TABLE OF CONTENTS

ACTI MECHATRONICS CLASSES

OSHA ................................................................. 1
Technical Mathematics
 & Blueprint Reading ........................................ 2
Electricity DC Fundamentals ............................. 3
Electricity AC Fundamentals ............................. 4
DC/AC Motor Controls ...................................... 5
Mechanical Drives .......................................... 6
Electro-Mechanical Devices ............................. 7
Hydraulic Fundamentals .................................. 8
Pneumatics Fundamentals ............................... 9
Introduction to Programmable Logic Controllers .......................... 10
Robotics Fundamentals ................................... 11-12
National Electrical Code ................................. 13
Integrated Systems Troubleshooting ................. 14

ADVANCED ACTI MECHATRONICS CLASSES

Intermediate PLC .............................................. 15
Sequence Control ............................................ 16
Electric Pneumatics ....................................... 17
Advanced PLC ............................................... 18
OSHA

General industry workers need information about their rights, employer responsibilities, and how to file a complaint as well as how to identify, abate, avoid and prevent job related hazards on a job site. Learn a variety of general industry safety and health hazards which a worker may encounter as well as an emphasis on hazard identification, avoidance, control and prevention, to OSHA standards.

Topics covered will include:

OSHA Required (7 hours):
- Introduction to OSHA
- Walking and Working Surfaces
- Electrical Safety
- Hazard Communication
- Personal Protective Equipment

OSHA Elective (3 hours) – Recommended:
- Hazardous Materials (Flammable and Combustible Liquids)
- Ergonomics
- Fall Protection

OSHA Optional:
- Forklift Familiarization Safety

By the completion of the training participants will be able to:

Have a working knowledge of basic general industry safety requirements in the workplace
Have general knowledge of OSHA rules and what OSHA is about
Have a working knowledge of potential hazards in general industry
Know proper use and care of personnel protective equipment
Knowledge on how to locate safety information and stay abreast of current safety information
Technical Mathematics & Blueprint Reading

Technical math and blueprint reading go hand-in-hand. Get skills training with an emphasis on numbering systems, calculations, and problem solving skills needed to solve for electronic circuit parameters and to read blueprints.

**Topics covered will include:**

- Math Operations
- Exponents and Radicals
- Basic Geometry
- Basic Trigonometry
- Measurement Tools
  - Caliper (Vernier, Digital and Dial)
  - Micrometer
  - Height Gauge
- Introduction to Blueprint Reading
- View and Sectioning Conventions
- Dimensioning Practices
- Tolerance as a Method of Control
- Interpreting Special Applications

"It was helpful to refresh my knowledge on what I don’t use everyday and reinforce what I already know."

– Jeffrey
Caterpillar

By the completion of the training participants will be able to:

- Demonstrate basic math operations
- Demonstrate geometry and trigonometry
- Perform math conversions
- Interpret basic blueprint drawings
Electricity DC Fundamentals

Gain fundamental knowledge of electrical theory and skills required in the industrial or manufacturing industry. Learn Direct Current (DC) including Ohm’s law, Kirchhoff’s laws, and circuit analysis techniques. Emphasis is on circuit analysis of resistive networks and DC voltage measurements.
(Prerequisite: Technical Math and Blueprint Reading)

Topics covered will include:
Introduction to Electricity
Metric Prefixes
Scientific and Engineering Notation
Current/Amperage
Voltage/Volts
Resistor/Resistance
DC Circuit Problem Solving
DC Series Circuits
DC Parallel Circuits
Combinational Circuits (Series-Parallel)
Wheatstone Bridge
Metering Circuits (multi-meter)

“\textit{I’ve been working with DC electricity for years and this course closed a lot of gaps I’ve had.}”

–John Arconic

By the completion of the training participants will be able to:
Understand the fundamentals of DC circuits
Understand how Direct Current works
Understand Ohm’s law
Understand Kirchhoff’s Voltage Law and Kirchhoff’s Current Law
Understand DC series/parallel/combination circuits

40 hours
Electricity AC Fundamentals

Understanding Alternating Current (AC) circuits is a required skill. Learn the fundamentals of Alternating Current (AC), Capacitance, Inductance, Power, transformers, and fundamentals of DC/AC motors. (Prerequisite: Technical Math and Blueprint Reading; DC Fundamentals)

Topics covered will include:
- Principles of Alternating Current
- Oscilloscope
- Function Generator
- Capacitor/Capacitance
- Inductor/Inductance
- Power in AC Circuits
- RLC Circuits
- Single-Phase Transformers
- Three-Phase Systems
- Fundamentals of DC/AC Motors

By the completion of the training participants will be able to:
- Understand the fundamentals of AC/DC circuits, how they differ and how they are similar
- Demonstrate how electrical energy is turned into heat energy
- Understand the difference in AC circuits: resistance versus impedance
- Understand how oscilloscope and function generators work
- Understand how AC works
- Understand phase shift
- Understand how transformers work
- Demonstrate a basic knowledge of AC Inductive and AC Capacitive circuits
- Demonstrate a fundamental knowledge of DC/AC motors

“Great class and the instructor made us feel comfortable. This will be something I can use every day.”

–Steven
H-E-B
DC/AC Motor Controls

Get skilled in the fundamentals of electric motors with an emphasis on starting, and speed control as well as braking systems. Understand the various concepts of motor controls, circuits and components that are needed to accomplish different controls.
(Prerequisite: Technical Math and Blueprint Reading; DC Fundamentals and AC Fundamentals)

Topics covered will include:
- DC Power Supplies
- DC Generators
- DC Armatures
- DC Motors
- Single Phase AC Motors
- Control Pilot Devices
- Circuit Layout
- Connections and Symbols
- Basic Control Circuits
- Jogging (Inching) Control Circuits
- Basic motor troubleshooting skills
- Multi-meters

By the completion of the training participants will be able to:
- Understand the different types of motors (DC vs AC)
- Identify types of motor maintenance
- Identify characteristics of a motor maintenance program
- Identify safety procedures to use during motor maintenance
- Understand motor control components
- Demonstrate knowledge of different theories of operation
- Interpret electrical diagrams
- Demonstrate industrial motor control knowledge through “hands-on” learning lab experience
- Troubleshoot a failed component during learning lab practical assignments

“Excellent material covered over classroom time and hands-on practice. The instructor made it easy to understand.”
— Marco Caterpillar

80 hours
Mechanical Drives

Get the necessary knowledge and hands-on experience for initial entry into machine drive maintenance and repair.

(Prerequisite: Technical Math and Blueprint Reading)

Topics covered will include:
Introduction to Mechanical Drive Systems
Belt Drives
Chain Drives
Gear Drives
Lubrication
Couplings
Shaft Alignment
Bearings
Ball Screws
Linear Bearings
Gaskets and Seals
Clutches
Brakes

By the completion of the training participants will be able to:
Identify the characteristics of seals, bearings, lubricants, and fasteners
Install seals, bearings, fasteners and gear drives
Apply various lubricants in accordance with preventive and corrective maintenance requirements
Operate hand and power tools, belt and chain drive systems, and gear drive systems

“The labs were the most useful part of the class. I learn better with hands-on practice.”

— Juan
Alcoa San Antonio Works

40 hours
Electro-Mechanical Devices

This course is a study of electro-mechanical devices for manufacturing including motion control systems, process control systems, components of motors, various switches, sensors, photo eyes and electromagnetic relays.

(Prerequisite: Technical Math and Blueprint Reading; DC Fundamentals; AC Fundamentals)

Topics covered will include:
- Classification and characteristics of motion control systems and process control systems
- Open-loop systems and closed-loop systems and how they differ
- Four control modes
- Major components of DC motors
- Motor action, main field, commutation, torque, and other characteristics of motors
- How heat and pressure affects a process
- Different types of standard electronic and pneumatic transmission signals
- Control valves
- Limit switches
- Inductive and capacitive proximity sensors
- Photo electric sensors and photo eyes
- Electro-magnetic relay
- Feedback devices

By the completion of the training participants will be able to:
- Understand two classifications of control systems, three common characteristics of motion control systems, and two categories of process control systems
- Identify the differences between open-loop and closed-loop systems, and describe the elements of a closed-loop system
- Understand the four control modes used by industrial controllers
- Describe how varying heat and pressure levels affect a process
- Provide the different types of standard electronic and pneumatic transmission signals and their numerical signs
- Understand types of control valves, describe their characteristics and applications
- Describe the operation of a limit switch
- Explain operations of an inductive proximity sensor
- Describe the operation of a capacitive proximity detector; and Hall Effect proximity sensor; photo electric sensor; and various photo eyes; electromagnetic relay
- Describe the operations of an Electromagnetic Relay

“The class helped me understand the right function and proper use for sensors.”
–Juan Toyotetsu

40 hours
Hydraulic Fundamentals

Many manufacturing systems use the power of fluids. Learn the principles of fluid power energy and its controlled applications in this modularized entry level course.

(Prerequisite: Technical Math and Blueprint Reading)

Topics covered will include:

- Hydraulic systems safety
- Various hydraulic components including power unit, relief valve, flow control valve, directional control valve
- Pascal's Law
- Flow rate and velocity
- Meter-in, meter-out and bypass flow control circuit
- Force, work, power and efficiency of a hydraulic system
- Cylinders in series
- Cylinders in parallel
- Regenerative circuit
- Accumulators, hydraulic motors, pressure reducing valves and remotely controlled relief valves

By the completion of the training participants will be able to:

- Identify hydraulic symbols
- Identify hydraulic components and schematics drawings
- Understand the basic physical concepts
- Understand and build basic lab applications
- Demonstrate knowledge of the advantages/disadvantages of hydraulic components
- Understand basic electrical hydraulic circuits

“...and schematics has helped me understand how hydraulics operate.”

– Bruno
City of San Antonio
Pneumatics Fundamentals

A strong command of pneumatic components is vital to a successful industrial career. This is a modularized entry level course in the principles of pneumatic energy and its controlled application that consists of an introductory and an advanced training module. Learn to build basic Electro-pneumatic Circuits and apply fault finding techniques. (Prerequisite: Technical Math and Blueprint Reading; DC Fundamentals; AC Fundamentals; DC/AC Motor Controls)

Topics covered will include:

Pneumatics Trainer, Pneumatics Power, Conditioning Unit and its components
Basic pneumatics physical concept; Pressure vs. Force; Pressure vs. Volume; Pressure Drop vs. Flow; and Vacuum Generation
Directional Control Valves
Directional and Speed Control of Cylinders
Cylinders in Series
Cylinders in Parallel
Pneumatic Motor Circuit
Basic Electro-pneumatic circuit

By the completion of the training participants will be able to:

Identify pneumatic symbols
Identify pneumatic components and schematics drawings
Understand the basic physical concepts
Understand and build basic lab applications
Demonstrate knowledge of the advantages/disadvantages of pneumatic components
Identify pumps
Understand basic motor circuits
Understand the fundamentals of electricity
Understand the construction and function of the components in electro-pneumatic control systems
Identify and use control schematics
Introduction to PLC

Programmable Logic Controllers are used throughout industry in today’s world. Learn the maintenance, programming and troubleshooting of Allen Bradley PLC systems. It includes power supplies, discrete Input/Output (I/O) modules, programming devices, processors, basic logic elements, PLC programming, timers, counters, program control instructions, data manipulation instructions and math instructions.

(Prerequisite: Technical Math and Blueprint Reading; DC Fundamentals; AC Fundamentals; DC/AC Motor Controls; Electromechanical Devices)

Topics covered will include:
PLC Safety
PLC’s vs. Relay Logic
Advantages and Disadvantages of PLC
Basic Instructions
Number Systems
Normally open/closed contacts inputs
Coils Outputs
Basic PLC Operations
And/Or/Combination Circuits
I/O Wiring
Allen Bradley Control Logix 1200 Hardware and Software
Basics of PLC Programming
Fundamentals of Logic
Timers/Counters
Basic Program Control Instructions

By the completion of the training participants will be able to:
Understand the fundamental principles of PLC hardware structure and programming
Understand and design programming
Understand the fundamental principles and PLC operations
Demonstrate an understanding of programming software
Understand the fundamentals of timers, counters and other different instructions
Demonstrate an understanding of PLC programming using different functions
Demonstrate basic troubleshooting skills for Allen Bradley PLCs

“The hands-on and the knowledgeable instructor helped me learn a lot in this class.”
– Ray
H-E-B
Robotics Fundamentals

Robotics is increasingly used by companies as a means for increased production. Learn the fundamentals of robotics used in manufacturing with an emphasis on safety, robot operations, programming, applications in manufacturing, and general industry.

(Prerequisite: DC Fundamentals; AC Fundamentals; DC/AC Motor Controls; Electro-mechanical Devices; Pneumatics Fundamentals and Introduction to PLC)

Topics covered will include:

Safety with Robotics in Industry
Work Envelopes/Work Areas
Robotic Systems and Operation
Teach Pendants
Start Up Procedures
Programming using Teach Pendant
Virtual Programming
  - Robo CIM – Festo/Lab Volt
  - Robo Guide - Fanuc

Fanuc Specific Topics
  - Error & Fault Recovery
  - Frames
  - Motion Programs
  - Motion Instructions
  - Copying and Editing Programs
  - Branching Programs
  - Instructions
  - Position Registers
  - Input / Output
By the completion of the training participants will be able to:

Complete a written pre-assessment to assist in establishing a baseline
Identify and discuss the difference between the maximum envelope and work envelope of a robotic system
Identify at least three safety features/devices used to ensure employee safety where robotic systems are in use, and the two types of control systems used in robotic systems
List the five major systems that comprise an industrial robotic system, and the six degrees of freedom and associated movements
Define and explain the difference between linear and rotary actuation
Explain how a non-servo control system operates, and how a servo control system operates
Identify at least two of the three types of actuator drives and explain their operations

Given a Festo/Lab Volt Robotic Training System with teach pendant participants will be able to:
- Demonstrate the ability to calibrate the system using tools provided, to execute a soft and a hard home
- Develop programs to execute set criteria within given tolerances
- Demonstrate the ability to effectively recover the system from minor faults

Given a Fanuc LR Mate 200ic robot and teach pendant participants will be able to demonstrate how to:
- Identify and explain the operation of various switches and buttons on the Teach Pendant; the purpose of, and demonstrate the correct operation of the Deadman Switch
- Demonstrate the ability to navigate and describe the purpose of various menus on the teach pendant
- Correctly power up and power down the robot system
- Demonstrate how to reset a general fault, reset a Cartesian/ Joint DCS error, recover from various Alarms/Errors, jog the robot in the Joint frame mode, and how to change the speed of axis movement
- Explain and demonstrate the use of the Abort All command
- Select a prescribed frame
- Define Singularity and demonstrate recovery from a singularity fault

Given RoboGuide virtual programming software participants will be able to demonstrate the ability to:
- Navigate the software and create a robot work cell
- Demonstrate Jogging the virtual robot
- Add parts and fixtures to the work cell
- Create and execute multiple programs in various configurations

Demonstrate successful transfer of knowledge and skills through attaining a score of 70% or higher through a written, a virtual, and a hands-on-final review exercise
National Electrical Code

Get a basic overview and introduction to the 2017 National Electrical Code® (NEC®). Learn the structure of the various articles of the NEC®, how to navigate these complex articles, understand major changes, and basic application of the major articles. Cover the major articles found in the current 2017 edition of the NFPA 70 National Electrical Code®.

“The classes were put together very well and the teacher was very knowledgeable and helpful.”

– Shawn
Pressure Systems International

By the completion of the training participants will be able to:

Identify key terms associated with the NEC®
Identify the nine chapters associated with the NEC®
Identify basic requirements covered by the four general chapters of the NEC®
Demonstrate understanding of the organization of the NEC® through classroom exercises
Demonstrate an understanding of how to identify 2017 NEC® updates
Demonstrate ability to apply NEC® applications through written exercises to 70% accuracy
Demonstrate ability to apply NEC® by completing a written assessment with 65% accuracy
Integrated Systems Troubleshooting

Is there an indispensable skill needed in the manufacturing environment? Basic troubleshooting is it. Experience this capstone class that utilizes the AMTEC Manufacturing Simulator to provide an introduction and troubleshooting skills using the integrated systems approach for advanced integrated automation systems used in today’s industrial manufacturing. You focus on the overview/familiarization of the sophisticated manufacturing systems, various factors and skills to troubleshoot systems and the subsystems.

(Prerequisite: Technical Math and Blueprint Reading; DC Fundamentals; AC Fundamentals; DC/AC Motor Controls; Hydraulics Fundamentals; Pneumatics Fundamentals; Electro-mechanical Devices and Introduction to PLC)

By the completion of the training participants will be able to:
Identify troubleshooting safety hazards
Demonstrate the various factors of the troubleshooting process
Demonstrate a standard process for reducing machines from the systems to their subsystems
Demonstrate the philosophies of troubleshooting in an industrial environment

80 hours
Intermediate PLC

Continue learning the fundamentals of PLC and covers the maintenance, programming and troubleshooting of Allen Bradley PLC systems. It includes PLC programming, program control instructions, data manipulation instructions, math instructions, and shift register instructions.

Topics covered will include:
- Continuous to work on Timers and Counters
- Master Control Reset (MCR) instruction
- Jump Instruction (JMP)
- Subroutine (JSR) Function
- Immediate Input/Output Instructions
- Data Transfer Operations
- Data Compare Instructions
- Data Manipulation Instructions
- Bit/Words Shift Instructions

By the completion of the training participants will be able to:
- Be more familiar with PLC programming
- Understand more clearly about timers and counters in PLC applications
- Describe the operation of the master control reset instruction
- Describe the operation for the jump instruction and the label instruction
- Explain the function of subroutines
- Describe the immediate input and output instruction function
- Execute data transfer of word and file level instructions from one memory location to another
- Interpret data compare instructions
- Describe the operation of bit and word shift instructions
Sequence Control

Focus on how various components, machines, systems, and larger entities rely on each other through interaction and integration between various systems. Although operated on a smaller scale than most industrial plants, it will provide participants with a good understanding of how the larger systems are sequenced to ensure fluid and efficient control.

Topics covered will include:
Safety in Industry
Review of Electrical Symbols & Schematics
Variable Frequency Drives (VFD)
Review of Basic Control Circuits
Review of Jogging (Inching) Control Circuits
Methods of Braking
Reduced AC Voltage Starters
Synchronous Machine Controls

By the completion of the training participants will be able to:
Identify power hazards and describe the proper safety precautions related to safety practices used in industry
Demonstrate the use of the following items to navigate, identify, and describe the function of electrical circuits: Symbols>Electrical Diagrams>Schematics>Line Diagrams>Applications
Understand variable frequency drives and how a variable frequency drive controls the speed, acceleration and deceleration of an induction motor
Be familiar with different control circuits, e.g., two-wire controls, three-wire controls, hand-off-automatic controls, multi-pushbuttons, mechanical interlock for reversing control, sequence control etc.
Be familiar with different jogging control circuits, e.g. Jogging using a control relay and a reversing starter, jogging using a reversing starter and a selector switch
Connect and troubleshoot reduced voltage starters using resistors, and an autotransformer starter
Understand synchronous motors
Connect and troubleshoot a pushbutton synchronous motor control circuit, and a timed semi-automatic synchronous motor controller
Synchronize a synchronous alternator to a power system
Electric Pneumatics

Review basic concepts of electricity, ladder diagrams, basic electrically controlled pneumatic circuits, logic function valves, and cover functional systems, industrial pneumatic applications including drilling system and garbage compactor circuit and PLC controlled pneumatic systems.

Topics covered will include:
- Basic Electricity
- Ladder Diagrams
- Basic Electrically controlled Pneumatic Circuits
- Basic and/or Logic Function Circuit
- Sequencing Pneumatic Circuits
- Time-Delay Electro-pneumatic Applications
- PLC-Controlled Clamp and Work Circuit
- PLC-Controlled Conveyor system

By the completion of the training participants will be able to:
- Describe electrically controlled pneumatic systems
- Understand indirect control e.g., how a directional valve is actuated by a pressure signal delivered by another directional valve or by an electrical signal provided by an input device
- Understand the basic memory and priority electro-pneumatic circuit
- Be familiar with multi-pressure systems, sequencing pneumatic circuits, time-delay electropneumatic applications, and pneumatic actuator deceleration circuits
- Understand how PLC controls electro-pneumatic circuits, and how to use simple and logical methods to perform troubleshooting application to both electric and pneumatic circuits
- Understand industrial type circuits and sensors used in different applications
Advanced PLC

Take your PLC knowledge and skills to the next level. Get a basic overview of the Allen Bradley Control Logix5000 family of industrial automation.

Topics covered will include:
- Logix5000 system with different modules configuration
- RSLinx including RS232 serial driver and Ethernet
- RSWho
- Control Logix Controller
- I/O Configurations
- Alias Tag and Base Tag
- Data Types
- Subroutine
- Tasks, Programs, and Routines
- Get System Values (GSV)
- Cross Reference
- Forcing in RSLinx5000
- Trends
- Produced and Consumed Tags
- Messaging
- DeviceNet

By the completion of the training participants will be able to:
- Understand the controller properties and tag memory with I/O configurations
- Understand control logix addressing scheme
- Demonstrate basic programming concepts and online editing in RSLinx5000
- Understand the difference between base tags and alias tags and how to create and apply alias tags
- Recognize the different data types and memory usage
- Understand the properties of tasks, programs, and routines
- Cross references tags and I/O cards
- Be familiar with the troubleshooting skills and understanding of the tools available in the software
- Describe the messaging and produced/consumed tags configured over Ethernet Peer to Peer Communications
- Be familiar with DeviceNet
- Understand configuration in Networks
Alamo Colleges District

Campus Locations

Northeast Lakeview

Northwest Vista

Palo Alto

St. Philip's

San Antonio

Serving San Antonio & Surrounding Counties
Strengthening skills to develop your workforce!

800 Quintana Rd., Bldg. 8, San Antonio, TX 78211

For more information call (210) 485-0880