

**AP E 103 Inductance and Capacitance Theory and Codeology (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP E 102**Note:** May be taken 2 times

Review of the International Brotherhood of Electrical Workers constitution and local union by-laws. Study of the effects of inductance and capacitance on current and voltage. Application of phase angle calculation and the National Electric Code. Overview of workplace problems due to drug abuse.

**AP E 104 Transformers and Code Calculations, Conduit Bending and Blueprints (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP E 103**Note:** May be taken 2 times

Study of transformers theory, installation, connection and distribution systems. Performing short circuit calculations, selecting of building wire for specific applications, calculating loads for residential and multifamily loads and service feeders. Applying conduit bending principles using mechanical benders to fabricate segmented concentric bends.

**AP E 105 Introduction to Electronics and Industrial Blueprints (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP E 104**Note:** May be taken 2 times

Introduction to basic electronics including examination of semiconductor devices, current and voltage manipulation, applications, and blueprint reading.

**AP E 106 Grounding, Electrical Services, and Transform Three-Phase Connections (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP E 105**Note:** May be taken 2 times

Study of requirements for electrical services installation. Study of electrical grounding including merits, impact on safety, ground fault protection, and identification of grounding system elements and functions.

**AP E 107 Electrical Motor Control, Pilot Devices, Starters and Relays (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP E 106**Note:** May be taken 2 times

Study of controls and circuits, pilot devices, starters, and relays. Includes the analysis and development of circuits, the installation and service of electrical equipment, and the electrical code.

**AP E 108 Digital Electronics (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP E 107**Note:** May be taken 2 times

Introduction to digital electronic technology and electronic equipment. Instruction includes basic digital systems, binary and decimal numbering systems, decision-making logic circuits, Boolean Algebra, flip-flops, counters, shift registers, encoders, decoders, ROMs, DC to AC converters and organization of these component blocks to accomplish manipulation of data.

**AP E 109 Management, Fire Alarms, High Voltage Testing, and Telephone and Security Wiring (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP E 108**Note:** May be taken 2 times

Introduction to management and marketing practices, installation of fire alarm systems and the National Electric Code as it relates to alarm installation and high voltage of telephone wiring and security systems.

**AP E 110 Programmable Logic Controllers (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP E 109**Note:** May be taken 2 times

Introduction to basic input/output hardware, processors and memory numbering systems associated with programmable controllers. Instruction includes use of personal computer to create and modify ladder diagrams and relay instructions, using solid state logic elements, counters, and shift registers. Principles of process control are explained and principle components are identified.

**AP E 197 Electrical Topics (.5-4)**

Units awarded in topics courses are dependent upon the number of hours required of the student. Any combination of lecture, laboratory, or lecture/laboratory may be scheduled by the department. Refer to Class Schedule.

**Prerequisite:** Indentured apprentice to the San Diego Electrical Joint Apprenticeship and Training Committee or the Riverside and San Bernardino Joint Electrical Apprenticeship Training Committee**Note:** May be taken 4 times

Concentrated courses on electricity. Course title will designate subject covered.

**Inside Wireman (AP IW)**

A five-year apprenticeship program. Study of technical course development and delivery techniques for the electrical trade, utilizing classroom-proven techniques. The student will familiarize him/herself with classroom management, testing and assessment techniques, curriculum development and material presentation based on industry-standard and college level instructional methodologies. Applications for this program should be directed to the San Diego Electrical Training Trust, 4675 Viewridge Avenue, Suite D, San Diego, CA 92123. Telephone (858) 569-6633, ext. 111.

**A.A. DEGREE MAJOR OR CERTIFICATE OF ACHIEVEMENT**

Program Requirements		Units
AP IW 101	Introduction to the Electrical Trade	4
AP IW 102	Electrical Theory, Practice and Blueprint Reading	4
AP IW 103	Inductance and Capacitance Theory	4
AP IW 104	Transformer, Motors, and Motor Controls	4
AP IW 105	Special Electrical Systems	4
AP IW 106	Specialized Electrical Applications	4
AP WE 113	Electrician Work Experience	16
Electives (Select 16 units)		
AP IW 107	Advanced Electronics I	4
AP IW 108	Advanced Electronics II	4
AP IW 109	Advanced Motor Controls	2
AP IW 110	AutoCAD	4
AP IW 111	Electric Motor Drives	4
AP IW 112	Introduction to Computers	4
AP IW 113	Electrical Project Supervisor	4
AP IW 114	Electrical Certification Preparation	4
AP IW 115	Low Voltage	4
AP IW 116	Photovoltaics	4
AP IW 117	Service Equipment	2
AP IW 118	Test Equipment	2
AP IW 119	Welding	2
AP IW 120	Instructional Leadership I	4
AP IW 121	Programmable Logic Controllers	4
AP IW 122	Fire/Life Safety Systems	4
AP IW 123	Instrumentation	4
AP IW 124	Instructional Leadership II	4
AP IW 125	Building Automation Systems	4
AP IW 126	Electrical Construction Practices	4
AP IW 197	Inside Wireman Topics	2 - 4
<b>TOTAL UNITS</b>		<b>56</b>

**COURSE OFFERINGS****AP IW 101 Introduction to the Electrical Trade (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** One semester of Algebra I with a grade of 'C' or better; designated tests with a passing grade determined by the appropriate committee, and indentured apprentice to the San Diego Electrical Joint Apprenticeship and Training Committee or the Riverside and San Bernardino Joint Electrical Apprenticeship Training Committee.

**Note:** May be taken 2 times

Introduction to the electrical industry, with emphasis on jobsite safety, basic conduit bending, National Electric Code (NEC), sexual harassment, introduction to blueprints, tools and their use. Particular attention will be given to fastening devices, basic mathematics, resistance, voltage, power in DC series, parallel, and combination circuits.

#### **AP IW 102 Electrical Theory, Practice and Blueprint Reading (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 101

**Note:** May be taken 2 times

Survey of drug awareness, Union Constitution and Bylaws, parliamentary procedure, test instruments, 3Ø electrical systems, DC and AC power generation, specialized conduit bending techniques, National Electric Code (NEC), solid state devices, blueprint analysis, AC theory, transformers, vector analysis, impedance, voltage, power in AC series, parallel, and combination circuits.

#### **AP IW 103 Inductance and Capacitance Theory (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 102

**Note:** May be taken 2 times

Study of circuit analysis techniques, power factor, semiconductors, AC system grounding and bonding, ground fault protection systems, overcurrent protective devices (fuse and circuit breakers), test instruments, National Electric Code (NEC), and industrial blueprint analysis.

#### **AP IW 104 Transformer, Motors, and Motor Controls (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 103

**Note:** May be taken 2 times

Study of real-world application of transformer, motor and motor control concepts utilizing extensive hands-on labs and demonstrations. Students work in foremen-led teams to design, build, and test motor control circuits. Students will gain familiarity with a wide array of test instruments including DMMs, voltage testers, megohmmeters, clamp-on ammeters, capacitance testers and other equipment.

#### **AP IW 105 Special Electrical Systems (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 104

**Note:** May be taken 2 times

Introduction to telephony and data networks, fire alarm systems, nurse call systems, Programmable Logic Controllers (PLCs), arc-flash protection, and instrumentation concepts, National Electric Code (NEC), and OSHA rules and regulations.

#### **AP IW 106 Specialized Electrical Applications (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 105

**Note:** May be taken 2 times

Introduction to electrical power quality, CATV and CCTV Systems, security systems, fiber optics, hazardous locations, lighting protection, advanced conduit bending, HVAC principles and controls, blueprints, and leadership skills.

#### **AP IW 107 Advanced Electronics I (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106

**Note:** May be taken 2 times

Comprehensive study of DC circuits, AC circuits and semiconductor power electronic devices and circuits for future applications. Emphasis is placed on schematic interpretation and testing with troubleshooting techniques for electrical and electronic circuits and systems. Integrating theory and lab, this class employs project-based learning techniques and team-based labs to emphasize practical application, teamwork, and communication skills.

#### **AP IW 108 Advanced Electronics II (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106

**Note:** May be taken 2 times

Study of the essential concepts of digital electronics by constructing and programming a micro-computer, computer interface, and programmable-robot. A strong emphasis is placed on schematic interpretation and testing and troubleshooting techniques for electrical and electronic circuits and systems.

#### **AP IW 109 Advanced Motor Controls (2)**

*1½ hours lecture-1½ hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106

**Note:** May be taken 2 times

Study of advanced techniques for control system installations of motors and related equipment, utilizing field-proven techniques for installation, start-up, control system documentation, and trouble-shooting. Students will become familiar with industry-standard control configurations that are used in a variety of installation scenarios. Specialized control devices will be examined.

#### **AP IW 110 AutoCAD (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106 and AP IW 112

**Note:** May be taken 2 times

Application of a step-by-step approach to the commands of AutoCAD LT. Topics include application fundamentals, drawing setup, file operations, commands, object properties, dimensioning, menus, drawing management, and AutoCAD LT applications in the electrical trade.

#### **AP IW 111 Electric Motor Drives (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106 and AP IW 109

**Note:** May be taken 2 times

Comprehensive study of the technology behind and installation requirements for electric motor drives. Topics include motor load analysis, electric motor drive operation fundamentals, drive startup procedures, and drive testing and troubleshooting.

#### **AP IW 112 Introduction to Computers (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106

**Note:** May be taken 2 times

Instruction in basic computer skills. Topics include basic personal computer design and construction, computer operating systems, and select applications. Internet applications, basic keyboarding, computer peripherals, file structures, and data management techniques will be examined.

#### **AP IW 113 Electrical Project Supervisor (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106

**Note:** May be taken 2 times

An overview of all processes required to run a successful job. The class utilizes field trips and speakers to give the student a 360° view of the workplace. Each speaker will bring expertise from the field into the classroom where students will learn the right and the wrong way to organize and run a jobsite.

#### **AP IW 114 Electrical Certification Preparation (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106

**Note:** May be taken 2 times

Designed to prepare the student to take the California Electrician Certification Examination (CECE). Provides a review of concepts and principles, but focuses primarily on understanding and applying the national Electric Code (NEC), the set of standards upon which the CECE is based.

#### **AP IW 115 Low Voltage (4)**

*3 hours lecture-3 hours laboratory*

**Prerequisite:** A minimum grade of 'C' in AP IW 106

**Note:** May be taken 2 times

Study of technologies and installation requirements for low voltage systems. Subjects presented in this course are Low Voltage Design and Specification Techniques, Fiber Optics, LAN Cabling Systems, IEEE Grounding Requirements for Electronic Equipment, Power Quality to Support Low Voltage Systems, Telephone Systems, Nurse Call, and CCTV.

**AP IW 116 Photovoltaics (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

Technologies and installation requirements for photovoltaic systems. Subjects presented in this course are renewable energy construction, renewable energy resources, renewable energy efficiency, and energy savings devices used in construction.

**AP IW 117 Service Equipment (2)**

1½ hours lecture-1½ hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

Presentation of the technologies and skill sets required for installing and provisioning an electrical service for commercial or industrial facilities. Topics presented in this course include electrical distribution overview, safety, OSHA requirements, shoring, trenching, Sempra Service Guide requirements, rigging, IEEE Standards, and National Electrical requirements (Article 230) for an electrical service.

**AP IW 118 Test Equipment (2)**

1½ hours lecture-1½ hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

The technologies and skill sets required for testing and troubleshooting electrical distribution systems and associated hardware including electric motors and drives. The topics presented in this course include testing procedures, test equipment, testing documentation, lighting and branch circuit analysis and troubleshooting.

**AP IW 119 Welding (2)**

1½ hours lecture-1½ hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

Basic understanding of cutting torch and electrical resistance welding principles and techniques. Covers safe storage, transportation, and use of acetylene, oxygen, and chemelene (MAPP) gases for cutting, as well as "stick" and wire-feed welding safety and technique. Upon completion of the course students will be able to weld in vertical, overhead and horizontal positions.

**AP IW 120 Instructional Leadership I (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

Study of technical course development and delivery techniques for the electrical trade, utilizing classroom-proven techniques. The student will familiarize him/herself with classroom management, testing and assessment techniques, curriculum development and material presentation based on industry-standard and college level instructional methodologies.

**AP IW 121 Programmable Logic Controllers (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106, AP IW 109 and AP IW 112**Note:** May be taken 2 times

Provides an in-depth study of programmable logic controllers (PLC) while examining standard programming languages and common PLC hardware applications. This course focuses on the underlying principles of PLCs and provides practical information on installing, programming, maintaining, and troubleshooting PLCs.

**AP IW 122 Fire/Life Safety Systems (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

Introduces students to the code requirements, design concepts, and installation techniques required for an efficiently installed and properly working fire alarm system. Includes an overview of NFPA 70 (NEC) – 2002 edition as it applies to Fire Alarm, an introduction to NFPA 72 – 1999 edition National Fire Alarm Code with overview of Chapters 1 through 9, including Appendix A.

**AP IW 123 Instrumentation (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

Provides students with a more advanced understanding of instrumentation and control, covering temperature, pressure, flow, and level detection (process control) systems; their principles of operation, and strategies for installation, maintenance, and troubleshooting of these systems.

**AP IW 124 Instructional Leadership II (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

Study of technical course development and delivery techniques for the electrical trade, utilizing classroom-proven techniques. The student will familiarize him/herself with classroom management, testing and assessment techniques, curriculum development and material presentation based on industry-standard and college level instructional methodologies.

**AP IW 125 Building Automation Systems (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

Covers the technologies and installation requirements for Building Automation Systems (BAS.) The subjects presented in this course are Building Automation applications and requirements used in the construction of commercial and industrial buildings.

**AP IW 126 Electrical Construction Practices (4)**

3 hours lecture-3 hours laboratory

**Prerequisite:** A minimum grade of 'C' in AP IW 106**Note:** May be taken 2 times

The technologies and skill sets required for installing and provisioning the electrical requirements for commercial or industrial facilities. The topics presented in this course include electrical distribution overview, safety, OSHA requirements, shoring, trenching, Sempra Service Guide requirements, rigging, IEEE Standards, Blueprints, CSI Master Format construction specifications and National Electrical requirements for electrical services and distribution systems.

**AP IW 197 Inside Wireman Topics (.5-4)**

Units awarded in topics courses are dependent upon the number of hours required of the student. Any combination of lecture, laboratory, or lecture/laboratory may be scheduled by the department. Refer to Class Schedule.

**Note:** May be taken 4 times

Topics in Inside Wireman. See Class Schedule for the specific topic offered. Course title will designate subject covered.

**Plasterer (AP PL)**

A four-year apprenticeship program. Applicants for this program should be directed to the Carpenters Joint Apprenticeship and Training Committee for Southern California, San Diego Carpenters Training Center, 8595 Miralani Drive, San Diego, CA 92126. Telephone (858) 621-2667.

### A.A. DEGREE MAJOR OR CERTIFICATE OF ACHIEVEMENT

Program Requirements	Units
AP DL/AP PL/ AP AC 201	Orientation 1.5
AP DL/AP PL/ AP AC 202	Safety and Health Certifications 1.5
AP DL/AP PL/ AP AC 203	Printreading 1.5
AP DL/AP PL/ AP AC 204	Advanced Printreading 1.5
AP DL/ AP PL 205	Basic Lathing 1.5
AP PL 206	Basic Plastering 1.5