decision resolving the controversy when the investigation is concluded

If the apprentice or sponsor disputes supervisor decision:

- Within: 30 calendar days of supervisor's decision, request for WSATC hearing
- Request must be in writing
 - Must specify reasons supporting the request
 - Request and supporting documents must be given to all parties
 - WSATC must conduct the hearing in conjunction with the regular quarterly meeting

- Within: 30 calendar days after hearing
- WSATC to issue written decision

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XI. COMMITTEE – RESPONSIBILITIES AND COMPOSITION

NOTE: The following is an overview of the requirements associated with administering an apprenticeship committee and/or program. These provisions are to be used with the corresponding RCW and/or WAC.

The sponsor is the policymaking and administrative body responsible for the operation and success of this apprenticeship program. A committee is responsible for the day-to-day operations of the apprenticeship program and they must be knowledgeable in the process of apprenticeship and/or the application of chapter 49.04 RCW and chapter 296-05 WAC. Sponsors must develop procedures for:

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Committee Operations (WAC 296-05-316): (Not applicable for Plant Programs)
Convene meetings at least three times per year of the program sponsor and apprenticeship committee attended by a quorum of committee members as defined in the approved Standards. If the committee does not indicate its definition of quorum, the interpretation will be "50% plus 1" of the approved committee members.
Conference call meetings may be conducted in lieu of regular meetings but must not

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exceed the number of attended meetings and no disciplinary action can be taken during conference call meetings.

B. Program Operations (Chapter 296-05 WAC - Part C & D):

1. The program sponsor will record and maintain records pertaining to the administration of the apprenticeship program and make them available to the WSATC or Department on request.

Records required by WAC 296-05-400 through 455 (see Part D of chapter 296-05 WAC) will be maintained for five (5) years; all other records will be maintained for three (3) years.

2. The sponsor will submit to the Department through the assigned state apprenticeship consultant the following list:

Forms are available on line at

<http://www.lni.wa.gov/TradesLicensing/Apprenticeship/FormPub/default.asp> or from your assigned apprenticeship consultant.

- Apprenticeship Agreements – within first 30 days of employment
- Authorization of Signature forms - as necessary
- Approved Training Agent Agreements (sponsor approving or canceling) – within 30 days
- Minutes of Apprenticeship Committee Meetings – within 30 days of meeting (not required for Plant program)
- Request for Change of Status - Apprenticeship/Training Agreement and Training Agents forms – within 30 days of action by sponsor.
- Journey Level Wage Rate – annually, or whenever changed
- Request for Revision of Standards - as necessary
- Request for Revision of Committee - as necessary
- Related Supplemental Instruction (RSI) Hours Reports (Quarterly):
 - 1st quarter: January through March, by April 10
 - 2nd quarter: April through June, by July 10
 - 3rd quarter: July through September, by October 10
 - 4th quarter: October through December, by January 10
- On-the-Job Work Hours Reports (bi-annual)
 - 1st half: January through June, by July 30
 - 2nd half: July through December, by January 31

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3. The program sponsor will adopt, as necessary, local program rules or policies to administer the apprenticeship program in compliance with these Standards that must be submitted for Department approval and updating these Standards. The apprenticeship program manager may administratively approve requests for revisions in the following areas of the Standards:

- Program name
- Sponsor’s introductory statement (if applicable)

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- Section III: Conduct of Program Under Washington Equal Employment Opportunity Plan
- Section VII: Apprentice Wages and Wage Progression
- Section IX: Related/Supplemental Instruction
- Section XI: Committee - Responsibilities and Composition (including opening statements)
- Section XII: Subcommittees
- Section XIII: Training Director/Coordinator

4. The sponsor will utilize competent instructors as defined in WAC 296-05-003 for related/supplemental instruction. Furthermore, the sponsor will ensure each instructor has training in teaching techniques and adult learning styles, which may occur before or within one year after the apprenticeship instructor has started to provide instruction.

C. Management of Apprentices:

1. Each apprentice (and, if under 18 years of age, the parent or guardian) will sign an apprenticeship agreement with the sponsor, who will then register the agreement, with the Department before the apprentice attends the related/supplemental instruction classes, or within the first 30 days of employment as an apprentice. For the purposes of industrial insurance coverage and prevailing wage exemption under RCW 39.12.021, the effective date of registration will be the date the agreement is received by the Department.

The Department must be notified within 30 days of program approval, of all requests for disposition or modification of agreements, with a copy of the minutes approving the changes, which may be:

- Certificate of completion
- Additional credit
- Suspension (i.e. military service or other)
- Reinstatement
- Cancellation and/or
- Corrections

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2. Rotate apprentices in the various processes of the skilled occupation to ensure the apprentice is trained to be a competent journey-level worker.
3. Periodically review and evaluate apprentices before advancement to the apprentice's next wage progression period. The evidence of such advancement will be the record of the apprentice's progress on the job and during related/supplemental instruction.
4. The sponsor has the obligation and responsibility to provide, insofar as possible, continuous employment for all apprentices in the program. The sponsor may arrange to transfer an apprentice from one training agent to another or to another

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sponsor when the sponsor is unable to provide reasonably continuous employment, or they are unable to provide apprentices the diversity of experience necessary for training and experience in the various work processes as stated in these Standards. The new sponsor or training agent will assume all the terms and conditions of these Standards. If, for any reason, a layoff of an apprentice occurs, the apprenticeship agreement will remain in effect unless canceled by the sponsor.

5. An apprentice who is unable to perform the on-the-job portion of apprenticeship training may, if the apprentice so requests and the sponsor approves, participate in related/supplemental instruction, subject to the apprentice obtaining and providing to the sponsor written requested document/s for such participation. However, time spent will not be applied toward the on-the-job portion of apprenticeship training.
6. Hear and adjust all complaints of violations of apprenticeship agreements.
7. Upon successful completion of apprenticeship, as provided in these Standards, and passing the examination that the sponsor may require, the sponsor will recommend that the WSATC award a Certificate of Completion of Apprenticeship. The program will make an official presentation to the apprentice that has successfully completed his/her term of apprenticeship.

D. Training Agent Management:

1. Offer training opportunities on an equal basis to all employers and apprentices. Grant equal treatment and opportunity for all apprentices through reasonable working and training conditions and apply those conditions to all apprentices uniformly. Provide training at a cost equivalent to that incurred by currently participating employers and apprentices. Not require an employer to sign a collective bargaining agreement as a condition of participation.
2. Determine the adequacy of an employer to furnish proper on-the-job training in accordance with the provisions of these Standards. Require all employers requesting approved training agent status to complete an approved training agent agreement and comply with all federal and state apprenticeship laws and the appropriate apprenticeship Standards.
3. Submit approved training agent agreements to the Department with a copy of the agreement and/or the list of approved training agents within thirty days of committee approval. Submit rescinded approved training agent agreements and/or the list of approved training agents to the Department within thirty days of said action.

E. Composition of Committee: (see WAC 296-05-313)

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SCHWEITZER ENGINEERING LABORATORIES

Apprenticeship committees must be composed of an equal number of management and non-management representatives composed of at least four members but no more than twelve. If the committee does not indicate its definition of a quorum, the interpretation will be "50% plus 1" of the approved committee members.

Apprenticeship committees shall elect a chairperson and a secretary who shall be from opposite interest groups, i.e., chairperson-employers; secretary-employees, or vice versa; EXCEPT, this does not apply where the Registration Agency represents the apprentice(s).

For plant programs the WSATC or the Department designee will act as the employee representative.

Quorum: **"50% plus one**

Program type administered by the committee: **Individual Non-Joint**

The employer representatives shall be:

Scott Kemp, Chairman
2350 NE Hopkins Ct.
Pullman, WA, 99163

Kyle Hildenbrand
2350 NE Hopkins Ct.
Pullman, WA, 99163

The employee representatives shall be:

Doug Knapp, Secretary
2350 NE Hopkins Ct.
Pullman, WA, 99163

Patrick Niehinke
2350 NE Hopkins Ct.
Pullman, WA, 99163

XII. SUBCOMMITTEE:

Subcommittee(s) approved by the Department, represented equally from management and non-management, may also be established under these Standards, and are subject to the main committee. All actions of the subcommittee(s) must be approved by the main committee.

None

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XIII. TRAINING DIRECTOR/COORDINATOR:

The sponsor may employ a person(s) as a full or part-time training coordinator(s)/training director(s). This person(s) will assume responsibilities and authority for the operation of the program as are delegated by the sponsor.

None

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Apprenticeship Committee Representative Qualification Information Experience & Education History

NAME OF PROGRAM/SPONSOR:	Schweitzer Engineering Laboratories
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Committee Representative Name: Scott Kemp
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WORK EXPERIENCE			
POSITION (Most recent first)	EMPLOYER / ORGANIZATION	FROM: (Month & Year)	TO: (Month & Year)
Facilities Operation Supervisor	Schweitzer Engineering Laboratories	12/15	Current
Facilities Lead	Schweitzer Engineering Laboratories	3/15	12/15
Maintenance Technician	Schweitzer Engineering Laboratories	10/13	3/15
Journeymen HVAC Installer	Mikes Heating and Air Conditioning	9/04	10/13

EDUCATION HISTORY				
Name and Location of Training and/or School	Month/Year Attended		Program of Study	Type of Certificate or Degree Awarded, if any
	From	To		
Lewis Clark State College	10/04	5/08	HVAC Apprenticeship Program	HVAC Journeymen

OTHER TECHNICAL CERTIFICATIONS or LICENSES HELD		
State of Washington Gas Heating Mechanic 1		
EPA Universal Refrigeration License	RECEIVED <small>Labor & Industries Apprenticeship Section</small>	RECEIVED BY L&I AC: <u>5/31/16 EL</u>
Plumbing Specialty Journeymen License	MAY 31 2016	E-MAIL RECEIVED BY CENTRAL OFFICE: <u>6/6/16 KR</u>
	Region 6 Spokane, WA	

Sponsors may attach additional pages if necessary.



Apprenticeship Committee Representative Qualification Information Experience & Education History

NAME OF PROGRAM/SPONSOR:	Schweitzer Engineering Laboratories
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Committee Representative Name: Kyle Hildenbrand

WORK EXPERIENCE			
POSITION (Most recent first)	EMPLOYER / ORGANIZATION	FROM: (Month & Year)	TO: (Month & Year)
Facilities Operations Manager	Schweitzer Engineering Laboratories	10/2015	Present
Production Manger	Schweitzer Engineering Laboratories	6/2011	9/2015
Production Supervisor	Schweitzer Engineering Laboratories	6/2006	5/2011
Manufacturing Supervisor	Eaton Corporation	5/2004	5/2006

EDUCATION HISTORY				
Name and Location of Training and/or School	Month/Year Attended		Program of Study	Type of Certificate or Degree Awarded, if any
	From	To		
Washington State University	8/2010	5/2016	Engineering Management and Technology	MS
Kansas State University	6/2002	5/2004	Mechanical Engineering	MS
Kansas State University	8/1998	5/2002	Mechanical and Nuclear Engineering	BS

OTHER TECHNICAL CERTIFICATIONS or LICENSES HELD	
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Apprenticeship Committee Representative Qualification Information Experience & Education History

NAME OF PROGRAM/SPONSOR:	Schweitzer Engineering Laboratories
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Committee Representative Name: Douglas Knapp

WORK EXPERIENCE			
POSITION (Most recent first)	EMPLOYER / ORGANIZATION	FROM: (Month & Year)	TO: (Month & Year)
Property Tech 4	Schweitzer Engineering Labs	2/2012	Present
Senior HVAC service Tech	Mikes heating and Air	5/1989	2/2012

EDUCATION HISTORY				
Name and Location of Training and/or School	Month/Year Attended		Program of Study	Type of Certificate or Degree Awarded, if any
	From	To		
LCSC	9/1983	5/1985	Major Appliance Repair	Certificate

OTHER TECHNICAL CERTIFICATIONS or LICENSES HELD	RECEIVED BY L&I AC:
EL6A HVAC/Refrig Electrical Licence Washington State dept of L&I	<u>5/31/16 EL</u>
HVAC Refrig Electrical Licence State of ID.	RECEIVED Labor & Industries Apprenticeship Section E-MAIL RECEIVED BY CENTRAL OFFICE:
HVAC Journeymans Licence State of ID.	MAY 31 2016 <u>6/6/16 CR</u>
Universal Refrigerant License	Region 6 Spokane, WA

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Apprenticeship Committee Representative Qualification Information Experience & Education History

NAME OF PROGRAM/SPONSOR:	Schweitzer Engineering Lab
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Committee Representative Name: Patrick Niehenke
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WORK EXPERIENCE			
POSITION (Most recent first)	EMPLOYER / ORGANIZATION	FROM: (Month & Year)	TO: (Month & Year)
Maintenance	Schweitzer Engineering	10/04	5/11
Electrical	Schweitzer Engineering	9/11	5/16

EDUCATION HISTORY				
Name and Location of Training and/or School	Month/Year Attended		Program of Study	Type of Certificate or Degree Awarded, if any
	From	To		
Lewis Clark State Collage	9/10	5/14	Electrical	AA

OTHER TECHNICAL CERTIFICATIONS or LICENSES HELD	
Washington State Journey level electrical license # 3NIEHEPJ853QW	
Idaho Journey level electrcal license #007930	
Certification Universal refrigerant #0404630122400	

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Apprenticeship Related/Supplemental Instruction (RSI) Plan Review

Program Sponsor: Schweitzer Engineering Laboratories	
Skilled Occupational Objective:	HVAC Journeymen Service Technician
Term/OJT Hours: 8000	Total RSI Hours: 672
Training Provider:	Training will be provided by Lewis Clark State College, Lewiston Idaho

- By the signature placed below, the program sponsor agrees to provide the prescribed RSI for each registered apprentice and assures that:
 - The RSI content and delivery method is and remains reasonably consistent with the latest occupational practices, improvements, and technical advances.
 - The RSI is coordinated with the on-the-job work experience.
 - The RSI is provided in safe and healthful work practices in compliance with WISHA and applicable federal and state regulations.

<i>Scott Kemp</i>	Scott Kemp, Chairmen
Signature of Program Sponsor	Print Name

- By the signature placed below, the training provider assures that:
 - The RSI will be conducted by instructors who meet the qualifications of "competent instructor" as described in WAC 296-05-003.
 - Has demonstrated a satisfactory employment performance in his/her occupation for a minimum of three years beyond the customary learning period for that occupation; and
 - Meets the State Board for Community and Technical Colleges requirements for a professional-technical instructor (see WAC 131-16-080 through -094), or be a subject matter expert, which is an individual, such as a journey worker, who is recognized within the industry as having expertise in a specific occupation; and
 - Has training in teaching techniques and adult learning styles, which may occur before or within one year after the apprenticeship instructor has started to provide the related technical instruction.
 - If using alternative forms of instruction, such as correspondence, electronic media, or other self-study, such instruction is clearly defined.

<i>Ron E. Smith</i>	Ron E. Smith
Signature of Training Provider	Print Name

Interim Vice President for Finance and Administration	Lewis Clark State College
Title	Organization

(If additional training providers, please provide information and signatures on next page.)

SBCTC Program Administrator has reviewed RSI plan and recommendations of the Trade Committee.

Signature of SBCTC Program Administrator	Print Name	Date
--	------------	------

SBCTC recommends approval SBCTC recommends return to sponsor

F110-519-000 RSI - Apprenticeship Related Supplemental Instruction (RSI) Plan Review Glossary of Term
F100-521-000 Apprenticeship Related Supplemental Instruction (RSI) Plan Review Criteria

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Additional training provider (if necessary)

<i>Scott Kemp</i>	Scott Kemp
Signature of Training Provider	Print Name

Facilities Operation Supervisor	Schweitzer Engineering Laboratories
Title	Organization

Additional training provider (if necessary)

Signature of Training Provider	Print Name

Title	Organization

Additional training provider (if necessary)

Signature of Training Provider	Print Name

Title	Organization

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Program Sponsor: Schweitzer Engineering Laboratories
Skilled Occupational Objective: HVAC Service Technician

NOTE: The description of each element must be in sufficient detail to provide adequate information for review by the SBCTC and review committee.

Describe minimum hours of study per year in terms of (check one):

- 12-month period from date of registration
- Defined 12-month school year
- 2,000 hours of on-the-job training

Element/course: <u>Basic math – Module 1 (YEAR 1)</u>	Planned Hours: 12
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Whole numbers o Addition and subtraction o Fractions o Decimals o Measurement of <ul style="list-style-type: none"> ▪ Lines ▪ Area ▪ Volume ▪ Weights ▪ Angles ▪ Pressure ▪ Vacuum ▪ Temperature o Trade related math 	
Objectives: <ul style="list-style-type: none"> Perform addition, subtraction, multiplication, and division calculations of whole numbers Perform addition and subtraction calculations of common fractions Perform multiplication and division calculations of common fractions Perform addition, subtraction, multiplication, and division calculations of decimal fractions Perform ratio and proportion calculations Perform percent, percentage, and discount calculations Perform angular, length, and converted temperature measure calculations Perform area calculations Perform volume calculations Perform estimates and billing calculations 	

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Element/course: <u>Basic Safety Hand and Power Tools – Module 2 (YEAR 1)</u>	Planned Hours: 18
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Tools <ul style="list-style-type: none"> ▪ Basic hand and power tools ▪ Soldering and brazing 	
Objectives: <ul style="list-style-type: none"> Describe potential excavation site hazards (1hr) Explain proper personal protective equipment use (1hr) 	

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Describe proper material handling, storage, use, and disposal
 Describe ladder, stairway and scaffold hazards and proper use
 Describe jobsite electrical hazards and proper lockout/tagout use
 Describe proper refrigerant and pressure vessel usage and storage
 Identify MSDS properties for refrigerants (1hr)
 Describe proper hand and power tool use
 Describes soldering and brazing methods

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Element/course: Fuel gas piping and venting – Module 3 (YEAR 1) Planned Hours: 60

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

Description of element/course:

- o Installation of fuel piping according to code and industry standards
- o Installation of venting according to code and industry standards
- o Installation of combustion air according to code and industry standards
- o Installation of make- up air according to code and industry standards
- o IFGC requirements

Objectives:

- Identify International Code administrative and enforcement rules
- Define key terms as applied to the IFGC
- Describe the building structural safety requirements for fuel gas equipment installation
- Examine fuel gas equipment combustion, ventilation and dilution air requirements
- Identify fuel gas equipment location, access and service space requirements
- Describe proper appliance condensate disposal and clearance reduction methods
- Perform gas pipe sizing exercises
- Identify proper gas pipe installation methods
- Describe proper gas pipe inspection, testing and purging procedures
- Describe chimney and vent types and construction
- Examine chimney installation requirements
- Examine gas vent installation requirements
- Describe gas appliance category I, II, III and IV characteristics
- Identify proper gas vent connector installation requirements
- Describe category I venting principals
- Perform single appliance category I vent sizing exercises
- Perform multiple appliance category I vent sizing exercises
- Determine capacity penalties for offsets in common vent and vent connectors
- Examine specific fuel gas appliance installation requirements
- Describe mechanical equipment location, access and service space requirements

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Element/course: Introduction to code – Module 4 (YEAR 1) Planned Hours: 6

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

Description of element/course:

- How to access information related to HVAC industry
 - o Idaho Code and Administrative rules
 - o International Mechanical Code

Objectives:

- Describe Idaho HVAC code and Administrative Rules requirements
- Identify International Mechanical Code general chapter requirements
- List International Mechanical Code HVAC specific equipment section

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Element/course: <u>Energy sources – Module 5 (YEAR 1)</u>	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Principles of different fuel sources o Fuel Oil o Electric o Gas / LP o Hydro / geothermal* o Wind / solar* Objectives: Explain natural, LP gas, and fuel oil combustion characteristics Describe the development and application of geothermal heat pump systems Describe the development and application of renewable energy systems	

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Element/course: <u>Basic systems overview – Module 6 (YEAR 1)</u>	Planned Hours: 12
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Warm air furnaces o Split system air conditioners o Commercial air conditioning systems o Forced air duct systems Objectives: Describe mid-efficiency and high efficiency furnace operation Describe the typical configuration of residential split air conditioning systems List the various types of commercial air conditioning systems and their application Describe the configuration of four common duct systems	

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Element/course: <u>Intro to applied science – Module 7 (YEAR 1)</u>	Planned Hours: 24
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o History of HVAC/R o Temperature measurement and conversion o Thermodynamics o Pressure / vacuum o Refrigeration cycle and components o Basic elements of matter o <i>Applied math</i> – 6 hours Objectives: Describe a brief modern history of HVAC Describe energy types and their properties Perform energy conversion calculations Perform sensible, latent and total heat calculations Differentiate between saturated, superheated, and subcooled refrigerant Explain atmospheric, absolute, and gauge pressure relationship Convert gauge pressure, absolute pressure and vacuum Diagram a basic refrigeration cycle identifying pressure, temperature and state of refrigerant List the type and function of the four major refrigeration components	

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Element/course: <u>Customer Service – Module 8 (YEAR 1)</u>	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Cleanliness <ul style="list-style-type: none"> ▪ Site ▪ Personal o Professional appearance o Timeliness o Work ethic o Communication skills Objectives: Describe good customer communication procedures	

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Element/course: <u>Appliance installation – Module 1 (YEAR 2)</u>	Planned Hours: 24
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Oil and fuel gas appliance installation o Split and packaged air conditioning system installation o Forced-air system installation o NEC – electrical code as applied to HVAC installation o IFGC, IMC, IRC code requirements for HVAC installation Objectives: Explain HVAC electrical branch circuit sizing and installation factors Interpret HVAC manufacturer electrical name plate data Explain combustion air and venting requirements for Category I, III and IV appliances Describe gas appliance installation, start-up and checkout procedures Describe oil appliance installation, start-up and checkout procedures Describe sheet metal, fiberglass and flex duct installation procedures Identify split and packaged air conditioning unit components Explain split and packaged air conditioning unit installation guidelines	

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Element/course: <u>Introduction to blueprints and specifications – Module 2 (YEAR 2)</u>	Planned Hours: 24
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Site plans, floor plans and elevation drawings o Mechanical, plumbing and electrical drawings o Specifications o Shop drawings and submittals o Takeoff procedures o As-built drawings Objectives: Read blueprints and architect plans Interpret mechanical, plumbing and electrical drawings Interpret specification documents and apply to plans Interpret shop drawings and apply to plans and specifications Describe a submittal and its derivation, routing and makeup	

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Develop cut lists for duct runs from shop drawings
 Interpret as-built modifications on HVAC mechanical plans
 Perform an HVAC equipment and material takeoff

Element/course: <u>Basic electricity – Module 3 (YEAR 2)</u>	Planned Hours: 60
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course:	
<ul style="list-style-type: none"> o Basic electrical theory o Electrical safety o Series and parallel circuits o AC and DC theory o HVAC electrical control devices o HVAC electrical load devices o HVAC electrical schematic diagrams o Power generation and distribution o HVAC branch circuits o Applied math – 9 hours integrated <ul style="list-style-type: none"> ▪ Ohm's Law ▪ Engineering notation o Single-phase, three-phase and ECM Motors o Single-phase motor starting components 	<p>RECEIVED BY L&I AC: <u>6/13/16 EL</u></p> <p>E-MAIL RECEIVED BY CENTRAL OFFICE: <u>6/16/16 KR</u></p> <p>RECEIVED Labor & Industries Apprenticeship Sector JUN 13 2016 Region 6 Spokane, WA</p>
Objectives:	RECEIVED BY L&I AC: <u>6/4/16 EL</u>
<ul style="list-style-type: none"> Examine basic electrical theory Explain series circuit characteristics Explain parallel circuit characteristics Calculate electrical circuit values Analyze series/parallel circuits Describe electrical meter operation Measure electrical circuit values Identify electrical symbols Draw basic HVAC electrical circuit diagrams Interpret basic HVAC schematic diagrams Interpret advanced HVAC schematic diagrams Explain AC circuit characteristics Describe power distribution transformer systems Calculate HVAC branch circuit conductor, breaker and disconnect sizes Examine basic motor theory Draw single phase motor diagrams Explain single-phase motor starting relay operation Calculate motor capacitor replacement values Explain three-phase motor operation Explain ECM motor operation 	<p>E-MAIL RECEIVED BY CENTRAL OFFICE: <u>6/6/16 KR</u></p> <p>RECEIVED Labor & Industries Apprenticeship Sector JUN 04 2016 Region 6 Spokane, WA</p>

Element/course: <u>Indoor air quality – Module 4 (YEAR 2)</u>	Planned Hours: 15
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course:	
<ul style="list-style-type: none"> o Pollutants and pollutant pathways o Prevention, control and remediation strategy o Tools and testing 	

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- o Energy recovery ventilation systems*
- o Filters and humidifiers*
- o IAQ checklists
- o Home energy/IAQ evaluation*

Objectives:

- Describe indoor air quality factors as related to HVAC
- Identify various indoor air quality pollutant and pollutant pathways
- Describe indoor air quality evaluation and measurement tools
- Explain appropriate prevention, control and resolution strategies for IAQ issues
- Determine guidelines for involving professionals in IAQ issues

Element/course: <u>Residential load calculation – Module 5 (YEAR 2)</u>	Planned Hours: 21
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Calculations to determine residential heat gain / loss* Objectives: Examine importance of heat load calculation in building design Differentiate sensible, latent and total heat gain/loss Determine U values and R values for various building construction components Calculate Btu gain/loss values using HTM and temperature difference factors Determine heating and cooling load temperature difference and daily range values Explain the relationship between house orientation and solar heat gain Perform building component area and volume calculations from blueprints Perform winter/summer infiltration calculations using Manual J procedures Perform heat gain calculations using Manual J procedures Perform heat loss calculations using Manual J procedures Determine sensible, latent and total heat house block and room values	

Element/course: <u>Basic controls – Module 1 (YEAR 3)</u>	Planned Hours: 30
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Basic electro-mechanical control devices o Gas, oil, electric and hydronic heating controls o Manufacturer wiring diagram analysis o Troubleshooting electric control devices o Residential air conditioning control systems o Commercial and industrial air conditioning control systems o Electronic control devices o Electronic control module troubleshooting procedures Objectives: Explain contactor, relay and overload operation Explain thermostat, pressure switch and transformer operation Describe standing pilot gas burner control systems Describe intermittent and direct ignition gas burner control systems Examine gas furnace manufacturer wiring diagrams Explain oil furnace primary control operation Describe electric furnace operating sequence Describe hydronic heating system controls	

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Perform gas, oil and electric heating control system troubleshooting procedures
 Describe motor circuit troubleshooting procedures
 Examine packaged and split air conditioning systems wiring diagrams
 Identify commercial and industrial air conditioning system control methods
 Describe basic electronic control system troubleshooting procedures

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Element/course: System air flow and duct sizing – Module 2 (YEAR 3) Planned Hours: 30

6/13/16 EL

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

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Description of element/course:

- o Basic principles of air flow
- o Air distribution system components
- o Air distribution system application and configuration
- o Air flow calculation
- o Primary equipment selection using Manual J and Manual S*
- o Secondary equipment selection using manufacturer tables
- o Basic duct system layout from floor plans
- o Duct system sizing using Manual D*

Objectives:

- Describe basic air flow characteristics
- Explain duct system pressures
- Calculate duct system air flow
- Determine proper air flow requirements
- Describe air distribution system configurations
- Select primary heating/cooling equipment using Manual J and Manual S data
- Determine air-side component pressure drops from manufacturer tables
- Sketch a residential duct system layout using a home floor plan and Manual D tables
- Complete Manual D effective length, friction rate and duct sizing worksheets
- Perform Manual D duct sizing exercises

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Element/course: Basic air conditioning and refrigeration – Module 3 (YEAR 3) Planned Hours: 30

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

Description of element/course:

- o Thermodynamics and heat transfer principals
- o Refrigeration cycle operating principals
- o Pressure / temperature relationship
- o Refrigeration system components and operation
- o Refrigerant properties and characteristics
- o Refrigerant oils – types and application
- o Refrigeration system access tools and procedures
- o Refrigerant management- EPA Section 608*
- o Refrigeration system recovery, evacuation and charging procedures

Objectives:

- Explain latent, sensible and total heat differences
- Diagram refrigeration cycle conditions and components
- Explain pressure-enthalpy diagrams
- Examine compressor design and efficiency
- Explain water/air-cooled condenser operation and performance
- Examine metering device design and operation
- Describe evaporator types

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Identify proper refrigerant line sizing and installation practices
 Explain various refrigerant physical and chemical properties
 Explain refrigerant oil properties and application
 Describe proper refrigeration system access procedures
 Differentiate between recovered, recycled and reclaimed refrigerant
 Explain proper refrigerant recovery, evacuation and charging procedures

Element/course: Introduction to Hydronics – Module 4 (YEAR 3)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Operating principles o Piping systems o Preventative maintenance o Components o System overview Objectives: Identify hydronic piping system types Describe hydronic heating system components Explain hydronic heating systems drain and fill procedures Diagram basic hydronic heating system control circuits	

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Element/course: Basic sheet metal – Module 5 (YEAR 3)	Planned Hours: 39
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Sheet metal layout and processes o Parallel line development and fabrication o Radial line development and fabrication o Triangulation development and fabrication o Layout and fabricate various duct fittings Objectives: Define basic sheet metal layout terms Explain three methods of sheet metal layout development Explain parallel line development procedures Layout and fabricate the following sheet metal fittings: Pittsburgh seam and square elbow Layout and fabricate the following sheet metal fitting: 90 degree elbow and transition Explain radial line development procedures Layout and fabricate the following sheet metal fitting: symmetrical tapered duct Layout and fabricate the following sheet metal fitting: square to square tapered duct Explain triangulation development procedures Layout and fabricate the following sheet metal fitting: two-way offset transition Layout and fabricate the following sheet metal fitting: tapered duct section	

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Element/course: Introduction to service – Module 6 (YEAR 3)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Air conditioning mechanical, electrical and refrigeration system analysis o Gas heating system mechanical, electrical and combustion analysis 	

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- o Oil heating system mechanical, electrical and combustion analysis
 - o Electric heating system mechanical and electrical analysis
 - o Heating and cooling equipment maintenance procedures*
- Objectives:
- Describe air conditioning system problems and prescribe corrections
 - Describe gas heating system problems and prescribe corrections
 - Describe oil heating system problems and prescribe corrections
 - Describe electric heating system problems and prescribe corrections
 - List gas, oil and electric heating and air conditioning maintenance procedures

Element/course: Introduction to Testing and Balancing – Module 1 (YEAR 4)	Planned Hours: 12
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Psychrometrics – Fundamentals of the Properties of Air o Psychrometrics – Calculating the Performance of HVAC Equipment o Testing and Balancing Tools* o Basic Air & Water Testing and Balancing Procedures* Objectives: Explain psychrometric properties Diagram psychrometric conditions Describe air flow and water flow measuring devices Explain basic air flow and water flow balancing procedures	

Element/course: Introduction to HVAC Control Strategies – Module 2 (YEAR 4)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o HVAC Systems & Control Basics o Electric Control Systems o Pneumatic & DDC Control Systems Objectives: Describe basic HVAC control principals Interpret basic HVAC pneumatic control diagrams Explain DDC control system basic operation	

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Element/course: Advanced Air Conditioning and Heat Pump Systems – Module 3 (YEAR 4)	Planned Hours: 39
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> o Commercial Air Conditioning Systems o Packaged Unit Air Handling Systems o Water Chillers o Cooling Towers o Basic Heat Pump Theory o Heat Pump Components o Heat Pump Charging Procedures o Heat Pump Electrical Systems o Heat Pump Defrost Systems 	

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- o Heat Pump Service Procedures
 - o Heat Pump Troubleshooting Procedures
 - o Water Source Heat Pump Design*
 - o Water Source Heat Pump Components
 - o Water Source Heat Pump Troubleshooting Procedures
- Objectives:
- Explain commercial fan coil unit operation
 - Examine package unit building system configurations
 - Describe building chilled water system operation
 - Describe induced and forced draft cooling tower operation
 - Explain heat pump heating and cooling cycles
 - Describe the purpose and operation of various heat pump components
 - Prescribe heat pump charging procedures
 - Examine heat pump manufacturer electrical wiring diagrams
 - Differentiate heat pump time/temperature and demand defrost control systems
 - Explain heat pump service checklist readings
 - Interpret air source heat pump diagnostics
 - Explain geothermal heat pump system applications
 - Describe water-to-air and water-to-water heat pump operation
 - Interpret water source heat pump diagnostics

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Element/course: <u>Advanced Service – Module 4 (YEAR 4)</u>	Planned Hours: 24
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Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

- Description of element/course:
- o Air Conditioning Air Side Troubleshooting Procedures
 - o Air Conditioning Refrigeration Side Troubleshooting Procedures
 - o Air Conditioning Service Diagnostics
 - o Air Conditioning Electrical Schematics & Troubleshooting Procedures
 - o Gas Furnace Electrical Schematics & Troubleshooting Procedures
 - o Gas Furnace Service Diagnostics
 - o Electric Furnace Service Diagnostics
 - o Oil Furnace Service Diagnostics
- Objectives:
- Prescribe air flow troubleshooting procedures
 - Explain standard and high efficiency air conditioner operation
 - Explain service checklist readings
 - Determine variable load air conditioning operating conditions
 - Prescribe refrigeration side troubleshooting procedures
 - Troubleshoot residential and commercial control systems
 - Interpret air conditioning manufacturer electrical wiring diagrams
 - Perform interactive air conditioning technician service calls
 - Prescribe gas furnace troubleshooting procedures
 - Perform interactive gas furnace technician service calls
 - Prescribe electric furnace troubleshooting procedures
 - Prescribe oil furnace troubleshooting procedures

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Element/course: <u>System Integration and Design (Project format) – Module 5 (YEAR 4)</u>	Planned Hours: 12
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Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

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Description of element/course:

- o Residential Comfort and Design Standards*
- o Primary Equipment Selection and Sizing*
- o Primary Equipment Installation and Operation*
- o System Replacement and Retrofit*

Objectives:

- Describe residential comfort and design standards
- Examine residential equipment selection and sizing requirements
- List residential equipment installation and startup procedures
- Prescribe residential equipment retrofit procedures

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Element/course: Code review – Module 6 (YEAR 4)	Planned Hours: 42
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Mode of Instruction (please check all that apply):

Classroom Lab On-line Self-study

Provided by: Lewis Clark State College

Description of element/course:

- o Review of International Fuel Gas Code (27 hrs)
- o Review of International Mechanical Code* (9 hrs)
- o Review of National Electrical Code (6 hrs)

Objectives:

- Identify International Code administrative and enforcement rules
- Describe the building structural safety requirements for fuel gas equipment installation
- Examine fuel gas equipment combustion, ventilation and dilution air requirements
- Identify fuel gas equipment location, access and service space requirements
- Perform gas pipe sizing exercises
- Identify proper gas pipe installation methods
- Examine chimney and gas vent installation requirements
- Perform single and multiple category I vent sizing exercises
- Examine specific fuel gas appliance installation requirements
- Describe mechanical equipment location, access and service space requirements
- Identify proper supply, return and exhaust air system installation methods
- Examine specific mechanical equipment installation requirements
- Identify proper HVAC equipment branch circuit installation methods
- Perform HVAC equipment branch circuit sizing exercises

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Element/course: Project Management – Module 7 (YEAR 4)	Planned Hours: 9
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Mode of Instruction (please check all that apply):

Classroom Lab On-line Self-study

Provided by: Lewis Clark State College

Description of element/course:

- o Personnel Management
- o Communication Skills
- o Project Control
- o Inter-Trade Relations
- o Work Ethics

Objectives:

- Perform problem solving and decision making exercises
- Perform active communication exercises
- Describe proper project control methods

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Element/course: Lewis Clark State College	Basic Trainee Classes, Provided by: "Authorized providers" WAC 296-46B-970 2.(B) (i), Continuing education and classroom education requirements.	Planned Hours: 96
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by:		
Description of element/course: Electrical trainees must take certain basic trainee classroom instruction courses to maintain their training certificate. See list of courses, http://www.lni.wa.gov/TradesLicensing/Electrical/files/edclass/BasicTraineeClassroomEducation.pdf		

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Apprenticeship Related/Supplemental Instruction (RSI) Plan Review

Program Sponsor: Schweitzer Engineering Laboratories	
Skilled Occupational Objective:	Industrial Maintenance Electrician
Term/OJT Hours: 8000	Total RSI Hours: 741
Training Provider:	Training will be provided by Lewis Clark State College, Lewiston Idaho

- By the signature placed below, the program sponsor agrees to provide the prescribed RSI for each registered apprentice and assures that:
 - The RSI content and delivery method is and remains reasonably consistent with the latest occupational practices, improvements, and technical advances.
 - The RSI is coordinated with the on-the-job work experience.
 - The RSI is provided in safe and healthful work practices in compliance with WISHA and applicable federal and state regulations.

<i>Scott Kemp</i>	Scott Kemp, Chairmen
Signature of Program Sponsor	Print Name

- By the signature placed below, the training provider assures that:
 - The RSI will be conducted by instructors who meet the qualifications of "competent instructor" as described in WAC 296-05-003.
 - Has demonstrated a satisfactory employment performance in his/her occupation for a minimum of three years beyond the customary learning period for that occupation; and
 - Meets the State Board for Community and Technical Colleges requirements for a professional-technical instructor (see WAC 131-16-080 through -094), or be a subject matter expert, which is an individual, such as a journey worker, who is recognized within the industry as having expertise in a specific occupation; and
 - Has training in teaching techniques and adult learning styles, which may occur before or within one year after the apprenticeship instructor has started to provide the related technical instruction.
 - If using alternative forms of instruction, such as correspondence, electronic media, or other self-study, such instruction is clearly defined.

<i>Ron E. Smith</i>	Ron E. Smith	RECEIVED Labor & Industries Apprenticeship Section
Signature of Training Provider	Print Name	JUN 04 2016
Interim Vice President for Finance and Administration	Lewis Clark State College	Region 6 Spokane, WA
Title	Organization	

(If additional training providers, please provide information and signatures on next page.)

SBCTC Program Administrator has reviewed RSI plan and recommendations of the Trade Committee.

Signature of SBCTC Program Administrator	Print Name	Date
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SBCTC recommends approval SBCTC recommends return to sponsor

F110-519-000 RSI - Apprenticeship Related Supplemental Instruction (RSI) Plan Review Glossary of Term

F100-521-000 Apprenticeship Related Supplemental Instruction (RSI) Plan Review Criteria

F100-520-000 Apprenticeship Related/Supplemental Instruction (RSI) Plan Review 11-2013

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Additional training provider (if necessary)

<i>Scott Kemp</i>	Scott Kemp
Signature of Training Provider	Print Name
Facilities Operations Supervisor	Schweitzer Engineering Laboratories
Title	Organization

Additional training provider (if necessary)

Signature of Training Provider	Print Name
Title	Organization

Additional training provider (if necessary)

Signature of Training Provider	Print Name
Title	Organization

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Program Sponsor: Schweitzer Engineering Laboratories

Skilled Occupational Objective: Industrial Maintenance Electrician

NOTE: The description of each element must be in sufficient detail to provide adequate information for review by the SBCTC and review committee.

Describe minimum hours of study per year in terms of (check one):

- 12-month period from date of registration
- Defined 12-month school year
- 2,000 hours of on-the-job training

Element/course: <u>Introduction to Electrical Work: Safety</u> <u>General Safety Rules On-The-Job Safety (YEAR 1)</u>	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • State basic on-the-job safety rules • Explain what a material safety data sheet (MSDS) is and its requirements. • Explain safety procedures for trenches • Explain safety for confined space • Explain lockout and tagout • Explain protective clothing to include eye and hearing protection • Explain the use of a safety harness • Explain safety for ladders and scaffolds • State the purpose of arc-fault and ground-fault circuit interrupters 	

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Element/course: <u>Electrical Theory: Atomic Structure, Electrical Qualities, and Ohm's Law. (YEAR 1)</u>	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Explain the structure of the atom • Explain electron flow • State the difference between insulators and semiconductors • Explain the basic methods of producing electricity • Describe electrical effects such as magnetism, light, and heat. • Define a coulomb • Define an ampere • Define an ohm • Define a watt • Calculate different electrical values using Ohm's law. • Select the proper Ohm's law formula from a chart. 	

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Element/course: <u>Static Electricity and Magnetism, and Resistors (YEAR 1)</u>	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study	

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Provided by: Lewis Clark State College
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none">• Discuss the nature of static electricity• Discuss lighting protection• Give examples of both nuisance and useful static charges• Discuss the properties of permanent magnets• Discuss the operation of electromagnets• Determine the polarity of an electromagnet when the direction of the current is known• Determine the resistance of a resistor using the color code or an ohmmeter• Determine whether a resistor is operating within its power rating

Element/course: Series Circuits (YEAR 1)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none">• Discuss the properties of series circuits• List three rules for solving electrical values of series circuits• Calculate values of voltage, current, resistance, and power for series circuits	

Element/course: Parallel Circuits (YEAR 1)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none">• Discuss the characteristics of parallel circuits• State three rules for solving electrical values of parallel circuits• Solve the missing values in a parallel circuit using the three rules and Ohm's law• Calculate current values using the current divider formula	

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Element/course: Combination Circuits (Year 1)	Planned Hours: 15
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College e	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none">• Define a combination circuit• List the rules for parallel circuits• List the rules for series circuits• Solve combination circuits using the rules for parallel circuits, rules for series circuits, and Ohm's law	

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Element/course: Electrical Testing Equipment (YEAR 1)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Use an ohm meter and measure any resistance in electrical equipment or conductor • Measure voltage between phases and phase to ground • Take an ampere reading of any load • Diagram the proper connection of a watt meter • State the operation characteristics of analog and digital meters • Recognize the wave form on an oscilloscope 	

Element/course: Introduction to the National Electrical Code and Definitions NEC Articles 90 and 100 (YEAR 1)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College e	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Understand how the NEC began and its purpose • Understand how changes to the code evolve • Be familiar with the terminology, presentation, and format of the NEC • State the roles of nationally recognized testing laboratories, the National Electrical Manufacturers Association, and the National Fire Protection Association • Accurately evaluate a location as accessible, readily accessible, or not readily accessible • Identify equipment classified as appliances • State the four categories of branch circuits • State the difference between a continuous load and a non-continuous load • State the difference between a branch circuit and a feeder • State the difference between „grounded“ and „grounding“ • Define what “in sight” means in the NEC • Give examples of damp, wet, and dry locations using the code book • Determine which conductors are the neutral conductors • Define a separately derived system using the NEC 	

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Element/course:	Boxes and Enclosures (YEAR 1) References: Objectives to be taught from NEC Articles 312, 314, 382, and other appropriate NEC sections.	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine the cubic inch capacity of boxes when installing conductors # 6 AWG and smaller • State which items replace volume allowances of conductor fill when calculating box fill • State how identical switches or receptacles can be mounted side by side in a two gang box can have different cubic-inch volume allowances • Determine the box size when the number of conductors is known • Know the minimum conductor length to be left inside a box • Explain what must be accessible after installation • State the mounting and supporting provisions for boxes and conduit bodies using the NEC • Determine the type of box needed for various applications using the NEC • Calculate for junction box sizing containing #4 AWG and larger conductors using the NEC 		

Element/course:	Cables (YEAR 1) References: Objectives to be taught from NEC Articles 320 through 340 and other appropriate NEC sections	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • State the distance from the wood framing member a cable can be installed unless a steel plate is installed • State the requirements for protection of cable in metal framing using the NEC • State the sealing requirements in fire-resistant-rated construction when electrical penetrations are made • Identify what cables are permitted in spaces used for environmental air • Determine the support requirements for MC, AC, and nonmetallic-sheathed cable using the NEC • Identify the conductors in a cable and use the NEC to state how certain conductors can be re-identified • Determine underground installation provisions the NEC • Identify special application cables using the NEC (This is not to be for installation requirements as this is for first year students) 		

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<u>Raceways and Conductors (YEAR 1)</u> References: Objectives are based in NEC Sections 110.14, 240.4, 300.19; and NEC Articles 310, 342 through 378, Chapter 9 tables, and other appropriate NEC sections.	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine the general provisions for any raceway installation using the NEC • Determine the type of raceways suited for individual installations • Determine the support requirements for various raceways using the NEC • Determine the provisions for nonmetallic and flexible conduit using the NEC • Successfully calculate the electrical trade size conduit required for any circuit or feeder • Determine basic conductor properties using the NEC • Show conductor temperature limitations • Determine the provisions for conductors connected in parallel • Apply conductor ampacity correction factors to include continuous loads. 	

<u>General Provisions for One-Family Dwellings (YEAR 1)</u> References: Objectives are based in NEC Articles 210, 250, 314, 402, 404, 406, 410, 422, and other appropriate NEC sections.	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Calculate the minimum number of 15 and 20 amp branch circuits in a one-family dwelling • Determine the requirements for single receptacles on individual branch circuits • Determine the branch-circuit ratings allowed for general-purpose receptacles • Demonstrate the layout of general-purpose receptacles in a dwelling • Determine the receptacle rating allowed on various size branch circuits using the NEC • Determine the requirements for wet bar receptacles using the NEC • Determine the requirements for lighting and switching using the NEC • Determine how and when to use the white conductor as an ungrounded conductor • Determine any general requirement for boxes using the NEC • Determine any illumination requirement for entrances and exits • Determine the allowable use of vegetation such as trees for the mounting of outlets. 	

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Specific Provisions for One-Family Dwellings (YEAR 1)		Planned Hours: 6
Element/course: References: Objectives are based in NEC Articles 210, 410, 422, and other appropriate NEC sections.		
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine the required ampere rating for any receptacle or branch circuit in kitchens, pantries, dining rooms, breakfast rooms, and similar locations • Determine the requirements for counter top receptacle placement using the NEC. • State the minimum number of utility circuits required and their application • Determine the requirements for appliances both cord and plug and permanently connected • Calculate the load requirements for appliance branch circuits • State the specific provisions for GFCI placement • Identify luminaries permitted in closets and its placement • Define a bathroom by the NEC and discuss the circuit requirements for receptacles, lights and fans • Determine the requirements for receptacles and lighting in attached garages, detached garages, and basements • Determine the requirements for laundry rooms to include the clothes dryer • Determine the lighting and receptacle requirements for attic, crawl space, and HVAC equipment. 		

Load Calculations for One-Family Dwellings (YEAR 1)		Planned Hours: 12
Element/course: References: Objectives are based in NEC Articles 210, 220, 310 and other appropriate NEC sections.		
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Calculate the general lighting for a one-family dwelling • Specify the volt-amp requirements for small appliance and laundry branch circuits • Apply demand factors to the general lighting load • Apply demand factors to fastened-in-place appliances • Calculate feeder demand loads for household clothes dryers • Calculate feeder demand loads for household cooking equipment • Calculate feeder demand loads for heating and air conditioning • Calculate a one-family dwelling or feeder using the standard method • Calculate a one-family dwelling or feeder using the optional method • Size service and feeder conductors • Calculate the minimum size neutral conductor • Select the proper grounding electrode conductor 		

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<u>Services and Electrical Equipment for One Family Dwellings (YEAR 1)</u>		Planned Hours: 9
Element/course: References: Objectives are based in NEC Articles 110, 225, 230, 240, 250, 300, 310 and other appropriate NEC sections.		
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine adequate strength for a mast supporting service-drop conductors • Explain the use of service-entrance cable, though it is used little in the western U.S. • Define a service lateral and briefly explain its provisions • Determine clearances for service and outside overhead wiring • Determine work space required for electrical equipment, services, and panels • Define a panelboard, an enclosure, and a cutout box • Determine the proper application and use of circuit breakers and fuses using the NEC • Determine the appropriate table (310.15(B)(7) or 310.15(B)(16) for conductor sizing • Size the grounding electrode conductor, equipment grounding conductor, main bonding jumper, bonding jumpers on the supply side or load side of the main breaker or fuse on any one-family dwelling service • Properly install grounded and grounding conductors in subpanels • Prevent objectionable current flow in grounding conductors and equipment • Properly install a panelboard in a separate building or structure 		

<u>Comprehensive Provisions for Multifamily Dwellings (YEAR 1)</u>		Planned Hours: 9
Element/course: References: Objectives are based in NEC Articles 210, 230, 240, 310, Chapter 9, Tables 8 and 9, and other appropriate NEC sections.		
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine when more than one service can be installed on a multifamily building • Determine the proper number of disconnects allowed on a service • Determine proper access to a units disconnecting means by any occupant • Properly install the grounding electrode conductors to the grounding electrode • Determine the proper use of tables 310.15(B)(7) and 310.15(B)(16) when sizing service and feeder conductors • Determine outdoor receptacle placement • Calculate voltage-drop (The use of Ugly's Electrical Reference is strongly recommend) 		

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Hand Bending Conduit (YEAR 1)		Planned Hours: 3
Element/course:	References: www.mikeholt.com/documents/freestuff/BendingRoundRaceways.pdf or publications from manufactures such as Ideal, Greenlee, etc.	
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Properly use a hand bender • Create a 90 degree the correct length using a hand bender • Bend an offset for any measurement • Create a saddle bend • Have the confidence to begin running conduit under supervision on the job 		

Commercial Locations: General Provisions (YEAR 1)		Planned Hours: 6
Element/course:	References: Objectives are based in NEC Articles 210, 220, 310, 410, 600, and other appropriate NEC sections.	
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Compare receptacle placement with that of one-family dwellings to show the difference • Determine the receptacle requirements in a commercial bathroom • Determine the sign outlet requirements in a commercial installation • Determine the branch circuit requirements for motors and air conditioning • Determine the volt-amp ratings for receptacles (single, duplex, quad, etc.) • Determine the maximum number of receptacles permitted on a 15 amp and 20 amp circuit • Apply accessibility requirements to receptacles in guest rooms of hotels and motels • Determine showcase and show window requirements using the NEC • Calculate general lighting load based on square-foot area • Determine the provisions for florescent, HID, recessed, and track lighting provisions • Determine the proper use and restrictions when using luminaries as raceways • Determine metal pole conductor access requirements 		

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Commercial Locations: Services, Feeders and Provisions (YEAR 1)	Planned Hours: 6
Element/course: References: Objectives are based in NEC Articles 110, 250, 368, 408, and other appropriate NEC sections.	

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

Description of element/course:

At the completion of this lesson the student should be able to:

- Determine minimum vertical clearances for each installation using the NEC
- Apply dedicated space requirements to electrical equipment to include the area that is to be clear of foreign systems unless protection is provided
- Determine the working clearances of any installation using the NEC
- Properly install both grounding and grounded conductors on the line side and load side of the service supply conductors
- Determine the conditions that require ground-fault protection of equipment
- Recognize a transformer and a generator separately derived systems
- Properly ground and bond a separately derived system
- Recognize and explain the use of busways

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Hazardous Locations: Overview (YEAR 1)	Planned Hours: 6
Element/course: References: Objectives are based in NEC Articles 500 through 516	

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

Description of element/course:

The following areas of study are to be considered introductory to first year students and should be treated as such.

At the completion of this lesson the student should be able to:

- Explain what a hazardous location is
- Determine if a classified location is Class I, II or III and if it is Division 1 or 2 using the NEC
- Determine the provisions pertaining to commercial garages and repair and storage facilities using the NEC
- Determine the provisions for buildings in which aircraft are stored and repaired
- Determine the provisions for a motor fuel dispensing facility

Health Care (YEAR 1)	Planned Hours: 6
Element/course:	

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by: Lewis Clark State College

Description of element/course:

The following areas of study are to be considered introductory to first year students and should be treated as such.

At the completion of this lesson the student should be able to:

- Discuss basic health care terminology
- Determine the grounding and bonding requirements of any health care facility
- Identify patient care areas as general care or critical care and their branch circuit requirements

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- Determine the tamper-resistant requirements of pediatric facilities
- Define the two types of systems (equipment and emergency)

Element/course: Special Occupancies (YEAR 1) References: Objectives are based in NEC Articles 500 through 516	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: The following areas of study are to be considered introductory to first year students and should be treated as such. At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Define "places of assembly" according to the NEC • Determine manufactured building requirements • Determine agricultural building requirements • Determine requirements for mobile home parks and recreational vehicle parks 	

Element/course: REVIEW: Ohm's Law and Series, Parallel and Combination Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Demonstrate basic competencies in calculating series, parallel, and combination circuits using the Ohm's law wheel 	

Element/course: Basic Trigonometry (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Define a right triangle • Use the Pythagorean theorem to solve problems concerning right triangles • Solve problems using sines, cosines, and tangents 	

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Element/course: Alternating Current (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Discuss the difference between AC and DC • Compute instantaneous values of voltage and current for a sine wave • Compute peak, RMS, and average values of voltage and current • Define the phase relationship of voltage and current in a pure resistive circuit 	

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Element/course: Inductance in AC Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Define the properties of inductance in an AC circuit • Discuss inductive reactance • Calculate the values of inductive reactance and inductance • Define the relationship of voltage and current in a pure inductive circuit • Calculate values for inductors connected in series and parallel • Define reactive power • Define the Q of a coil 	

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Element/course: Resistive-Inductive Series Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> • Define the relationship of resistance and inductance in an AC circuit • Define power factor • Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RL series circuit • Calculate the phase angle for current and voltage in an RL circuit • Connect an RL series circuit and take measurements using test instruments 	

Element/course: Resistive-Inductive Parallel Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Define the operation of a parallel circuit containing resistance and inductance • Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RL parallel circuit • Connect an RL parallel circuit and measure circuit values using test instruments 	

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Element/course: *Capacitors (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> List three factors that detriment the capacitance of a capacitor Discuss the electrostatic charge State the difference between polarized and non-polarized capacitors Calculate the values for series and parallel connections of capacitors <p>*Note that power factor correction is and always has been "green." That is why the studies concerning capacitance are so identified. Though the watts consumed do not change for a facility with, say, 80% power factor, the power company needs to deliver less total volt-amps if it is corrected.</p>	

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Element/course: *Capacitance in AC Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> Explain why current appears to flow through a capacitor when connected to an AC circuit Define capacitive reactance Calculate the value of capacitive reactance in an AC circuit Calculate the value of capacitance in an AC circuit Explain the relationship of voltage and resistance in an AC circuit 	

Element/course: *Resistive-Capacitive Series Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> Explain the relationship of resistance and capacitance in an AC series circuit Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RC series circuit Calculate the phase angle for current and voltage in an RC series circuit Connect an RC series circuit and make measurements using test instruments 	

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Element/course: *Resistive-Capacitive Parallel Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Define the operation of a parallel circuit containing resistance and capacitance • Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RC parallel circuit • Connect an RC parallel circuit and measure circuit values using test instruments 	

Element/course: *Resistive-Inductive-Capacitive Series Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Explain AC circuits that contain resistance, inductance, and capacitance connected in series • Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RLC series circuit 	

Element/course: *Resistive-Inductive-Capacitive Parallel Circuits (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Explain AC circuits that contain resistance, inductance, and capacitance connected in parallel • Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RLC parallel circuit 	

Element/course: Three-Phase Circuits (2nd Year)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Explain the difference between single-phase and three-phase voltages • Draw a three-phase delta or wye connection • Calculate the voltage and current values for wye and delta circuits 	

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Element/course: Single-Phase Transformers (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Explain the difference between an isolation-transformer and an auto-transformer and how they work • Calculate the values of voltage, current, and turns for a single-phase transformer • Connect a transformer and test the voltage output of different windings • Explain the polarity markings 	

Element/course: Three-Phase Transformers <u>Note: Some of following objectives are closely related to the three-phase circuit subject matter already studied. Some of this is like a review and reinforcement</u> (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Connect three single-phase transformers to form a three-phase bank • Calculate voltage and current for three-phase transformer connections • Connect two single phase transformers to form a three-phase open-delta connection • Calculate the values of voltage and current for a three-phase transformer used to supply both three-phase and single-phase loads • Define what a harmonic is. • Discuss harmonic problems and their solution. 	

Element/course: Three-phase Motors (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Discuss the basis operating principals of a three-phase motor • Explain a rotating magnetic field • Discuss the operating principals of a squirrel-cage motor • Connect dual voltage motors for correct operation on the desired voltage • Reverse a three-phase motor by changing connections 	

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Element/course: Single-phase Motors (2nd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Reference the operation of various motor types • Explain the basic operation of a split-phase motor • Explain a starting winding and how it works • Explain the operation of a centrifugal switch • Recognize the types starting relays 	
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Element/course: Motor Load Calculations (2nd Year)	Planned Hours: 12
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine the full load current of any motor according to the NEC • Size the branch circuit wire size for any motor • Determine the appropriate circuit protection for any motor • Use the motor name plate to size overloads • Explain the difference between overload protection and short-circuit/ground-fault protection • Size a feeder for any set of motors • Size the feeder overcurrent device 	

Element/course: Box Fill and Junction Box Sizing (2nd Year)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Calculate box fill for any size wire and combination of devices • Properly size pull and junction boxes 	

Element/course: Conductor Ampacity Correction Factors (2nd Year)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Calculate correction factors for temperature • Calculate correction for raceway fill • Calculate correction factors for continuous loads • Calculate correction factors for any combination of the above • Properly use table 310.15(B)(16) and similar tables 	
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Element/course: Raceway Fill (2nd Year)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College e	
Description of element/course: <ul style="list-style-type: none"> • Use NEC tables to calculate raceway fill using any combination of wire sizes • Properly use Annex C tables • Properly fill conduit nipple 	

Element/course: Grounding and Bonding (2nd Year)	Planned Hours: 18
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> • Define objectionable current • Define a main bonding jumper • Properly size the grounding electrode conductor • Properly install the grounding electrode system • Explain the purpose of bonding • Properly size equipment grounding conductors • Use article 250 to properly ground and bond any system • Effectively use the NEC to answer any grounding question 	

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Element/course: Commercial Building Plans and Specifications (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Review and discuss a review of basic safety rules for electrical systems • Define the project requirements from the contract documents • Demonstrate the application of building plans and specifications • Locate specific information on building plans • Obtain information from industry-related organizations • Apply and interchange International System of Units (SI) and English measurements 	

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Element/course: Reading Working Drawings (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Read and interpret electrical symbols used in construction drawings • Identify the electrical installation requirements for a building 	

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- Determine elevations
- Determine the installation spaces of all other trades
- Determine construction materials, measurements, and specifications

Element/course: Calculating the Electrical Load (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine the minimum lighting load for a given area • Determine the receptacle load for a given area • Determine Equipment loads • Determine a reasonable calculated load • Apply the factors for continuous loads • Apply the factors for non-coincident loads 	

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Element/course: Branch Circuits (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine the required number of branch circuits for a set of loads • Apply adjustment and correction factors • Apply factors for continuous, motor, and heating loads • Determine correct rating for branch circuit protective devices • Determine appropriate wire type • Determine the proper size • Explain the heating effect of magnetic flux and how to properly wire to cancel it. 	

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Element/course: Switches and Receptacles (3rd Year)	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Discuss the various NEMA configurations for receptacles • Select the proper receptacle for use in hospitals, electronic equipment installations, and ground isolation • Determine the proper use of switches based on rating and terminations • Properly use color coding for electrical installations 	

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Element/course: Cooking Equipment (Based on Exam Prep) (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Calculate dwelling range loads of the same ratings • Calculate dwelling range loads of different ratings • Calculate demand loads for cooking equipment • Calculate loads for commercial kitchen equipment • Calculate loads for clothes dryers using the standard method • Calculate loads for clothes dryers using the optional method • Calculate neutral loads for cooking equipment and clothes dryers 	

Element/course: Commercial Calculations (Based on Exam Prep) (3rd Year)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Calculate a commercial electrical service load using the standard calculation method of article 220 • Calculate a commercial electrical service load using the optional calculation method of article 220 	

Element/course: Wiring Methods (Review and reinforcement from previous years) (3rd Year)	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Select the proper raceway of cable for the conditions • Identify the installation requirements for a raceway of cable • Select the proper raceway size, depending on the conductors to be installed • Properly size outlet, pull, and junction boxes 	

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Element/course: Motor and Appliance Circuits (Review and reinforcement from previous year) (3rd Year)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Use and interpret the word <i>appliance</i> • Use and interpret the term <i>utilization equipment</i> • Properly wire and properly install disconnecting means for appliances and motors • Understand the term <i>Type 1</i> and <i>Type 2</i> protection • Define <i>single phasing</i> 	

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- Design a motor circuit: calculate proper wire size, overcurrent protection, overload size, disconnect size, feeder size for several motors, feeder overcurrent protection

Element/course: Feeders (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Calculate feeder loading • Calculate the feeder overcurrent device • Calculate the proper feeder size for any combination of loads • Calculate correction factors • Calculate voltage drop • Calculate the reduced neutral size as is appropriate • Determine raceway size 	

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Element/course: Special Systems (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Select and install multi-outlet assemblies • Calculate the load allowance for multi-outlet assemblies • Select and install a floor outlet system • Determine proper wiring for fire alarm installations 	

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Element/course: Working Drawings-Upper Level (3rd Year)	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Tabulate materials required to install an electrical rough-in • Select the components to install large equipment such as commercial water heaters, heating, cooling, etc. • Explain the advantages and disadvantages between single-phase and three-phase systems 	

Element/course: Special Circuits (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Describe typical connection schemes for photocells and timers • Determine the requirements for wiring an elevator 	

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- Properly connect the controls for a sump pump

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Element/course: *Lamps and Ballast for Lighting (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Understand the technical terms for associated with lamps and ballast • Identify lamps scheduled to be used in a commercial building • Understand the basics of incandescent, halogen, fluorescent, LED, and HID lamps • Understand the practical application of lamps used in a commercial building • Understand more about energy savings for lamps and ballasts • Identify lamp types according to characteristics and letter designations • Be aware of the hazards of disposing lamps and ballasts 	

Element/course: *Luminaires (3rd Year)	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: <ul style="list-style-type: none"> • Locate luminaires in a space • Properly select and install luminaires • Discuss the attributes of different types of luminaires • Exercise some control over energy savings by giving proper advice 	

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Element/course: Overcurrent Protection: Fuses and Circuit Breakers (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • List and identify the types, classes, and ratings of fuses and circuit breakers • Describe the operation of fuses and circuit breakers • Develop an understanding of switch sizes, ratings, and requirements • Define <i>interrupting rating</i>, <i>short-circuit currents</i>, <i>RMS</i>, and <i>current limitation</i> • Use let-through charts 	

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Element/course: Short-Circuit Calculations and Coordination of Overcurrent Protective Devices (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	

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Description of element/course:

At the completion of this lesson the student should be able to:

- Perform Short-circuit calculations using the point-to-point method
- Calculate short-circuit currents using the appropriate tables and charts
- Define the terms *coordination, selective systems, and non-selective systems*

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Element/course: *Commercial Utility Interactive Photovoltaic Systems (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • List the components of a utility interactive solar photovoltaic system • Describe the function of a utility interactive solar photovoltaic system and components • Apply the NEC to the design and installation of commercial utility interactive solar photovoltaic system and components • Interpret a typical utility interactive solar photovoltaic system single line drawing 	

Element/course: Basic Principles of Motor Controls (3rd Year)	Planned Hours: 9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Recognize ladder diagrams • Recognize connection diagrams • Recognize pictorial diagrams • Use and interpret definitions, abbreviations, and graphic symbols used on motor control diagrams • Describe the function of pushbutton stations, solenoids, flow switches, pressure switches, limit switches, and timing relays 	

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Element/course: Components of Control Circuit Schematics, Magnetic Control (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Use a ladder diagram to illustrate a simple two wire control circuit for a single-phase motor operated by a float switch or similar device • Use a ladder diagram to illustrate a simple start/stop station operating a motor starter • Identify circuit types classified by power source—common control circuits, transformer control wiring, and separate control wiring • Identify control devices and their function • Identify remote-control circuits and their function • Use 120 volt control circuit to operate a 480 volt load 	

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• Explain the operation and use of magnetic motor starters

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Element/course: Basic Control Circuits, Overcurrent Protection for Control Circuits (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Design both two-wire and three-wire controls using start/stop stations and other devices such as float switches • Design a circuit operating a motor starter using two or more start/stop stations • Use the NEC to properly protect control circuits to include conductor sizes, overcurrent protection, and control transformers 	

Element/course: Indicator Lights and Illuminated Pushbuttons, Selector Switch Truth Tables (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Understand the use of illumination in motor controls • Interpret symbols used on diagrams • Read truth tables • Diagram the use of a selector switch on a three-wire control for a jogging application 	

Element/course: Reversing Controls for Three-Phase Motors, Reversing Controls with Indicator Lights for Three-Phase Motors, Reversing Controls with Limit Switches for Three-Phase Motors, Reversing Single Phase Motors (3rd Year)	Planned Hours: 6	RECEIVED BY L&I AC: 6/4/16 EL
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College		E-MAIL RECEIVED BY CENTRAL OFFICE: 6/6/16 KR
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Diagram the operation of a reversing starter • Diagram the operation of a reversing control station • Diagram the operation of a reversing control selector switch • Apply functional indicator lights to reversing controls • Diagram a limit switch to automatically stop a motor • Diagram reversing operations using limit switches 		RECEIVED Labor & Industries Apprenticeship Section JUN 04 2016 Region 6 Spokane, WA

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- Diagram the operation of a garage door
- Diagram the operation of reversing a single-phase motor

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Element/course: Sequencing Control and Master Stop Function, Introduction to Variable Frequency Drives - (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> On-line <input checked="" type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Interpret a diagram showing the sequencing of several motors • Apply the master stop function to and process using motor controls • Explain the basic operation of variable frequency drives 	

Element/course: Panelboard selection and Installation (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Identify the criteria for selecting a panelboard • Correctly place and number circuits in a panelboard • Calculate the proper feeder size for a panelboard • Determine the correct overcurrent protection for a panelboard • Prepare a panelboard directory 	

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Element/course: The Electric Service (3rd Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Install power transformers to meet NEC requirements • Draw the basic transformer connection diagram • Recognize different service types • Define the various components of service equipment • Correctly install service equipment • Connect metering equipment • Install the grounding system 	

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Element/course: Low Voltage Remote-Control (3rd Year)	Planned Hours: 3
Mode of Instruction (please check all that apply):	

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Description of element/course:

- At the completion of this lesson the student should be able to:
- Discuss the importance of energy savings and ways to accomplish it.
 - List the components of a low-voltage remote-control wiring system
 - Select the appropriate NEC sections governing the installation of a low-voltage remote-control wiring system
 - Demonstrate the correct connections for wiring a low-voltage remote-control system

Element/course: **Cooling Systems (3rd Year)** Planned Hours: 6

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
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Description of element/course:

- At the completion of this lesson the student should be able to:
- List the parts of a cooling system
 - Describe the function of each part in a cooling system
 - Calculate the sizes of the electrical components
 - Read a typical wiring diagram that shows the operation of a cooling unit

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Element/course: **Hazardous Locations: Articles 500 through 504 (4th Year)** Planned Hours: 6

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
Provided by: Lewis Clark State College

Description of element/course:

- At the completion of this lesson the student should be able to use the NEC to:
- Determine proper wiring of a Class I, Division 1 locations
 - Determine proper wiring of a Class I, Division 2 locations
 - Determine proper wiring of a Class II, Division 1 locations
 - Determine proper wiring of a Class II, Division 2 locations
 - Determine proper wiring of a Class III, Division 1 locations
 - Determine proper wiring of a Class III, Division 2 locations
 - Determine proper wiring of Commercial Garages
 - Determine proper wiring of Motor Fuel Dispensing Facilities

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Element/course: **Commercial Garages, Motor Fuel Dispensing Facilities: Articles 511 and 514 (4th Year)** Planned Hours: 6

Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
Provided by: Lewis Clark State College

Description of element/course:

- At the completion of this lesson the student should be able to:
- Define a major repair garage
 - Define a minor repair garage
 - Properly classify hazardous areas
 - Use the NEC to properly wire a commercial garage of any type
 - Define a Motor Fuel Dispensing Facility
 - Use the NEC to properly wire Motor Fuel Dispensing Facilities

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Element/course:	Health Care Facilities, Assembly Occupancies, Carnivals, Fairs and Similar Events: Articles 517 through 525 (4th Year)	Planned Hours:	6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College			
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Use the NEC to properly define a health care facility type • Define General Care Areas and Critical Care Areas • Discuss Essential Electrical Systems • Properly wire and ground a health care facility • Discuss the proper wiring methods for places of assembly • Discuss the proper wiring of carnivals, fairs, and similar events 			

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Element/course:	Agricultural Buildings, Marinas and Boatyards, Temporary Installations: Articles 547 through 590 (4th Year)	Planned Hours:	6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College			
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine the proper wiring for any agricultural building • Properly calculate farm loads using the NEC • Determine marina requirements using the NEC • Determine and discuss the requirements for temporary installations 			

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Element/course:	Electric Signs and Outline Lighting, Manufactured Wiring Systems, Elevators, Escalators, and Moving Walks: Articles 600 through 620 (4th Year)	Planned Hours:	6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College			
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine proper installation and requirements of electric signs and associated lighting • Compare manufactured wiring systems instructions against Article 604 or 605 as is appropriate • Determine proper installation and requirements of elevators, escalators, and moving walks 			

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Element/course: <u>Audio Signal Processing, Amplification, Reproduction Equipment, and Information Technology Equipment: Articles 640 and 645</u> (4th Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Apply the goal of reducing the spread of fire and smoke in case of a fire • Comply with other articles when installing audio equipment • Reduce shock hazards peculiar to audio equipment • Determine proper installations in IT rooms 	

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Element/course: <u>Swimming Pools, Spas, Hot Tubs, Fountains, and Similar Locations: Article 680</u> (4th Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine proper electrical installations for swimming pools • Determine proper electrical installations for spas and hot tubs • Determine proper electrical installations for fountains 	

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Element/course: <u>Emergency Standby Power Systems, Legally Required Power Systems, Optional Standby Power Systems: Articles 700 through 702</u> (4th Year)	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine the proper installation of systems deemed essential to protect human life • Determine the difference between <i>emergency stand by</i>, <i>legally required standby</i>, and <i>optional standby</i> power systems 	

Element/course: <u>Remote-Control, Signaling, and Power-Limited Circuits: Article 725</u> (4th Year)	Planned Hours: 3
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Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Define a class 1 circuit • Define a class 2 circuit • Define a class 3 circuit • Determine proper installation and requirements class 1, class 2, and class 3 circuits 	

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Element/course: Fire Alarm Systems: Article 760 (4th Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Define nonpower-limited fire alarm circuits • Define power-limited fire alarm circuits • Determine the proper installation of fire alarm wiring using the NEC • Determine where the use of GFCI and AFCI are restricted • Determine environmental air space 	

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Element/course: Optical Fiber Cables and Raceways, Communications Systems: Articles 770 and 800 through 820 (4th Year)	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine proper installation of optical fiber cables • Properly fire-stop penetrations • Determine proper grounding of communications wiring and equipment • Determine proper installations of communication wiring 	

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Element/course: Requirement for Electrical Installations: Article 110 (4th Year)	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine the proper termination of conductors • Determine the kinds of warnings, markings, and identification a given installation requires • Determine the proper working clearance for any installation • Determine proper voltage rating • Determine proper AIC rating 	

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Element/course:	Use and Identification of Grounded Conductors, Branch Circuits, Feeders: Articles 200, 210 and 215 (4th Year)	Planned Hours:	3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College			
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Properly identify a grounded conductor • Properly apply the general provisions of Article 210 • Properly apply the branch circuits ratings of Article 210 • Properly install the required outlets of Article 210 • Calculate the minimum size and ampacity of any feeder 			

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Element/course:	Branch Circuit, Feeder, and Service Calculations (review from previous years): Article 220 (4th Year)	Planned Hours:	12
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College			
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Demonstrate the ability to calculate the loads for a single family dwelling • Demonstrate the ability to calculate the loads for a multifamily dwelling • Demonstrate the ability to calculate the loads for a commercial or industrial installation 			

Element/course:	Outside Branch Circuits and Feeders, Services (review from previous years): Articles 225 and 230 (4th Year)	Planned Hours:	3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College			
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Properly install conductors and lighting installed outdoors • Determine vertical and horizontal clearance of overhead conductors • Determine proper disconnecting means and installation • Determine the proper installation and protection of "line" and "load" conductors 			

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Element/course: <u>Overcurrent Protection (critical review from previous years): Article 240</u> (4th Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Properly size a standard overcurrent device to any conductor • Properly apply the small conductor rules • Calculate transformer secondary conductor protection • Reference requirements for appliance protection • Calculate tap conductor protection • Reference protection for motors and air conditioners 	

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Element/course: <u>Grounding and Bonding (critical review from previous years): Article 250</u> (4th Year)	Planned Hours: 12
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College e	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Define the difference between grounding and bonding • Determine the proper grounding and bonding requirements of any system • Properly size the main bonding jumper • Properly size the grounding electrode conductor • Properly size equipment grounding conductors • Determine the various types of a grounding conductors • Design a proper grounding electrode system 	

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Element/course: <u>Surge Protective Devices: Article 285</u> (4th Year)	Planned Hours: 1.5
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to: <ul style="list-style-type: none"> • Determine the installation requirements SPD's • Discuss the difference between Type 1, Type 2, and Type 3 SPD's and their use 	

Element/course: <u>Wiring Methods, Conductors for General Wiring: Articles 300 and 310</u> (4th Year)	Planned Hours: 12
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine how to route, splice, protect, and secure conductors and raceways • Determine the general requirements for conductors such as insulation markings, ampacity ratings, and conductors to use in specific installations • Properly use the Article 310 tables 	

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- Apply Chapter 9 tables
- Properly derate any conductor based on wire fill, temperature, and continuous load
- Define the meaning of conductor insulation lettering
- Discuss the effects of nonlinear loads on multiwire branch circuit and feeder neutral conductors and if a neutral conductor is to be counted as current carrying.

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Element/course:	<u>Cabinets, Cutout Boxes, and Meter Socket Enclosures; Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Handhole Enclosures; Articles 312 and 314</u> (4th Year)	Planned Hours:	9
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College			
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine the use of any enclosure based on the conditions of use • Determine the installation requirements for any enclosure • Properly use boxes and fittings based on internal volume • Determine the requirements for fill of boxes and fittings • Properly size pull and junction boxes for No. 4 AWG conductors and larger 			

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Element/course:	<u>Armored Cable, Metal Clad Cable, Nonmetallic-Sheathed Cable, Service-Entrance Cable, Underground Feeder and Branch-Circuit Cable (Type UF); Articles 320, 330, 334, 338, and 340</u> (4th Year)	Planned Hours:	3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College			
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine the installation requirements of Armored Cable • Determine the installation requirements of Metal-Clad Cable • Determine the installation requirements of Nonmetallic-Sheathed Cable • Determine the installation requirements of Service-Entrance Cable • Determine the installation requirements of Underground Feeder and Branch-Circuit Cable (Type UF) • Relate temperature concerns, derating, etc. to other appropriate articles in the NEC 			

Element/course:	<u>Intermediate Metal Conduit, Ridged Metal Conduit, Flexible Metal Conduit, Liquidtight Flexible Metal Conduit; Articles 342, 344, 348, and 350</u> (4th Year)	Planned Hours:	3
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Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	RECEIVED BY L&I AC: <u>6/4/16 EL</u>
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine the installation requirements of Intermediate Metal conduit • Determine the installation requirements of Ridged Metal Conduit • Determine the installation requirements of Flexible Metal Conduit • Determine the installation requirements of Liquidtight Flexible Metal Conduit • Relate conductor fill, derating, etc. to other appropriate articles in the NEC 	E-MAIL RECEIVED BY CENTRAL OFFICE: <u>6/6/16 KR</u>

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Element/course: <u>Ridged Polyvinyl Chloride Conduit, Liquidtight Flexible Nonmetallic Conduit, Electrical Metallic Tubing, Electrical Nonmetallic Tubing: Articles 352, 356, 358, and 362 (4th Year)</u>	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine the installation requirements of Ridged Polyvinyl Chloride Conduit • Determine the installation requirements of Liquidtight Flexible Nonmetallic Conduit • Determine the installation requirements of Electrical Metallic Tubing • Determine the installation requirements of Electrical Nonmetallic Tubing • Relate conductor fill, derating, etc. to other appropriate articles in the NEC 	

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Element/course: <u>Metal Wireways, Multioutlet Assemblies, Surface Metal Raceways, Cable Trays: Articles 376, 380, 386, 392 (4th Year)</u>	Planned Hours: 3
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to: <ul style="list-style-type: none"> • Determine the proper installation of a metal wireway • Calculate the proper conductor fill of a metal wireway • Calculate the proper size of a metal wireway based on conductor size and conduit entries • Properly splice conductors in a metal wireway • Determine the proper installation of multioutlet assemblies • Determine the proper installation of surface metal raceways • Determine the proper installation and use of cable trays 	

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Element/course: <u>Flexible Cords and Flexible Cables, Fixture Wires, Switches, Receptacles, Cord Connectors, and Attachment Plugs: Articles 400, 402, 404, and 406 (4th Year)</u>	Planned Hours: 6
Mode of Instruction (please check all that apply):	

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Classroom Lab On-line Self-study
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Description of element/course:
 At the completion of this lesson the student should be able to use the NEC to:

- Identify requirements, applications, and construction specifications of cords and cables
- Select cords, cables, and fittings listed for specific applications
- Identify requirements and specifications of fixture wires
- Determine types and uses of switches
- Mount receptacles according to the details of 406.4 (A) through (G)
- Following the grounding requirements of the specific device being used

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Element/course: <u>Switchboards and Panelboards, Luminaires, Lampholders, and Lamps: Articles 408 and 410</u> (4th Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to:	
<ul style="list-style-type: none"> • Determine the specific requirements for switchboards, panelboards, and distribution boards that control power and lighting circuits • Properly identify the use of each circuit in a panelboard or switchboard • Properly terminate conductors in panelboards and switchboards • Determine the general requirements of Part I of Art. 410 • Determine the location requirements of Part II of Art. 410 • Determine the box and covers requirements of Part III of Art. 410 • Determine the support requirements of Part IV of Art. 410 • Determine the grounding requirements of Part V of Art. 410 • Determine the wiring requirements of Part VI of Art. 410 	

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Element/course: <u>Lighting Systems Operating at 30 Volts or Less: Article 411</u> (4th Year)	Planned Hours: 1.5
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	
Description of element/course: At the completion of this lesson the student should be able to use the NEC to:	
<ul style="list-style-type: none"> • Explain the potential for fire in low voltage lighting systems because of currents as high as 25 amps • Explain the need for an isolation transformer • Discuss the proper wiring method for low voltage lighting 	

Element/course: <u>Appliances, Fixed Electric Space Heating Equipment: Articles 422 and 424</u> (4th Year)	Planned Hours: 6
Mode of Instruction (please check all that apply): <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input type="checkbox"/> On-line <input type="checkbox"/> Self-study Provided by: Lewis Clark State College	

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 Spokane, WA

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Description of element/course:
At the completion of this lesson the student should be able to use the NEC to:

- Calculate and determine proper branch circuit ratings for any appliance
- Calculate and determine proper overcurrent protection for any appliance
- Determine the requirements for nonmotor appliances
- Explain article 430 compliance for motor operated appliances
- Explain article 440 compliance for appliances containing hermetic compressors
- Determine proper disconnecting means
- Determine requirements for heating installations using Article 424, Part I through Part VI
- Understand the content of Article 424, Part VII through IX

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Element/course: <u>Motors, Motor Circuits, and Controllers: Air-conditioning and Refrigeration Equipment, Articles 430 and 440 (review from previous years) (4th Year)</u>	Planned Hours: 12	RECEIVED BY L&I AC: 6/13/16 EL
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Mode of Instruction (please check all that apply):
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Description of element/course:
At the completion of this lesson the student should be able to use the NEC to:

- Determine the proper conductor size for any motor
- Determine the proper overcurrent protection for any motor
- Explain why the apparent over-fusing of conductors according to table 430.52 is both safe and necessary
- Determine the proper disconnect for any motor
- Determine the proper overload protection for any motor and condition (easy start, hard start, etc.)
- Determine the minimum size feeder for a group of motors
- Determine the feeder overcurrent protection
- Properly size circuits and overcurrent devices for air conditioning and refrigeration equipment
- Determine the requirements for the disconnecting means of refrigeration equipment

Element/course: Lewis Clark State College	Basic Trainee Classes, Provided by: "Authorized Providers" WAC 296-46B-970 2.(B) (i), Continuing education and classroom education requirements.	Planned Hours: 96
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Mode of Instruction (please check all that apply):
 Classroom Lab On-line Self-study
 Provided by:

Description of element/course:
Electrical trainees must take certain basic trainee classroom instruction courses to maintain their training certificate. See list of courses,
<http://www.lni.wa.gov/TradesLicensing/Electrical/files/edclass/BasicTraineeClassroomEducation.pdf>

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Department of Labor & Industries
 Apprenticeship Section
 PO Box 44530
 Olympia WA 98504-4530



Journey Level Wage Rate

From which apprentices' wages rates are computed

TO: Washington State Apprenticeship & Training Council

From Schweitzer Engineering Labs.

(NAME OF STANDARDS)

Occupations	County(s)	Journey Level Wage Rate	Effective Date:
Industrial Maintenance Electrician	Whitman	\$18.92 hr	1/1/16
HVAC Journeymen Technician	Whitman	\$18.92 hr	1/1/16

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