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<td>I. SAFETY</td>
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<td>I-A. General jobsite safety awareness</td>
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<td>1) Why safety is important</td>
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<td>2) Key factors involved with safe work practices</td>
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<td>3) Develop a respect for electricity</td>
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<td>a) be aware of dangers of shock</td>
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<td>b) describe locations of potential shock hazards</td>
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<td>c) demonstrate use of no contact voltage indicators and other devices to determine if the system is energized</td>
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<td>d) demonstrate techniques for working on energized circuits</td>
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<td>4) Hazards created by poor housekeeping on the job</td>
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<td>5) Maintain safe work area and tools</td>
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<td>6) Be aware of the dangers of falling objects</td>
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<td>7) Respect and obey job safety rules</td>
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<td>I-B. Emergency procedures</td>
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<td>1) First aid training and CPR</td>
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<td>I-C. Compliance with OSHA and EPA regulations</td>
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<td>1) Attend and/or conduct regular safety meeting</td>
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<td>2) General OSHA requirements on the jobsite</td>
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<td>3) The guidelines for OSHA Assured Grounding and GFI usage</td>
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<td>4) Use of material safety data sheets (MSDS) to identify and properly handle hazardous materials (e.g. cleaning fluids, transformer oils)</td>
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<td>I-D. Substance abuse</td>
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<td>II. TOOLS, MATERIALS AND HANDLING</td>
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<td>1) Identify common hand and power tools</td>
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<td>2) Proper selection and application of hand tools</td>
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<td>3) Proper selection and application of power tools</td>
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<td>4) Proper care for tools</td>
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<td>5) Safe techniques for using ladders</td>
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<td>6) Defects that make tools unsafe for use</td>
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<td>II-B. Proper rigging methods</td>
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<td>1) Proper knots</td>
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<td>III. MATH</td>
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<td>III-A. Appropriate mathematical calculations to solve for unknowns</td>
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<td>1) Arithmetic operators</td>
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<td>4) Reducing fractions to lowest terms</td>
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<td>5) Converting decimals to fractions and back</td>
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<td>6) Angles and sides of triangles</td>
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<td>7) Unknown angles and sides of a triangle</td>
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<td>8) Metric prefixes and converting different prefixes</td>
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<td>9) Using powers of ten to perform math functions</td>
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<td>10) Converting from english to metric measuring systems</td>
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<td>11) Algebraic formulas</td>
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<td>12) Square roots</td>
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<td>13) Ratio, percentage, and proportion</td>
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<td>14) Problems using direct and inverse relationships</td>
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<td>IV. ELECTRICAL THEORY</td>
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<td>IV-A. Basic electrical theory</td>
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<td>1) Define terms, units of measure</td>
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IV-B. Ohm's Law, Kirchhoff's Laws, Lenz's Law, Thevenin's and Norton's Theorems

1) Identify differences between 3 wire single phase and three phase circuits
2) Resistance of circuits
3) Total resistance
4) Effects of changing voltage and resistance
5) Law of proportion for series voltage divider circuits
6) Power used in circuits
   a) by components
   b) Wasted power
IV-D. Parallel circuits
1) Components
2) Differences between series and parallel circuits
3) Ohm's Law
4) Circuits
5) Total resistance using product-sum and reciprocal methods
6) Alternate current paths
7) Currents
8) Law of proportion
9) Power requirements of components

IV-E. Combination circuits
1) Combination circuits
2) Components
3) Equivalent resistance
4) Alternate current paths
5) Ohm's Law
6) Power use and dissipation

IV-F. Characteristics of voltages in circuits
1) Polarity and flow of electrons
2) Distribution and voltage drops
3) Proper wire size needed to lower losses

IV-G. Characteristics of magnetism/electromagnetism

IV-H. Theory of superposition and solving for multiple voltage sources circuits

IV-I. Operation and characteristics of three wire systems

IV-J. Operation and characteristics of three phase systems
1) Identify differences between 3 wire single phase and three phase circuits
2) Voltage drop and power loss

IV-K. AC Theory
1) Terms associated with ac theory
2) Currents and voltages for components and circuits
3) Conductor sizes using NEC
4) Current and voltage sine waves to demonstrate phase relationships
5) Maximum, effective (rms), average, and peak to peak voltage and current
6) Inductance
   a) Factors that effect inductance
   b) Behavior of current when inductance is present
   c) Relationship between current, applied voltage and counter-electromotive force
7) Capacitance
   a) Effects on circuits with capacitance
   b) Capacitance, capacitive reactance, and frequency
8) Relations and behaviors of series RL, parallel RL, series RC, parallel RC, series LC, parallel LC, series RLC, parallel RCL circuits
9) Function, operation and characteristics or rectifiers
   a) Actions of full wave and half wave rectifiers
   b) Schematics
10) Series resonance, parallel resonance and circuits
11) Filters
12) Power Factor
   a) Watts, vars, and volt-amperes
   b) Reactive power

IV-C. Series circuits
1) Components
2) Resistance of circuits
3) Total resistance
4) Effects of changing voltage and resistance
5) Law of proportion for series voltage divider circuits
6) Power used in circuits
   a) by components
   b) Wasted power
### APPROVED CURRICULUM FOR GENERAL ELECTRICIAN CERTIFICATION PROGRAM

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<td>c) Proper placement of power factor correction capacitors</td>
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<td>d) Procedure to recognize and correct poor power factor arrangements</td>
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<td>13) Power quality issues</td>
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<td>a) Causes of poor power quality</td>
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<td>b) The effect of harmonics</td>
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<td>c) Locating harmonics through observation and test equipment</td>
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<td>d) Techniques to reduce and eliminate effects and harmonics</td>
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### IV-L. Use of electronics

1) Electron Flow through solid state components
2) Precautions against electrostatic discharges around semiconductor devices
3) Functions, operation and characteristics of diodes and zener diodes
   a) characteristic curves
   b) testing procedures
   c) schematics including diodes
4) Functions, operation and characteristics of transducers
   a) operation of transducers
   b) schematics including transducers
5) Functions, operation and characteristics of various types of transistors (diacs, triacs, SCR's, etc.)
   a) operation of transistors
   b) current and voltage values
   c) testing procedures
   d) schematics including transistors
6) Functions, operations, and characteristics and circuit configurations of amplifiers
   a) basic circuit configurations for various types of amplifiers
7) Functions, operations and characteristics of integrated circuits (IC's)
   a) schematics of and including IC's
   b) information on data sheets for integrated circuits
8) Functions, operations and characteristics of three main categories of photo-operated devices
9) Digital logic circuits
   a) terms associated with digital logic circuits
   b) Types of circuits
   c) The operative symbols for AND, OR, NOT operations
   d) the use of Boolean algebra equations, laws operations, and theorems
   e) truth tables
   f) gate functions and gate circuits
   g) BUFFER and INVERTER amplifiers and accompanying truth tables
   h) operation and characteristics of NAND, and NOR logic accompanying truth tables
   i) operation and characteristics of XOR and X NOR logic and accompanying truth tables
   j) positive and negative logic and its effect on gate operation
   k) digital logic equivalent circuits
   l) various optoelectric devices

### V. CODE REQUIREMENTS

V-A. National Electrical Code and local code

1) Purpose and intent of electrical codes
2) Scope on NEC and local codes
3) How local codes may differ from local codes

4) Functions, operation and characteristics of transducers
   a) operation of transducers
   b) schematics including transducers
5) Functions, operation and characteristics of various types of transistors (diacs, triacs, SCR's, etc.)
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   j) positive and negative logic and its effect on gate operation
   k) digital logic equivalent circuits
   l) various optoelectric devices
4) Utilizing code book
   a) mandatory rules
   b) fine print rules
   c) "neat and workmanlike"
   d) locate definitions
   e) interpretations
   f) recognize and use exceptions
   g) materials recognized by the NEC
   h) identify code markings
   i) distinguish wet, damp, and dry locations
   j) determine if specific installations are acceptable to the code
   k) requirements for special occupancies
   l) answer specific questions

5) Use NEC to calculate various conductors and fill situations
   a) service conductors
   b) permissible loads on various circuits
   c) allowable cable tray fills
   d) imparity of various conductor and fill situations
   e) imparity of various circuits and load types
   f) overload protection for motors, equipment and phase converters
   g) minimum ampacity for motor disconnect means
   h) horsepower ratings for motors and disconnecting means
   i) grounding requirements

6) Use NEC for hazardous locations
   a) hazardous locations by class
   b) equipment and wiring methods necessary for particular hazardous locations

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7/24/2006
Version 1: Fall 2006 and Spring 2007
VI. CONDUCTORS

VI-A. Various types of conductors
1) Types of conductors and insulators
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
2) Why some materials are better conductors or insulators than others
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
3) Effect of heat on insulators
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
4) Sizing and typing of conductors
   a) Use better symbols to identify insulator types
      ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
      x x
   b) Use American wire gauge chart
      ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
      x x
   c) Convert inches, mils, square mils, and circular mils from one to the other
      ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
      x x
5) Differences between aluminum and copper conductors
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
6) Properties of high voltage cables
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
7) Effects of soil conditions on underground cables
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x

VI-B. Conductor installation techniques
1) Different wiring methods for particular conductors and situations
   a) Wire connectors
      ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
      x x
   b) Types, installation, limitations
      ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
      x x
2) Different methods of installing conductors in conduits, raceways and cable trays
   a) Problems which may be encountered
      ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
      x x
   b) maximum tension allowed
      ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
      x x
   c) Use of pulling machines to assist in installation of conductors
      ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
      x x
3) Proper splicing methods and techniques for various conductors and locations
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x

VI-C. Methods for selecting conductors
1) Using code to determine type of conductor to use in a particular situation
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
2) Using mathematical calculations to determine current carrying capacity of conductors
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
3) Calculating or selecting cable ampacity from N.E.C. tables
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
4) Loads for sizing conductors
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
5) Code requirements depending on type of circuits and loads (lighting, appliance, heating, service entrance)
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x

VI-D. Cable fault situations
1) The types and causes of cable faults
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
2) Methods and equipment for locating cable faults including terminal tracing and magnetic detection
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x

VII. CONDUIT, RACEWAYS, PANELBOARDS AND SWITCHBOARDS

VII-A. Terms associated with conduits and raceways
ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
x x

VII-B. Conduit and wiring support systems recognized by code
1) Select appropriate conduit type
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
2) Select and utilize appropriate connectors
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
3) Select and utilize appropriate fastening devices and reinforcements
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x
4) Special considerations
   ELEC 31,33 ELECTRICAL WIRING METHODS AND INDUSTRIAL VETING METHODS
   x x

VII-C. Procedures for laying out various types of bends
1) Take-up and gain
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
2) Kicks and offsets
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
3) Calculate degrees
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
4) Back-to-back bends
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
5) Determine overall length of conduit for specific situations
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
6) Locating bending points
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
7) Four techniques for segment bending
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
8) Techniques and operations for making concentric bends
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
9) Radius of a circle
   ELEC 31 ELECTRICAL WIRING METHODS
   x x

VII-D. Procedures for making bends when fabricating conduits
1) Hand benders to make small bends on small diameter conduit
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
2) Power benders to make bends on larger diameter conduit
   ELEC 31 ELECTRICAL WIRING METHODS
   x x
<table>
<thead>
<tr>
<th>CAC CURRICULUM ITEM</th>
<th>San Joaquin Delta College</th>
<th>COURSE(S) ID</th>
<th>COURSE TITLE</th>
<th>LEC</th>
<th>LAB</th>
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</thead>
<tbody>
<tr>
<td>a) Make offsets using &quot;constants&quot; or &quot;shrink&quot; methods</td>
<td>ELEC 31</td>
<td>ELECTRICAL WIRING METHODS</td>
<td>x</td>
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<td>b) Make bends in proper sequence, direction and with necessary accuracy</td>
<td>ELEC 31,33</td>
<td>INDUSTRIAL WIRING METHODS</td>
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<tr>
<td>VII-E. Fabricating raceways and wiring support systems</td>
<td>ELEC 31</td>
<td>ELECTRICAL WIRING METHODS</td>
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<td>VII-F. Cable assembly wiring methods recognized by the N.E.C.</td>
<td>ELEC 31</td>
<td>ELECTRICAL WIRING METHODS</td>
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<tr>
<td>VII-G. Function, operation and requirements for various panelboards and switchgear</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
<td>x</td>
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<tr>
<td>1) Installation of panels</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
<td>x</td>
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<td>2) Installation of components</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
<td>x</td>
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<tr>
<td>3) Wiring and connectors</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
<td>x</td>
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<td>4) Special considerations and occupancies</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>VIII. LIGHTING SYSTEMS</td>
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<tr>
<td>VIII-A. Function, operation and characteristics of various lighting systems</td>
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<tr>
<td>1) Incandescent</td>
<td>ELEC 31,33</td>
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<td>2) Fluorescent</td>
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<td>3) High Intensity Discharge</td>
<td>ELEC 31,33</td>
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<td>4) Low voltage</td>
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<td>VIII-B. Lighting distribution and layout</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>VIII-C. Installation and connection of fixtures</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>IX. OVERCURRENT DEVICES</td>
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<td>IX-A. Function, operation and characteristics of overcurrent protection devices</td>
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<tr>
<td>1) Purpose and location of devices</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>2) Three considerations necessary for the electrical component</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>3) Interrupting ratings</td>
<td>ELEC 31,33</td>
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<td>4) Short circuit currents</td>
<td>ELEC 31,33</td>
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<td>5) Overload and overcurrent situations</td>
<td>ELEC 31,33</td>
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<td>6) 10 and 25 foot tap rules</td>
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<td>7) Operation and application of fuses</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>a) Single element and time delay</td>
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<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>b) The effects of heat</td>
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<td>8) Operation and application of various types of circuit breakers (e.g. molded case, air break)</td>
<td>ELEC 31,33</td>
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<td>9) Utilize Peak-Let-Thru charts and table</td>
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<td>10) Function, operation and characteristics of ground fault circuit interrupters</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>11) Function, operation and characteristics of surge protectors</td>
<td>ELEC 31,33</td>
<td>ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS</td>
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<td>12) Appropriate devices for situation and according to code</td>
<td>ELEC 31,33</td>
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</table>
X. GROUNDING SYSTEMS
X-A. Functions, operation and characteristics of grounding systems
1) Reasons for grounding
2) General types of faults
3) Grounding electrode systems

X-B. Sizing, layout and installation of grounding systems
1) N.E.C. requirements and interpretations
2) Size of conductors and electrodes
3) Installation of electrodes
4) Installation of conductors and connection to electrodes
5) The impact of soil conditions on earth grounding systems and procedures of earth resistance testing
6) Principles and procedures of earth resistance testing
7) Determine when ground fault protection is required

X-C. Difference between insulation, isolation and elevation

X-D. Difference between grounding, grounded, and bonding
1) Systems over 1,000 volts
2) Separately derived systems
3) Buildings sharing service

XI. PRINTS AND SPECIFICATIONS
XI-A. Creation of blueprints, plans, and specifications
1) Utilize symbols used in electrical and related trades
2) Recognize functions of basic line types
3) Identify drawing tools and techniques
   a) Orthographic views
   b) Types of projections
   c) Drafting scales
4) Recognize and apply dimensions
5) Prepare "as built" drawings
6) Differences between wiring diagrams, line diagrams, schematics, and ladder diagrams
   a) Given schematics complete wiring diagrams
   b) Given panels and equipment layouts create drawings showing conduits and conductors using appropriate scale

XI-B. Use of blueprints, plans, and specifications
1) Recognize function of various types of plots, sections, details, schedules, specification sheets, addendums and revisions
2) Determine devices, locations, quantities, feeds, conduit types and sizes and conductor sizes
   a) Parts of the electrical service
   b) Identifying special purpose outlets and the loads they serve
   c) Completing take-off sheets for ordering material
   d) Determine costs for jobs
   e) How costs affect jobs
3) Interpret non-electrical dimensions and considerations
4) Relationships between architectural considerations and electrical installations
5) Correlate information from other trades plans with electrical plans to determine potential conflicts
XII-A. Function, operation and characteristics of various types of motors (AC, DC, dual voltage repulsion, universal, 3 phase, squirrel cage, synchronous)

1) Physical parts of various motors
2) Utilize information sheets, plans, schematics, and motor nameplates
to gain information
3) Motor Losses
4) Starting and operating characteristics
5) Methods to identify windings in DC motor
6) Means for providing field failure, current limit, voltage and speed control
7) Block diagrams to demonstrate power supplies, armature, field and control features
8) Torque, locked rotor current, no-load speed, and slip
9) Reasons for low voltage starting
10) Function, operation and characteristics of stepping motors

XII-B. Proper techniques for motor installations
1) Necessary calculations for electrical requirements per code
2) Correct power factor
3) Proper wire type and size
4) Appropriate connections
5) How various motors can be made to run at a different speed or direction
   a) Schematics
   b) Connections to reverse or change direction

XII-C. Function, operation and characteristics of motor controllers, circuits and devices
1) Ways and means of starting and stopping motors
2) Operation of a magnetic coil
3) Use of magnetic starters and controllers
4) Correct sizing of magnetic starters and controllers
5) Difference between starters and contactors
6) Function, operation, and characteristics of overload protective devices
7) Schematics for various control circuits
8) Two-wire control
9) Three-wire control circuits
10) Interlocking methods
11) Reversing and sequential controllers
12) Jogging, inching, plugging
13) Multiple start-stop controls and selector switches
14) Phase failure relays
15) Various manual and automatic speed control techniques
16) Function, operation, and characteristics of variable frequency drive systems
17) Function, operation, characteristics and installation procedures, programmable logic controllers
   a) Function of central processing unit
   b) Memory types and sizes
   c) User and storage memory
   d) Back-up batteries
   e) Peripheral devices
18) Ladder diagrams
19) Function, operation, and characteristics of timers, counters, sequencers
20) Utilize appropriate manual and information for start-up, maintenance, and testing

XII-D. Function, operation and characteristics of switches and relays
1) Schematic including switches and relays
2) Installation and connection methods for various switch types
3) Installation and connection methods for various relays
4) Function, operation and characteristics of electronic sensor and pilot devices
5) Function, operation and characteristics of control transformers
   a) Leads of control transformers
   b) Proper sizing of control transformers

XII-E. Mechanical connections to utilize motors
1) Operation of mechanical clutch and magnetic drives
2) Direct and offset drives
3) Proper pulley sizes required

XII-F. Process control systems and devices
1) Operating requirements followed by manual and automatic controllers
2) Function, operation, characteristics and installation of:
   a) Closed loop and open loop systems
   b) Feedback control
   c) Proportional control
d) Integral control
e) Derivative control
3) Block diagrams, including control and devices
4) The function, operation, characteristics of sensors and transmitters
### XIII. GENERATORS AND POWER SUPPLIES

| ELEC 32 | Electrical Motors | X | X |

#### XIII-A. Principles of electromotive force

1) Parts, functions, operation and characteristics of the AC generator
2) Parts, functions, operation and characteristics of the DC generator
3) "left hand rule" for generators
4) RPM, frequency and number of poles in a given generator
5) 3 phase generation
6) Wye and Delta windings
7) 3 phase sine wave

#### XIII-B. Principles of generating electricity

1) Make up and organization of the industry
2) Organizations within the industry
3) Types and configurations of uninterruptible power supplies (UPS)
4) Types and configurations of battery systems used for UPS systems

### XIV. TRANSFORMERS

| ELEC 33 | INDUSTRIAL WIRING METHODS | X | X |

#### XIV-A. Function, operation, and characteristics of transformers

1) Electrical principles involved in transformer operation
2) Transformer classifications and applications
3) Transformer losses
4) Ratios for voltage and amperage with respect to number of turns

#### XIV-B. Selection and installation of transformers

1) Nameplate information
2) Techniques for sizing transformers (single and three phase)
3) Determining if given transformer meets voltage, current, and impedance
4) Calculating voltages and currents for load and windings
5) Determining whether to use wye or delta wiring schemes
6) Steps for receiving and preparing transformer for installation
7) Necessary test to assure proper operation
8) Proper techniques for power and load conductors
9) Methods for determining proper type and values of electrical protective device
10) Proper grounding procedures

#### XIV-C. Distribution systems

1) Functions, operation and characteristics of various types of distribution systems
2) Criteria for selecting particular type of distribution system

### XV. PERSONAL DEVELOPMENT

#### XV-A. Orientation

1) Make up and organization of the industry
   a) Jobsite chain of command
      (1) owner/customer
      (2) architects/engineers
      (3) inspection authorities
      (4) construction managers
      (5) general contractors
      (6) other contractors and trades
2) Organizations within the industry
   a) manufacturers
   b) distributors

#### XV-B. Methods of working with others

1) The three basic methods of motivation
2) Need levels of humans
3) The role of supervisors
   a) leadership styles appropriate to certain situations
   b) need for competent supervisors
4) Effective communications
   a) importance of communications in the industry and on the job
   b) barriers to communications
   c) keys to effective communications
### XV-C. Economic considerations

1) Why worker future is tied to employer's
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

2) Responsibilities of employer
   a) keeping skills current
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X
   b) managing your future
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

3) Costs of doing business
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

4) Importance of satisfying customers
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

5) Impact of job performance, behavior and appearance on prospects for future work
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

6) Functions of marketing
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

### XVII. TESTING

#### XVII-A. Steps used for various testing processes

1) Acceptance testing of cables
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

2) Maintenance testing of generators
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

3) Insulation tests using megohmmeter
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

#### XVII-B. Utilizing the results of testing procedures

1) Special requirements for high voltage testing
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

2) Describe potential safety hazards
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

3) Characteristics and properties of high voltage cable and insulators
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

4) Appropriate tests, methods, voltages, and equipment
   - ELEC 31, 33
   - ELECTRICAL WIRING METHODS AND INDUSTRIAL WIRING METHODS
   - X
   - X

### XVIII. SPECIALTY SYSTEMS

#### XVIII-A. Fire Alarms

1) Functions, operations and characteristics of various types of fire alarm systems and components
   - ELEC 15D
   - FIRE ALARMS
   - X
   - X

2) Code requirements and use code to answer specific questions
   - ELEC 15D
   - FIRE ALARMS
   - X
   - X

3) The functions, operation, and characteristics of fire alarm initiating and indicating devices
   - ELEC 15D
   - FIRE ALARMS
   - X
   - X

4) Multiplexing of system components
   - ELEC 15D
   - FIRE ALARMS
   - X
   - X

5) Various types of areas and methods to protect them
   - ELEC 15D
   - FIRE ALARMS
   - X
   - X

6) Appropriate wiring methods and devices
   - ELEC 15D
   - FIRE ALARMS
   - X
   - X

7) Utilize manuals to start-up and check out system
   - ELEC 15D
   - FIRE ALARMS
   - X
   - X

8) Utilize proper manuals and techniques for system maintenance and troubleshooting
   - ELEC 15D
   - FIRE ALARMS
   - X
   - X

#### XVIII-B. Security Alarms

1) Functions, operations and characteristics of various types of security systems and components
   - ELEC 15E
   - Security Alarms
   - X
   - X

2) Code requirements and use code to answer specific questions
   - ELEC 15E
   - Security Alarms
   - X
   - X

3) The functions, operation, and characteristics of alarm initiating and indicating devices
   - ELEC 15E
   - Security Alarms
   - X
   - X

4) Multiplexing of system components
   - ELEC 15E
   - Security Alarms
   - X
   - X

5) Various types of areas and methods to protect them
   - ELEC 15E
   - Security Alarms
   - X
   - X

6) Appropriate wiring methods and devices
   - ELEC 15E
   - Security Alarms
   - X
   - X

7) Utilize manuals to start-up and check out system
   - ELEC 15E
   - Security Alarms
   - X
   - X

8) Utilize proper manuals and techniques for system maintenance and troubleshooting
   - ELEC 15E
   - Security Alarms
   - X
   - X
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<th>San Joaquin Delta College</th>
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<td>XVIII-C. Voice, Data, TV, Signaling Systems</td>
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<td>2) The proper cabling systems required for various systems (telephone, data, Local Area Networks, etc.)</td>
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<td>4) How cable defects and installation errors can degrade system</td>
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<td>XVIII-D. Lightning Protection Systems</td>
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