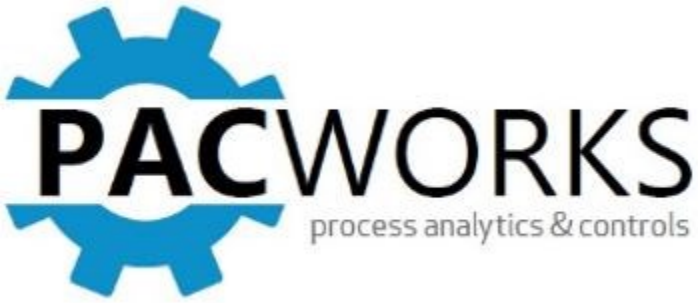

PAC Works Training Facility
700 W. Texas Ave., Suite 100
Baytown, TX 77520
(832) 926-4717

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HISTORY

George Morgan began his career as an electrician. After years of working in this field, he decided to retool his skillset to include Instrumentation, Analyzers and Control systems. Mr. Morgan has excelled in his career to become a Subject Matter Expert (SME) and the go-to person in the areas of Commissioning, Sample System Design and Flaws. He has added to his achievements the training of young and upcoming techs at Lee College in Baytown TX. Mr. Morgan has worked with Engineers to save millions of dollars for his client. George has worked for companies such as Enterprise.

ACCREDITATION AND APPROVALS

PAC WORKS instructors are certified to teach NCCER courses and assess Performance Evaluations. PAC WORKS, INC became an Accredited Training Sponsor Candidate in January 2018 and has been providing NCCER training since that time. NCCER is the source of accreditation for these programs providing PAC WORKS, INC with a nationally recognized standard for training and/or assessment.

PAC WORKS is approved and regulated by the Texas Workforce Commission, Career Schools and Colleges, Austin, Texas.

FACILITIES AND EQUIPMENT

The PAC WORKS Training Facility is located at 700 W. Texas Avenue, Suite 100 in Downtown Baytown, Texas. The nearly 5000 square feet building includes two classroom areas, four labs outfitted with operating instruments and modeled from real situations at work in industrial environments, fully functioning process analyzers, and supplied with standard tools and diagnostic equipment of the industry. The Training Facility also has a student break room and an administrative office.

BOARD OF TRUSTEES

George Morgan
Roxann Inniss

ADMINISTRATION, FACULTY AND STAFF

George Morgan – Owner, Director, Instructor, BS University of Texas, Arlington; AAS Instrumentation Lee College, Baytown TX.
Certificates Analyzer Specialists, NCCER Instructor and Master Trainer, Sample System Design, Consulting and Commissioning Services, and Journeyman Electrician

Roxann Inniss –Owner, Business Manager, Instructor, AAS Instrumentation, Lee College, Baytown TX: Certification Analytical Instrumentation, NCCER Instructor.

Bernadette Coates – Manager, Instructor, BA Organization Leadership and Supervision, University of Houston: AAS Instrumentation Technology, Lee College, Baytown TX: Certification Process Instrumentation & Electrical Design.

Cesar Vasquez, Instructor
Mitchell Wells, Instructor
Mitchell Perrill, Instructor

TUITION AND FEES

PACWORKS process analytics & controls	Industrial E&I Maintenance Courses	Instrumentation Courses	Analytical Instrumentation Course	Industrial Electrician Course	PV Instrumentation Performance Prep
Tuition	$15,480.00	$5,160.00	$5,235.00	$4,160.00	$2,310.00
Registration	$450.00	$150.00	$150.00	$150.00	$150.00
Study Materials & Module Testing	$900.00	$300.00	$300.00	$300.00	$100.00
Written Assessment	$225.00	$75.00	$0	$75.00	---
Technology Fee (Laboratory)	$525.00	$175.00	$175.00	$175.00	$95.00
Total Cost	**$17,580.00**	**$5,860.00**	**$5,860.00**	**$4,860.00**	**$2,655.00**

HOLIDAYS

New Year's Day
Labor Day
Thanksgiving Day
Christmas Eve
Day After Christmas
Fourth of July
Good Friday
Day after Thanksgiving Day
Christmas Day

ENROLLMENT PERIODS

Open enrollment begins two months before the first day of classes for each program term.

PROGRAM TERM DATES

Fall 2019 --- Sixteen Weeks: August 26 – December 21
Day, evening and weekend classes available and scheduled as filled.

Spring 2020 --- Sixteen Weeks: January 4 – April 25
Day, evening and weekend classes available and scheduled as filled.

Summer 2020 --- Sixteen Weeks: May 4 – August 22
Day, evening and weekend classes available and scheduled as filled.

OFFICE HOURS

School office hours are 9:00 AM to 5:00 PM Monday through Friday, except holidays. The school office will close for lunch between 12:00 noon to 1:00 pm.

School hours of operation are 9:00 am to 10:00 pm Monday through Friday and 9:00 am to 6:00 pm Saturdays, except holidays, during each term. Meal breaks are observed 12:00 noon to 1:00 pm and 5:00 pm to 6:00 pm. Classes will observe at least one ten-minute break for each two hours of class or lab time.

The office and school are officially closed between academic program terms but are typically staffed to schedule appointments or conduct other business. The school or office can be reached by phone at (832) 926-4717 to schedule a meeting between terms.

ADMISSION REQUIREMENTS

Individuals applying for all courses are required to:

a. be at least 18 years of age;
b. possess ability to read and write in English, and
c. interview with a PAC Works representative(s). PAC Works is an equal opportunity training facility for individuals that demonstrate a positive and professional attitude with social manners. Interviewees that exhibit hostilities or do not demonstrate professional standards or social manners may not be admitted.

PAC Works will review previous education, training, or experience for potential credit.

CANCELLATION POLICY

A full refund will be made to any student who cancels the enrollment contract within 72 hours (until midnight of the third day excluding Saturdays, Sundays and legal holidays) after the enrollment contract is signed. A full refund will also be made to any student who cancels enrollment within the student's first three scheduled class days, except that the school may retain not more than $150 in any administrative fees charged, as well as items of extra expense that are necessary for the portion of the program attended and stated separately on the enrollment agreement.

REFUND POLICY

1. Refund computations will be based on scheduled course time of classes through the last date of attendance. Leaves of absence, suspensions and school holidays will not be counted as part of the scheduled class attendance.

2. The effective date of termination for refund purposes will be the earliest of the following:
   a. the last day of attendance, if the student is terminated by the school;
   b. the date of receipt of written notice from the student; or
   c. ten school days following the last date of attendance.

3. If tuition and fees are collected in advance of entrance, and if after expiration of the 72 hour cancellation privilege the student does not enter school, not more than $150 in any administrative fees charged shall be retained by the school for the entire residence program or synchronous distance education course.

4. If a student enters a residence or synchronous distance education program and withdraws or is otherwise terminated after the cancellation period, the school or college may retain not more than $150 in any administrative fees charged for the entire program. The minimum refund of the remaining tuition and fees will be the pro rata portion of tuition, fees, and other charges that the number of hours remaining in the portion of the course or program for which the student has been

charged after the effective date of termination bears to the total number of hours in the portion of the course or program for which the student has been charged, except that a student may not collect a refund if the student has completed 75 percent or more of the total number of hours in the portion of the program for which the student has been charged on the effective date of termination.

5. Refunds for items of extra expense to the student, such as books, tools, or other supplies are to be handled separately from refund of tuition and other academic fees. The student will not be required to purchase instructional supplies, books and tools until such time as these materials are required. Once these materials are purchased, no refund will be made. For full refunds, the school can withhold costs for these types of items from the refund as long as they were necessary for the portion of the program attended and separately stated in the enrollment agreement. Any such items not required for the portion of the program attended must be included in the refund.

6. A student who withdraws for a reason unrelated to the student's academic status after the 75 percent completion mark and requests a grade at the time of withdrawal shall be given a grade of "incomplete" and permitted to re-enroll in the course or program during the 12-month period following the date the student withdrew without payment of additional tuition for that portion of the course or program.

7. A full refund of all tuition and fees is due and refundable in each of the following cases:
   a. an enrollee is not accepted by the school;
   b. if the course of instruction is discontinued by the school and this prevents the student from completing the course; or
   c. if the student's enrollment was procured as a result of any misrepresentation in advertising, promotional materials of the school, or representations by the owner or representatives of the school.

8. Refund Policy for Students Called to Active Military Service.

   A student of the school or college who withdraws from the school or college as a result of the student being called to active duty in a military service of the United States or the Texas National Guard may elect one of the following options for each program in which the student is enrolled:
   a. if tuition and fees are collected in advance of the withdrawal, a pro rata refund of any tuition, fees, or other charges paid by the student for the program and a cancellation of any unpaid tuition, fees, or other charges owed by the student for the portion of the program the student does not complete following withdrawal;
   b. a grade of incomplete with the designation "withdrawn-military" for the courses in the program, other than courses for which the student has previously received a grade on the student's transcript, and the right to re-enroll in the program, or a substantially equivalent program if that program is no longer available, not later than the first anniversary of the date the student is discharged from active military duty without payment of additional tuition, fees, or other charges for the program other than any previously unpaid balance of the original tuition, fees, and charges for books for the program; or
   c. the assignment of an appropriate final grade or credit for the courses in the program, but only if the instructor or instructors of the program determine that the student has:
      1) satisfactorily completed at least 90 percent of the required coursework for the program; and
      2) demonstrated sufficient mastery of the program material to receive credit for completing the program.

9. The payment of all refunds will be totally completed such that the refund instrument has been negotiated or credited into the proper account(s) within 60 days after the effective date of termination.

CERTIFICATES AND CERTIFICATIONS

PAC Works offers training programs for Electrical, Instrumentation and Analyzer Technicians. The courses prepare students to become NCCER Certified Instrumentation Technicians (TINST 12) and/or NCCER Certified Industrial Maintenance, E&I Maintenance Technicians (IMEIT 40). A Certificate of Completion can also be obtained for completing the Fundamentals of Analyzers course.

NCCER offers a complete series of entry-and journey-level written assessments and Performance Verifications (PV) as part of its National Craft Assessment and Certification Program (NCACP). These assessments evaluate the knowledge and skills of an individual in a specific craft area. All assessments are based upon the NCCER Curriculum and have been developed in conjunction with industry Subject Matter Experts.

INSTRUMENTATION TECHNICIAN

Course Objective/Purpose:
This single term (16 weeks) course[1] prepares individuals for entry-level jobs as an Instrumentation technician. Graduates may find suitable employment in manufacturing, chemical plants and refineries, paper and steel plants, power plants, offshore facilities and maintenance contractors supporting those facilities. This course combines lectures and labs to prepare students for NCCER certification as an Instrumentation Technician.

	Instrumentation	
Course #	**Subject Title**	**Clock Hours Lec/Lab/Ext/Total**
12115-14	Instrumentation Safety Practices	02 / 04 / 00 / 06
12105-01	Metallurgy for Instrumentation	02 / 04 / 00 / 06
12107-14	Instrument Drawings and Documents, I	01 / 04 / 00 / 05
12108-14	Gaskets and Packing	01 / 04 / 00 / 05
12109-14	Lubricants and Sealants	01 / 04 / 00 / 05
12110-15	Flow, Pressure, Level, and Temperature	01 / 05 / 00 / 06
12119-14	Craft Related Mathematics	01 / 05 / 00 / 06
12202-15	Instrument Drawings and Documents, II	01 / 05 / 00 / 06
12204-16	Process Control Theory	01 / 04 / 00 / 05
12205-16	Detectors, Secondary Elements, Transducers and Transmitters	01 / 05 / 00 / 06
12206-16	Controllers, Recorders and Indicators	01 / 04 / 00 / 05
12207-16	Control Valves, Actuators and Positioners	01 / 05 / 00 / 06
12208-16	Relays and Timers	01 / 04 / 00 / 05
12209-16	Switches and Photoelectric Devices	01 / 04 / 00 / 05
12210-15	Filters, Regulators and Dryers	01 / 04 / 00 / 05
12305-16	Instrumentation Electrical Circuitry	01 / 04 / 00 / 05
12306-16	Grounding and Shielding	01 / 04 / 00 / 05
12401-16	Digital Logic Circuits	01 / 04 / 00 / 05
12402-16	Instrument Calibration and Configuration	01 / 05 / 00 / 06
12410-16	Proving, Commissioning, and Troubleshooting a Loop	01 / 04 / 00 / 05
12405-16	Tuning Loops	01 / 04 / 00 / 06

[1] Pending student feedback, this course may become a two-term course in the future.

12406-16	Programmable Logic Controllers	01 / 04 / 00 / 05
12407-16	Distributed Control Systems	01 / 04 / 00 / 05
12409-16	Analyzers	01 / 04 / 00 / 05
Total		**26 / 102/ 00 / 128**

Instrumentation Course Competencies/Objectives/Hours:

(26 Lecture Hours, 102 Lab Hours, 128 Total Hours)

Instrumentation Safety Practices – NCCER Module # 12115-14

1. Demonstrate safe working procedures in a construction environment.
2. Explain the purpose of OSHA and how it promotes safety on the job.
3. Identify electrical hazards and how to avoid or minimize them in the workplace.
4. Explain safety issues concerning lockout/tagout procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection systems.

Metallurgy for Instrumentation – NCCER Module # 12105-01

1. Define metallurgy.
2. Identify types of common metals.
3. Describe uses and applications of metals in instrumentation.

Instrument Drawings and Documents, I – NCCER Module # 12107-14

1 Identify and describe standard International Society of Automation (ISA) instrument symbols and abbreviations.
2 Read and interpret instrument indexes.
3 Read and interpret general instrument specifications.
4 Read and interpret general notes and details included on instrument drawings and documents.
5 Read and interpret installation detail drawings.
6 Read and interpret location drawings.

Gaskets and Packing – NCCER Module # 12108-14

1 Identify the different types of gaskets and gasket material.
2 Identify the different types of packing.
3 Describe uses of packing.
4 Describe uses of O-rings.
5 Describe uses of gaskets.
6 Fabricate gaskets.

Lubricants and Sealants – NCCER Module # 12109-14

1 Identify and select the appropriate lubricants for use in specific applications.
2 Identify and select the appropriate sealants for use in specific applications.
3 Identify and select the appropriate cleaners for specific applications.
4 Describe the differences between lubricants, sealants, and cleaners.
5 Describe proper applications of lubricants, sealants, and cleaners.
6 Properly handle and store lubricants, sealants, and cleaners.
7 Explain Material Safety Data Sheets (MSDSs).

Flow, Pressure, Level, and Temperature – NCCER Module # 12110-15

1 Identify and describe characteristics of flow measurement.
2 Identify and describe characteristics of pressure measurement.
3 Identify and describe characteristics of temperature measurement.
4 Identify and describe characteristics of level measurement.

Craft Related Mathematics – NCCER Module # 12119-14

1 Identify similar units of measurement in both the English and metric systems and identify which units are larger.
2 Convert measured values in the English system, using common conversion factor tables, to equivalent metric values.
3 Use a handheld calculator to perform the basic mathematical operations necessary in instrumentation.
4 Use a handheld calculator to square numbers and find the square root of numbers.
5 Perform the mathematical conversions necessary for instrumentation measurements.

Instrument Drawings and Documents, II – NCCER Module # 12202-15

1 Identify common types of electrical and instrumentation diagrams and drawings.
2 Read and interpret electrical diagrams used in instrumentation work: Wiring diagrams, Ladder diagrams, One-line diagrams, and Motor controller diagrams.
3 Read and interpret instrumentation diagrams: P&ID diagrams, Loop diagrams, and Raceway diagrams.
4 Draw a loop diagram for a given instrumentation loop.

Process Control Theory – NCCER Module # 12204-16

1 Define process measurement and control.
2 Explain process characteristics that demand process control.
3 Describe the elements of an instrumentation channel, including: Detector (sensor), Transducer, Amplifier or signal conditioner, Transmitter, Controller, and Final element (control valve).
4 Define and describe process control loop types, including: Feedforward, Feedback, Cascade, and Ratio.
5 Define and describe process controller modes, including: On-off control (two-position control), Modulating control, Proportional (P), Integral (I), Derivative (D), Proportional plus integral (PI), Proportional plus derivative (PD), and Proportional plus integral plus derivative (PID).
6 Discuss various types of process control applications and loops.

Detectors, Secondary Elements, Transducers and Transmitters – NCCER Module # 12205-16

1 Identify the following primary elements (detectors) and describe their operation: Orifice plate, Pitot tube, Bimetallic strip device, and Thermocouple.
2 Identify the following secondary elements and describe their operation: Bourdon tube, Diaphragm device, Pressure capsule, and Bellows device.
3 Define an I/P and a P/I transducer and describe their operation.
4 Describe the operation of a strain gauge.
5 Identify a pneumatic DP transmitter and an electronic DP transmitter and describe their operation.
6 Identify the following primary components in a DP cell transmitter: Process measuring section (hi and lo sides), Force bar section, Flapper-nozzle (pneumatic only), Pneumatic relay (pneumatic only), and Input/output sections (pneumatic and electronic).
7 Draw a one-line diagram including a measuring element, transducer, and transmitter.

Controllers, Recorders and Indicators – NCCER Module # 12206-16

1 Describe the operation of a controller.
2 Describe the operation of a recorder.
3 Describe the operation of an indicator.
4 Using samples, pictures, or specification sheets, identify common types of controllers, recorders, and indicators.
5 Identify the common parts of a pneumatic controller.
6 Describe the functions of an electronic controller.
7 Identify the common parts of an electronic controller.

8 Identify the three main sections of a recorder.
9 Connect and use a short recorder.

Control Valves, Actuators and Positioners – NCCER Module # 12207-16

1 Describe the construction principles of operation of various control valves.
2 Describe the construction principles of operation of various actuators.
3 Describe the principles of operation of various positioners.
4 Describe the variables measured and used as inputs for various types of positioners.
5 Discuss valve selection criteria and identify various control valves, actuators, and positioners using specification sheets, pictures, or samples.

Relays and Timers – NCCER Module # 12208-16

1 Describe the basic functions of relays.
2 Describe and identify electromechanical relays and explain how they operate.
3 Install and connect relays in sockets.
4 Describe and identify solid state relays and explain how they operate.
5 Describe and identify pneumatic relays and repeaters. Explain how these operate.
6 Describe and identify hydraulic relays and explain how they operate.
7 Describe and identify timers and time delay relays, including: Dashpot, Synchronous time clock, and Solid state.
8 Describe the operation of a volume booster.
9 Install various types of timers.

Switches and Photoelectric Devices – NCCER Module # 12209-16

1 State the purpose of a switch.
2 Identify commonly used switches.
3 Describe the operation of various types of switches.
4 Classify switches, using wiring symbols, according to the number of poles and the number of throws.
5 State the purpose of an SCR.
6 Describe the operation of photoelectric devices.
7 Identify commonly used photoelectric devices.
8 State the electrical characteristics of a solar cell.

Filters, Regulators and Dryers – NCCER Module # 12210-15

1 Define and discuss principles of operation of various filters.
2 Define and discuss principles of operation of various regulators.
3 Define and discuss principles of operation of dryers.
4 Define and discuss variables measured and used as inputs to various types of regulators.
5 Discuss selection criteria, and identify various filters, regulators, and dryers using specification sheets, pictures, and samples.

Instrumentation Electrical Circuitry – NCCER Module # 12305-16

1 Explain the basic characteristics of series circuits, parallel circuits, and series-parallel circuits.
2 Analyze series, parallel, and series-parallel circuits.
3 Find the total resistance in series, parallel, and series-parallel circuits.
4 Determine the frequency and period for a given AC sine wave.
5 Calculate the peak, effective (rms), and average voltage or current values for an AC sine wave.
6 Describe the voltage and current phase relationship in a resistive AC circuit.
7 Define inductive reactance and state how it is affected by frequency.
8 Define capacitive reactance and state how it is affected by frequency.
9 Explain the terms true power, apparent power, reactive power, and power factor.
10 Explain why a 4–20mA signal is typically transmitted in a loop instead of a 1–5V signal.

11 Describe the characteristics of a digital signal.
12 Calculate the unknown resistance value in a resistance temperature detector (RTD) bridge circuit.

Grounding and Shielding – NCCER Module # 12306-16

1 Define electrical system grounding.
2 List the reasons electrical systems are grounded.
3 Describe methods used to ground electrical systems.
4 Define noise in instrumentation systems.
5 Describe types of noise in instrumentation systems.
6 Identify sources of noise in instrumentation systems.
7 Apply shielding methods to reduce noise.

Digital Logic Circuits – NCCER Module # 12401-16

1 Identify the different gates and circuits in digital logic.
2 Describe the truth tables and timing diagrams for various digital gates.
3 Describe the operation of different digital flip-flops.
4 Describe the operation of shift registers.
5 Describe the operation of counters.
6 State the purpose of the American National Standards Institute (ANSI) Q90–Q93 standards.

Instrument Calibration and Configuration – NCCER Module # 12402-16

1 Define calibration.
2 Discuss the three-point and five-point methods of calibration.
3 Calibrate the following pneumatic instruments using the proper equipment: Differential pressure transmitters and Temperature transmitters.
4 Calibrate the following 4–20mA instruments using the proper calibration equipment: Differential pressure transmitters and Temperature transmitters.
5 Define smart instruments.
6 Identify a HART® communicator.
7 Calibrate a smart transmitter using a HART® communicator.
8 Calibrate a transducer.
9 Calibrate the following valve positioners: Pneumatic positioner, Electro-pneumatic positioner, and Smart positioner (digital valve controller).

Proving, Commissioning, and Troubleshooting a Loop – Module # 12410-16

1 Describe how to visually inspect various loop components
2 Describe how to conduct loop continuity tests on electrical and pneumatic devices
3 Describe how to prove a loop.
4 Describe how to calibrate a loop.
5 Describe the documents associated with commissioning.
6 Describe the commissioning process.
7 Identify the fundamental steps in loop troubleshooting.
8 Describe the loop troubleshooting process for oscillating loops.

Tuning Loops – NCCER Module # 12405-16

1 Describe the importance and function of loop tuning.
2 Describe basic proportional control and define terms relevant to tuning.
3 State the basic equations needed for loop tuning.
4 Describe open loop tuning processes.
5 Describe closed loop tuning process.
6 Describe a visual loop tuning process.

Programmable Logic Controllers – NCCER Module # 12406-16

1 Describe the function and purpose of a programmable logic controller (PLC).

2 Compare hardwired and PLC systems.
3 Count and convert between number systems.
4 Explain the purpose of binary codes.
5 Describe the purpose of the various power supplies used within a PLC.
6 Explain the general function of an input/output (I/O) module, including the following types: Discrete, Numerical data, Special, and Remote.
7 Explain the power supply and ground connections to I/O modules.
8 State the function of the PLC processor module.
9 Explain the interrelations between the various microprocessor components.
10 State the characteristics of various types of memory.
11 Describe the characteristics and features of a PLC processor module.
12 Explain the purpose of PLC software and firmware.
13 Describe the features and the differences between PLC programming languages.
14 Describe the features of relay ladder logic instruction categories.
15 Explain the principles used to correlate PLC hardware components to software instructions.
16 Program and install a PLC.

Distributed Control Systems – NCCER Module # 12407-16

1 Define a distributed control system (DCS).
2 Identify the typical components associated with a DCS.
3 Identify the various network configurations used with a DCS.
4 Describe uses for a DCS.
5 Explain how an instrument technician interfaces with a DCS.

Analyzers – NCCER Module # 12409-16

1 Define the following properties in a process or environment, and identify methods used to analyze them: Density, Specific gravity, Viscosity, Turbidity, Flash point, Oxidation-reduction potential (ORP), pH, Conductivity of a liquid, Oxygen (O2), Carbon monoxide (CO), Carbon dioxide (CO2), Hydrogen sulfide (H2S), Total hydrocarbon content, and Particulates in a clean room.
2 Describe chromatography and its uses.
3 Describe ultraviolet analyzers and their uses.
4 Describe infrared analyzers and their uses.

Review and Assessments

The final classes will be used to review all topics covered in this course and completing the final written assessment. For the students meeting the minimum NCCER requirements, Performance Verifications needed to receive the NCCER Instrumentation Technician Certification will also be conducted.

INDUSTRIAL E&I MAINTENANCE TECHNICIAN

Course Objective/Purpose:

This series of three courses, each one term (16 weeks) in length, prepares individuals for journey-level jobs as an Industrial Maintenance, Electrical & Instrumentation Technician. Graduates may find suitable employment in manufacturing, chemical plants and refineries, paper and steel plants, power plants, offshore facilities and various maintenance contractors supporting those facilities. These courses combine lectures, demonstrations and labs to prepare students for NCCER certification as an Industrial Maintenance, Electrical & Instrumentation Technician.

	Industrial E&I I	
Course #	**Subject Title**	**Clock Hours Lec/Lab/Ext/Total**
00101-04	Basic Safety	03 / 08 / 00 / 11
00106-04	Basic Rigging	03 / 08 / 00 / 11
40103-07	Fasteners and Anchors	04 / 10 / 00 / 14
40105-07	Gaskets and Packing	04 / 10 / 00 / 14
40201-08	Industrial Safety for E&I Technicians	04 / 10 / 00 / 14
40203-08	Electrical Theory	03 / 08 / 00 / 11
40204-08	Alternating Current	03 / 08 / 00 / 11
40206-08	Flow, Pressure, Level, and Temperature	04 / 10 / 00 / 14
40209-08	Tubing	04 / 10 / 00 / 14
40210-08	Clean, Purge, and Test Tubing and Piping Systems	04 / 10 / 00 / 14
Total		**36 / 92 / 00 / 128**

Industrial E&I I Course Competencies/Objectives/Hours:
(36 Lecture Hours, 92 Lab Hours, 128 Total Hours)

Basic Safety – NCCER Module # 00101-04

1. Describe the importance of safety, the causes of workplace incidents, and the process of hazard recognition and control.
2. Describe the safe work requirements for elevated work, including fall protection guidelines.
3. Identify and explain how to avoid struck-by and caught-in-between hazards.
4. Identify common energy-related hazards and explain how to avoid them.
5. Identify and describe the proper use of personal protective equipment (PPE).
6. Identify and describe other specific job-site safety hazards.

Basic Rigging – NCCER Module # 00106-04

1. Identify and describe various types of slings.
2. Describe how to inspect various types of slings.
3. Identify and describe how to inspect common rigging hardware.
4. Identify and describe various types of hoists.
5. Identify and describe basic rigging hitches and the related Emergency Stop hand signal.

Fasteners and Anchors – NCCER Module # 40103-07

1. Identify and explain the use of threaded fasteners.
2. Identify and explain the use of non-threaded fasteners.
3. Identify and explain the use of anchors.
4. Select the correct fasteners and anchors for given applications.
5. Install fasteners and anchors.

Gaskets and Packing – NCCER Module # 40105-07

1. Identify the various types of gaskets and explain their uses.
2. Identify the various types of gasket materials and explain their applications.
3. Lay out, cut, and install a flange gasket.
4. Describe the use of O-rings.
5. Explain the importance of selecting the correct O-ring for an application.
6. Select an O-ring for a given application and install it.
7. Describe the uses and methods of packing.

Industrial Safety for E&I Technicians – NCCER Module # 40201-08

1. Demonstrate safe working procedures in an industrial environment.
2. Explain the purposes of OSHA and NFPA 70E and how they promote safety on the job.
3. Recognize electrical/energy hazards and describe how to avoid or minimize them in the workplace.
4. Explain safety issues concerning lockout/tagout procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection systems.
5. Recognize and apply safe working practices.

Electrical Theory – NCCER Module # 40203-08

1. Define voltage and identify the ways in which it can be produced.
2. Explain the difference between conductors and insulators.
3. Define the units of measurement that are used to measure the properties of electricity.
4. Identify the meters used to measure voltage, current, and resistance.
5. Explain the basic characteristics of series and parallel circuits.
6. Use Kirchhoff's current law to calculate the total and unknown currents in parallel and series-parallel circuits.
7. Use Kirchhoff's voltage law to calculate voltage drops in series, parallel, and series-parallel circuits.
8. Use the formula for Ohm's law to calculate voltage, current, and resistance.

Alternating Current – NCCER Module # 40204-08

1. Calculate the peak and effective voltage or current values for an AC waveform.
2. Calculate the phase relationship between two AC waveforms.
3. Describe the voltage and current phase relationship in a resistive AC circuit.
4. Describe the voltage and current transients that occur in an inductive circuit.
5. Define inductive reactance and state how it is affected by frequency.
6. Describe the voltage and current transients that occur in a capacitive circuit.
7. Define capacitive reactance and state how it is affected by frequency.
8. Explain the relationship between voltage and current in the following types of AC circuits: RL circuit, RC circuit, LC circuit, and RLC circuit.
9. Explain the following terms as they relate to AC circuits: True power, Apparent power, Reactive power, and Power factor.
10. Explain basic transformer action.

Flow, Pressure, Level, and Temperature – NCCER Module # 40206-08

1. Identify and describe methods of flow measurement.
2. Identify and describe methods of pressure measurement.
3. Identify and describe methods of temperature measurement.
4. Identify and describe methods of level measurement.40207-08 Process Mathematics

Tubing – NCCER Module # 40209-08

1. Identify the different kinds of tubing and describe the properties and common uses for each kind.
2. Explain the purpose for tubing standards and specifications.
3. Describe the proper handling and storage of tubing.
4. Cut tubing using the proper tools, cutting methods, and safety procedures.
5. Bend tubing using the proper tools, bending methods, and safety procedures.
6. Identify and select proper tubing fittings for selected instrumentation applications.
7. Flare tubing using the proper tools, flaring methods, and safety procedures.
8. Make and remake a compression fitting.

Clean, Purge, and Test Tubing and Piping Systems – NCCER Module # 40210-08

1. Identify cleaning, flushing, and purging procedures.
2. Describe the general cleaning and purging requirements for piping and tubing.
3. Perform the appropriate cleaning and flushing methods until required cleanliness has been achieved.
4. Describe and select pressure and leak testing methods for piping/tubing systems.
5. Identify precautions associated with testing piping/tubing systems.
6. Perform pressure leak tests per approved procedures.
7. Prepare required test documentation.

Review and Assessments

The final classes will be used to review all topics covered in this course and completing the final written assessment.

	Industrial E&I II	
Course #	**Subject Title**	**Clock Hours Lec/Lab/Ext/Total**
40211-08	Instrument Drawings and Documents, Part One	03 / 08 / 00 / 11
40213-08	Conductor Terminations and Splices	03 / 08 / 00 / 11
40302-09	Electronic Components	04 / 10 / 00 / 14
40303-09	E & I Drawings	04 / 10 / 00 / 14
40305-09	Distribution Equipment	04 / 10 / 00 / 14
40309-09	Layout and Installation of Tubing and Piping Systems	03 / 08 / 00 / 11
40311-09	Hydraulic Controls	03 / 08 / 00 / 11
40312-09	Pneumatic Controls	04 / 10 / 00 / 14
40402-09	Basic Process Control Elements, Transducers and Transmitters	04 / 10 / 00 / 14
40403-09	Instrument Calibration and Configuration	04 / 10 / 00 / 14
Total		**36 / 92 / 00 / 128**

Industrial E&I II Course Competencies/Objectives/Hours:

(36 Lecture Hours, 92 Lab Hours, 128 Total Hours)

Instrument Drawings and Documents, Part One – NCCER Module # 40211-08

1. Identify and describe standard Instrument Society of America (ISA) instrument symbols and abbreviations.
2. Read and interpret instrument indexes.
3. Read and interpret general instrument specifications.
4. Read and interpret general notes and details included on instrument drawings and documents.
5. Read and interpret installation detail drawings.
6. Read and interpret location drawings.

Conductor Terminations and Splices – NCCER Module # 40213-08

1. Describe how to make a sound conductor termination.
2. Prepare cable ends for terminations and splices and connect the ends using lugs or connectors.
3. Train cable at termination points.
4. Describe the National Electrical Code® (NEC®) requirements for making cable terminations and splices.
5. Demonstrate crimping techniques.
6. Select the proper lug or connector for the job.

Electronic Components – NCCER Module # 40302-09

1. Identify electronic system components.
2. Describe the electrical characteristics of solid-state devices.
3. Describe the basic materials that make up solid-state devices.
4. Describe and identify the various types of transistors and explain how they operate.
5. Describe and connect diodes, including light-emitting diodes (LEDs) and silicon-controlled rectifiers (SCRs).
6. Use a cross reference manual to find substitutes for electronic components.
7. Identify fuses used in electronic devices.
8. Identify the leads of various solid-state devices.
9. Describe integrated circuits.
10. Identify applicable pin numbers of integrated circuits.
11. Explain the purpose of logic gates.
12. Check diodes.

E & I Drawings – NCCER Module # 40303-09

1. Identify common types of electrical and instrumentation diagrams and drawings.
2. Read and interpret electrical diagrams used in instrumentation work: Wiring diagrams, Ladder diagrams, One-line diagrams, and Motor controller diagrams.
3. Read and interpret instrumentation diagrams: P&ID diagrams, Loop diagrams, and Raceway diagrams.
4. Draw a loop diagram for a given instrumentation loop.

Distribution Equipment – NCCER Module # 40305-09

1. Explain the necessity of overcurrent protection devices in electrical circuits.
2. Define the terms associated with fuses and circuit breakers.
3. Describe the purpose of switchgear.
4. Describe the four general classifications of circuit breakers and list the major circuit breaker ratings.
5. Describe switchgear construction, metering layouts, wiring requirements, and maintenance.
6. List National Electrical Code® (NEC®) requirements pertaining to switchgear.
7. Describe the visual and mechanical inspections and electrical tests associated with low-voltage and medium-voltage cables, metal-enclosed busways, and metering and instrumentation.
8. Describe a ground fault relay system and explain how to test it.

Layout and Installation of Tubing and Piping Systems – NCCER Module # 40309-09

1. Using prints, specifications, and visual inspections, determine the scope of the layout procedure.
2. Determine the proper methods for routing piping or tubing.
3. Apply fitter's math to measure and bend piping or tubing.
4. Cut piping or tubing.
5. Apply the appropriate calculations and bender to accurately bend piping or tubing to the proper angle in an offset.
6. Identify and state the usage of various piping and tubing supports.
7. Install various piping and tubing supports.
8. Identify and state the usage of various piping and tubing fittings, including: Flare tubing fittings, Compression tubing fittings, Threaded pipe fittings, and Pipe flanges.

Hydraulic Controls – NCCER Module # 40311-09

1. Explain hydraulic system safety.
2. Explain the principles of hydraulics.
3. Identify hydraulic devices and symbols and explain their functions.
4. Explain a hydraulic system in a process application.

Pneumatic Controls – NCCER Module # 40312-09

1. Explain pneumatic system safety.
2. Explain the physical characteristics of gases.
3. Explain compressing gases.
4. Explain the pneumatic transmission of energy.
5. Explain the principles of compressor operation.
6. Identify and explain types of compressors.
7. Explain compressed-air treatment.
8. Identify and explain pneumatic system components and symbols.

Basic Process Control Elements, Transducers and Transmitters – NCCER Module # 40402-09

1. Identify the following primary elements (detectors) and describe their operation: Orifice plate, Pitot tube, Thermocouple, and Resistance temperature detector (RTD).
2. Identify the following secondary elements and describe their operation: Bourdon tube, Diaphragm device, Capacitance-type pressure sensor, and Bellows device.
3. Define various transducer types: I/Ps, Strain gauges, Linear-variable differential transformer (LVDT), and Accelerometers.
4. Explain an I/P operation.
5. Describe the operation of a strain gauge.
6. Explain the function and installation of electronic transmitters and temperature detectors.
7. Draw a basic instrument channel diagram including a measuring element, transducer, and transmitter.

Instrument Calibration and Configuration – NCCER Module # 40403-09

1. Define calibration.
2. Discuss the three-point and five-point methods of calibration.
3. Explain zero suppression and elevation.
4. Calibrate the following pneumatic instruments using the proper equipment: Differential pressure and Temperature transmitters.
5. Calibrate the following 4–20mA instruments using the proper calibration equipment: Differential pressure and Temperature transmitters.
6. Define Smart instruments.
7. Identify a HART® communicator.
8. Calibrate a Smart transmitter using a HART® communicator.

Review and Assessments

The final classes will be used to review all topics covered in this course and completing the final written assessment.

	Industrial E&I III	
Course #	**Subject Title**	**Clock Hours Lec/Lab/Ext/Total**
40404-09	Pneumatic Control Valves, Actuators, and Positioners	04 / 15 / 00 / 19
40405-09	Performing Loop Checks	04 / 10 / 00 / 14
40406-09	Troubleshooting and Commissioning a Loop	04 / 15 / 00 / 19
40407-09	Process Control Loops and Tuning	04 / 15 / 00 / 19
40408-09	Data Networks	04 / 15 / 00 / 19
40409-09	Programmable Logic Controllers	04 / 15 / 00 / 19
40410-09	Distributed Control Systems	04 / 15 / 00 / 19
Total		**28 / 100 / 00 / 128**

Industrial E&I III Course Competencies/Objectives/Hours:
(28 Lecture Hours, 100 Lab Hours, 128 Total Hours)

Pneumatic Control Valves, Actuators, and Positioners – NCCER Module # 40404-09

1. Identify the various parts of control valves.
2. Describe the various types of control valve trims.
3. Describe what conditions determine the type of valve trim to be used.
4. Describe how actuators work and are bench set.
5. Describe how various positioners work and are calibrated.
6. Describe the various signals used to control inputs to valve positioners.
7. Describe how Smart positioners work and are calibrated.
8. Describe the operation of Tri-Loop and HIM signal converters.
9. Safely perform common maintenance practices for control valves and actuators.
10. Troubleshoot control valve failures.
11. Calibrate a pneumatic positioner.

Performing Loop Checks – NCCER Module # 40405-09

1. Verify mechanical installation.
2. Verify correct tag numbers according to loop sheets.
3. Perform continuity checks on both electrical and pneumatic loops.
4. Prove a loop.

Troubleshooting and Commissioning a Loop – NCCER Module # 40406-09

1. Practice universal and methodical troubleshooting techniques in a loop.
2. Troubleshoot an oscillating process.
3. Troubleshoot a newly installed control loop.
4. Practice safety procedures when troubleshooting a loop.
5. Commission a loop.

Process Control Loops and Tuning – NCCER Module # 40407-09

1. Describe basic process control theory.
2. Describe the function and applications of various PID controllers.
3. Describe how pneumatic controllers work.
4. Describe how electronic single loop controllers work.
5. Set up and maintain pneumatic controllers.
6. Apply the appropriate equations and perform closed-loop tuning.
7. Perform open-loop tuning.
8. Perform visual loop tuning.

Data Networks – NCCER Module # 40408-09

1. Describe how data networks are used in industrial facilities.
2. Identify the types of data networks used in industrial facilities and describe the methods used to control information flow within a network.
3. Describe how open connectivity is used in industrial data networks.
4. Identify the types of cables used to connect computers and other devices within a network and explain their applications.
5. Describe the physical layer of two or more device buses.
6. Apply connectors to UTP and coaxial cable.

Programmable Logic Controllers – NCCER Module # 40409-09

1. Describe the function and purpose of a programmable logic controller (PLC).
2. Compare hardwired and PLC systems.
3. Explain number systems.

4. Explain the general function of an input/output (I/O) module, including the following types: Discrete, Numerical and analog data, Special, and Remote.
5. Explain the power supply and ground connections to I/O modules.
6. Explain PLC architecture.
7. Explain the purpose of PLC software and firmware.
8. Describe the features and the differences between PLC programming languages.
9. Describe the features of relay ladder logic instruction categories.
10. Explain the principles used to correlate PLC hardware components to software instructions.

Distributed Control Systems – NCCER Module # 40410-09

1. Define distributed control systems and explain how they are applied in an industrial facility.
2. Identify and describe components of a DCS.
3. Describe network configurations for a DCS.
4. Describe basic service procedures that may have to be performed on a field device.
5. Describe installation practices of a DCS.
6. Describe power distribution requirements for a DCS.
7. Describe power supplies and their applications in a DCS.
8. Describe how to use a DCS interface to obtain process data and to troubleshoot plant equipment.

Review and Assessments

The final classes will be used to review all topics covered in this course and completing the final written assessment. For the students meeting the minimum NCCER requirements, Performance Verifications needed to receive the NCCER Industrial Maintenance, Electrical & Instrumentation Technician Certification will also be conducted.

ANALYZER TECHNICIAN

Course Objective/Purpose:

This course is designed to provide an in-depth analysis of the types of process analyzers used in industrial applications. This single term course (16 weeks) prepares individuals for entry level jobs as an Analyzer Technician. Graduates may find suitable employment in manufacturing, chemical plants and refineries, paper and steel plants, power plants, offshore facilities and various maintenance contractors supporting those facilities. The course combines lectures, demonstrations and labs. Students will receive a Certificate of Completion upon successful completion of the course.

	Analyzer Technician	
Course #	**Subject Title**	**Clock Hours Lec/Lab/Ext/Total**
	Electrochemical Process Analyzers: pH, Conductivity, ORP (Redox) and Fuel Cell	04 / 18 / 00 / 22
	Spectrophotometric Analyzers: IR/NDIR Absorption, UV/Visible Absorption, NIR, Fourier Transformation (FTIR) and Chemiluminescence	04 / 18 / 00 / 22
	Physical Property Analyzers: Thermoconductivity (Wheatstone bridge configuration), Moisture/Dew point, Refractive Index, Freeze Point, Flash Point, Trace Oxygen (Micro Fuel Cell), Sulfur Analysis (H2S and Total Sulfur), Vapor Pressure and Combustible Gas	04 / 18 / 00 / 22
	Oxygen Analysis: Paramagnetic and Zirconium Oxide	03 / 15 / 00 / 18

	Compositional Process Analyzers: Distillation (% OFF) and Gas Chromatography	04 / 18 / 00 / 22
	Sample Systems	04 / 18 / 00 / 22
Total		**24 / 104 / 00 / 128**

Fundamentals of Analytical Instrumentation Course Competencies/Objectives/Hours:

Formerly named Fundamentals of Analyzers Course

(24 Lecture Hours, 104 Lab Hours, 128 Total Hours)

Electrochemical Process Analyzers: pH, Conductivity, ORP (Redox) and Fuel Cell

1. Identify water analyzer components and explain their purpose.
2. Explain the proper operation of water analyzers.
3. List and describe maintenance steps associated with water analyzers.
4. Given a drawing, ensure proper wiring of a pH analyzer.
5. Calibrate a pH analyzer.
6. Determine the pH of an unknown solution.
7. Given a drawing, ensure proper wiring of an ORP analyzer.
8. Properly clean a fouled ORP analyzer probe.
9. Demonstrate the proper insertion of an ORP probe.
10. Identify factors that can affect ORP results.
11. Perform maintenance steps on an ORP analyzer.
12. Properly clean a fouled conductivity probe.
13. Demonstrate the proper conductivity probe orientation.
14. Identify factors that can affect conductivity results.
15. Perform maintenance steps on a conductivity analyzer.
16. Troubleshoot operations associated with water analyzers.

Spectrophotometric Analyzers: IR/NDIR Absorption, UV/Visible Absorption, NIR, Fourier Transformation (FTIR) and Chemiluminescence

1. Identify spectrophotometric components and explain their purpose.
2. Identify spectrophotometric analyzers components located in the lab.
3. Draw a block flow diagram of a spectrophotometric analyzer.
4. Explain the proper operation of a spectrophotometric analyzer.
5. Describe how HMI software is used to communicate with the analyzer components.
6. Identify HMI output signals.
7. Identify standards and tolerances associated with spectrophotometric output results.
8. Read a spectrophotometric data chart.
9. Explain the importance and general steps associated with calibrating a spectrophotometric analyzer.
10. Calibrate a spectrophotometric analyzer to match COA standards.
11. Given various spectrophotometric parts, repair and replace them correctly.
12. List and describe preventive maintenance tasks associated with a spectrophotometric.
13. Given the gas standards, inject a gas sample and compare analyzer output results to standards within required tolerance.
14. Given a scenario, troubleshoot operations associated with a spectrophotometric analyzer and provide viable solutions.

Physical Property Analyzers: Thermoconductivity (Wheatstone bridge configuration), Moisture/Dew point, Refractive Index, Freeze Point, Flash Point, Trace Oxygen (Micro Fuel Cell), Sulfur Analysis (H2S and Total Sulfur), Vapor Pressure and Combustible Gas

1. Identify continuous process gas stream analyzer components and explain their purpose.
2. Explain the proper operation of continuous process gas stream analyzers.
3. Explain the advantages and disadvantages of using various types of moisture analyzers.
4. Summarize results from various moisture analyzer conditions.
5. Identify safety hazards associated with working on continuous process gas stream analyzers.
6. List and describe maintenance steps associated with continuous process gas stream analyzers.
7. Troubleshoot operations associated with continuous process gas stream analyzers.
8. Identify area monitor components and explain their purpose.
9. Explain the proper operation of area monitors.
10. List and describe maintenance steps associated with area monitors.
11. Identify safety hazards associated with working on area monitors.
12. Calibrate the cell on an area monitor.
13. Troubleshoot operations associated with area monitors.

Oxygen Analysis: Paramagnetic and Zirconium Oxide

1. Identify continuous process oxygen gas stream analyzer components and explain their purpose.
2. Explain the proper operation of continuous process oxygen gas stream analyzers.
3. Given an unknown, calculate the O2 within the given tolerance on a zirconium oxide analyzer.
4. Calibrate a zirconium oxide analyzer.
5. Explain factors that can affect paramagnetic analyzer readings.
6. Calibrate a paramagnetic analyzer.
7. List and describe maintenance steps associated with continuous process oxygen gas stream analyzers.
8. Troubleshoot operations associated with continuous process oxygen gas stream analyzers.

Compositional Process Analyzers: Distillation (% OFF) and Gas Chromatography

1. Identify gas chromatograph components and explain their purpose.
2. Identify composition analyzer components located in the lab.
3. Draw a block flow diagram of a composition analyzer.
4. Describe the use and purpose of human machine interface (HMI) software.
5. Describe how HMI software is used to communicate with the analyzer components.
6. Identify HMI output signals.
7. Explain the proper operation of a gas chromatograph.
8. Identify the input locations for the various setpoints on a GC analyzer.
9. Given a setup sheet, set analyzer flows, temperatures and pressures for the desired sample stream.
10. Identify standards and tolerances associated with gas chromatograph output results.
11. Read a gas chromatograph data chart.
12. Given the gas standards, inject a gas sample and compare analyzer output results to standards within required tolerance.
13. Explain the purpose and steps associated with validation of a GC analyzer.
14. Differentiate between validation and calibration.
15. Calibrate a gas chromatograph to match COA standards.
16. Given various gas chromatograph parts, repair and replace them correctly.
17. List and describe preventive maintenance tasks associated with a gas chromatograph.
18. Perform routine preventive maintenance steps on gas chromatographs.
19. Troubleshoot operations associated with a gas chromatograph analyzer.

Sample Systems

1. Describe the role (purpose) of the sample system.

2. Identify factors that must be addressed prior to building the Sample System.
3. List the types of equipment/components that may be required in sample systems, and describe the design criteria and purpose of each.
4. Explain the importance of the location of the sample system and sample point.
5. Describe what considerations for sample temperature must be made when designing a sample system.
6. Describe what considerations for sample pressure must be made when designing a sample system.
7. Identify what devices can be employed to remove condensable materials from a process stream, and describe the situations when condensables must be removed from the sample.
8. Identify and distinguish between the two methods for removing a sample for presentation to a process analyzer.
9. With respect to sample phase, explain the impact of design parameters of the equipment, transport time, sample system location, and the analysis and accuracy required, provide an overview of the different types of extractive sample systems.
10. Explain the purpose of a sparger sample system, and identify its unique operating tips.
11. Describe the purpose of continuous emissions monitoring systems (CEMS)

Review and Assessments
The final classes will be used to review all topics covered in this course and completing the final written assessment.

INDUSTRIAL ELECTRICIAN

Course Objective/Purpose:
This single term (16 weeks) course prepares individuals for entry-level jobs as an Industrial Electrician. Graduates may find suitable employment in manufacturing, chemical plants and refineries, paper and steel plants, power plants, offshore facilities and maintenance contractors supporting those facilities. This course combines lectures and labs to prepare students for NCCER certification as an Industrial Electrician.

	Industrial Electrician	
Course #	**Subject Title**	**Clock Hours Lec/Lab/Ext/Total**
26102-17	Electrical Safety	01 / 04 / 00 / 05
26103-17	Introduction to Electrical Circuits	01 / 04 / 00 / 05
26104-17	Electrical Theory	01 / 05 / 00 / 06
26108-17	Raceways and Fittings	01 / 05 / 00 / 06
26109-17	Conductors and Cables	01 / 04 / 00 / 05
26110-17	Basic Electrical Drawings	01 / 05 / 00 / 06
26112-17	Electrical Test Equipment	01 / 04 / 00 / 05
26201-17	Alternating Current	01 / 05 / 00 / 06
26202-17	Motors: Theory and Application	01 / 05 / 00 / 06
26204-17	Conduit Bending	01 / 05 / 00 / 06
26205-17	Pull and Junction Boxes	01 / 05 / 00 / 06
26206-17	Conductor Installations	01 / 05 / 00 / 06
26207-17	Cable Tray	01 / 05 / 00 / 06
26208-17	Conductor Terminations	01 / 05 / 00 / 06
26209-17	Grounding and Bonding	01 / 05 / 00 / 06
26302-17	Conductor Selection and Calculations	01 / 05 / 00 / 06

26304-17	Hazardous Locations	01 / 05 / 00 / 06
26305-17	Overcurrent Protection	01 / 05 / 00 / 06
26306-17	Distribution Equipment	01 / 05 / 00 / 06
26307-17	Transformers	01 / 05 / 00 / 06
26311-17	Motor Controls	01 / 05 / 00 / 06
26409-17	Heat Tracing and Freeze Protection	01 / 05 / 00 / 06
Total		**22 / 106/ 00 / 128**

Industrial Electrician Course Competencies/Objectives/Hours:

(22 Lecture Hours, 106 Lab Hours, 128 Total Hours)

Electrical Safety – NCCER Module # 26102-17

1. Identify electrical hazards and their effects.
2. Use PPE to reduce the risk of injury.
3. Identify the standards that relate to electrical safety.
4. Recognize the safety requirements for various hazards.

Introduction to Electrical Circuits – NCCER Module # 26103-17

1. Describe atomic structure as it relates to electricity.
2. Identify electrical units of measurement.
3. Read schematic diagrams.

Electrical Theory – NCCER Module # 26104-17

1. Calculate values in resistive circuits.
2. Apply Kirchhoff's laws to various types of circuits.

Raceways and Fittings – NCCER Module # 26108-17

1. Select and install raceway systems.
2. Select fasteners and anchors for the installation of raceway systems.
3. Select and install wireways and other specialty raceways.
4. Select and install cable trays.
5. Handle and store raceways.

Conductors and Cables – NCCER Module # 26109-17

1. Classify conductors by wire size, insulation, and application.
2. Install conductors in a conduit system.

Basic Electrical Drawings – NCCER Module # 26110-17

1. Identify types of construction drawings.
2. Work with scale drawings.
3. Read electrical drawings.

Electrical Test Equipment – NCCER Module # 26112-17

1. Identify various types of electrical test equipment.
2. Select a meter with the correct category rating for an application.

Alternating Current – NCCER Module # 26201-17

1. Identify AC waveforms.
2. Determine unknown values in AC circuits.
3. Make power calculations in AC circuits.
4. Identify transformers and explain how they operate.

Motors: Theory and Application – NCCER Module # 26202-17

1. Identify direct current (DC) motors and describe their operating characteristics.
2. Identify alternating current (AC) motors and describe their operating characteristics.
3. Identify variable-speed drives and describe their operating characteristics.
4. Identify motor enclosures, frame designations, and operating characteristics.
5. Identify the connections and terminal markings for AC motors.
6. Identify the NEC® requirements for motors.

Conduit Bending – NCCER Module # 26204-17

1. Identify the NEC® requirements for conduit bends.
2. Use equations to find bend distances.
3. Use mechanical benders.
4. Use electric and hydraulic conduit benders.
5. Install PVC conduit.

Pull and Junction Boxes – NCCER Module # 26205-17

1. Identify boxes and fittings.
2. Size pull and junction boxes.
3. Identify specialty enclosures.

Conductor Installations – NCCER Module # 26206-17

1. Install cable in conduit systems.
2. Set up for high-force cable pulling.
3. Identify cable limitations when pulling.

Cable Tray – NCCER Module # 26207-17

1. Identify cable tray components.
2. Calculate the load on a cable tray.
3. Determine cable tray fill.

Conductor Terminations – NCCER Module # 26208-17

1. Strip and train conductors.
2. Make wire connections.
3. Reinsulate electrical connections.

Grounding and Bonding – NCCER Module # 26209-17

1. Identify grounding requirements and applications.
2. Identify service grounding methods.
3. Size and select equipment grounding.
4. Bond service equipment.
5. Ground and bond separately derived systems.
6. Test for effective grounds.

Conductor Selection and Calculations – NCCER Module # 26302-17

1. Select conductors for various applications.
2. Size conductors based on expected load and voltage drop.

Hazardous Locations – NCCER Module # 26304-17

1. Identify hazardous locations.
2. Prevent ignitions and explosions in hazardous locations.

Overcurrent Protection – NCCER Module # 26305-17

1. Recognize overcurrent conditions.
2. Identify fuses and their applications.
3. Identify circuit breakers and their applications.

4. Size and select overcurrent devices.
5. Test and troubleshoot circuit breakers and fuses.

Distribution Equipment – NCCER Module # 26306-17

1. Identify electrical distribution system components.
2. Identify the installation requirements for distribution equipment.
3. Test and maintain switchgear.

Transformers – NCCER Module # 26307-17

1. Identify the construction and operation of a transformer.
2. Apply the NEC® requirements for transformers and capacitors.
3. Troubleshoot and maintain transformers.

Motor Controls – NCCER Module # 26311-17

1. Identify relays and contactors.
2. Select magnetic and manual motor starters.
3. Identify control transformers and pilot devices.
4. Identify installation considerations for motor controls.

Heat Tracing and Freeze Protection – NCCER Module # 26409-17

1. Describe heat-tracing applications, components, controls, and selection/installation considerations related to piping.
2. Describe roof, gutter, and downspout de-icing systems and the relevant selection/installation considerations.
3. Describe snow-melting and anti-icing systems and the relevant selection/installation considerations.
4. Describe other electric heat-tracing and warming systems and the relevant selection/installation considerations.

Review and Assessments

The final classes will be used to review all topics covered in this course and completing the final written assessment. For the students meeting the minimum NCCER requirements, Performance Verifications needed to receive the NCCER Industrial Electrician Certification will also be conducted.

PV INSTRUMENTATION PERFORMANCE PREP

Course Objective/Purpose:

This prep (4 weeks) course prepares individuals working as an Instrumentation technician to gain technical skill directly relatable to their job tasks. Graduates may find suitable employment in manufacturing, chemical plants and refineries, paper and steel plants, power plants, offshore facilities and maintenance contractors supporting those facilities. This course combines lectures and labs to prepare students for NCCER performance certification as an Instrumentation Technician.

	PV Instrumentation Performance Prep	
Course #	**Subject Title**	**Clock Hours Lec/Lab/Ext/Total**
12110-15	Flow, Pressure, Level, and Temperature	01 / 07 / 00 / 08
12402-16	Instrument Calibration and Configuration	01 / 07 / 00 / 08
26104-17	Electrical Theory	01 / 07 / 00 / 08
26108-17	Raceways and Fittings	01 / 07 / 00 / 08
Total		**4 / 28/ 00 / 32**

PV Instrumentation Performance Prep Course Competencies/Objectives/Hours:
(4 Lecture Hours, 28Lab Hours, 32 Total Hours)

Flow, Pressure, Level, and Temperature – NCCER Module # 12110-15

1 Identify and describe characteristics of flow measurement.
2 Identify and describe characteristics of pressure measurement.
3 Identify and describe characteristics of temperature measurement.
4 Identify and describe characteristics of level measurement.

Instrument Calibration and Configuration – NCCER Module # 12402-16

1 Define calibration.
2 Discuss the three-point and five-point methods of calibration.
3 Calibrate the following pneumatic instruments using the proper equipment: Differential pressure transmitters and Temperature transmitters.
4 Calibrate the following 4–20mA instruments using the proper calibration equipment: Differential pressure transmitters and Temperature transmitters.
5 Define smart instruments.
6 Identify a HART® communicator.
7 Calibrate a smart transmitter using a HART® communicator.
8 Calibrate a transducer.
9 Calibrate the following valve positioners: Pneumatic positioner, Electro-pneumatic positioner, and Smart positioner (digital valve controller).

Control Valves, Actuators and Positioners – NCCER Module # 12207-16

1 Describe the construction principles of operation of various control valves.
2 Describe the construction principles of operation of various actuators.
3 Describe the principles of operation of various positioners.
4 Describe the variables measured and used as inputs for various types of positioners.
5 Discuss valve selection criteria and identify various control valves, actuators, and positioners using specification sheets, pictures, or samples.

Detectors, Secondary Elements, Transducers and Transmitters – NCCER Module # 12205-16

1 Identify the following primary elements (detectors) and describe their operation: Orifice plate, Pitot tube, Bimetallic strip device, and Thermocouple.
2 Identify the following secondary elements and describe their operation: Bourdon tube, Diaphragm device, Pressure capsule, and Bellows device.
3 Define an I/P and a P/I transducer and describe their operation.
4 Describe the operation of a strain gauge.
5 Identify a pneumatic DP transmitter and an electronic DP transmitter and describe their operation.
6 Identify the following primary components in a DP cell transmitter: Process measuring section (hi and lo sides), Force bar section, Flapper-nozzle (pneumatic only), Pneumatic relay (pneumatic only), and Input/output sections (pneumatic and electronic).
7 Draw a one-line diagram including a measuring element, transducer, and transmitter.

Review and Assessments

The final classes will be used to review all topics covered in this course and completing the final written assessment. For the students meeting the minimum NCCER requirements, Performance Verifications needed to receive the NCCER Instrumentation Certification will also be conducted.

GRADING POLICY

A student's final numeric grade for a subject will be compiled from the grades earned by the student for work assigned and then weighted by the instructor according to the proportions shown in the "Course Evaluation" sections of the subject syllabi provided to students by their instructors. To determine the student's final average for course completion, the subject numeric grades are converted to grade points based on a 4.00 scale using the table below:

Numeric Grade	Letter Grade	Grade Points
90 - 100	A	4.00
80 - 89	B	3.00
70 - 79	C	2.00
60 – 69	Remediation	1.00
Below 60	Remediation	0.00
*Incomplete	I	0.00
**Withdrawal	W	0.00

A student earning a final numeric grade of 70 or higher will receive a course completion certificate.

SATISFACTORY PROGRESS

To remain in good standing, the student must maintain at least a minimum grade point average of 2.00, achieve a passing grade on at least 80% of the quizzes, and where applicable, demonstrate hands on proficiency as specified by NCCER on all NCCER based lab projects. Progress will be evaluated at the end of class(es) for each subject. Written numeric grade reports for each subject will be provided to students by the second school day after the completion of classes for the subject.

ACADEMIC PROBATION

A student who is not making a numeric grade of 70 or higher at the completion of a subject course will be placed on academic probation for the next subject course. If a student on academic probation achieves satisfactory progress for the subsequent subject course, but does not achieve the required grades to meet overall satisfactory progress for the course, the student may be continued on academic probation for one more subject course. If a student on academic probation fails to achieve satisfactory progress for the first probationary subject course, the student's enrollment will be terminated. The enrollment of a student who fails to achieve overall satisfactory progress for the program at the end of two successive subject courses will be terminated.

When a student is placed on academic probation, the school will counsel the student prior to the student returning to class. The date, action taken, and terms of probation will be clearly indicated in the student's permanent file.

After one sixteen-week term has elapsed; a student whose enrollment was terminated for unsatisfactory progress may reenroll in a subsequent term in the next 12 calendar months. Such reenrollment does not circumvent the approved refund policy.

The school will place a student who returns after his/her enrollment was terminated for unsatisfactory progress on academic probation for the next subject course of the term. The school will advise the student of this action, and it will be documented in the student's file. If the student does not demonstrate satisfactory progress at the end of this probationary period, that student's enrollment will be terminated.

***Incomplete:** An "I" for Incomplete is assigned when all the work of a subject course cannot be completed due to circumstances beyond the control of the student. The student may complete the work by the end of the term, or the student can notify the school registrar for readmission for one opportunity to complete the work in a subsequent term beginning no later than 12 calendar months after the end of the term in which the student was assigned the "I". There will be no additional administrative or tuition fees charged for students who exercise this option; however, there may be additional fees for books, supplies, and/or tool kit.

****Withdrawal:** Under Texas Education Code §132.061(f), a student who is obligated for the full tuition and is withdrawing for an appropriate reason unrelated to the student's academic status may request a grade of "I" for incomplete.

A "W" for Withdrawal indicates that the student officially withdrew or was administratively withdrawn from the subject course. A student with a grade of "W" cannot complete the course of study and will be issued a refund in accordance with the PAC Works, Inc refund policy as stated in the catalog.

ATTENDANCE POLICY AND MAKE-UP WORK

Students are expected to attend all lectures, labs, and to be punctual in attending classes. Instructors will maintain a positive record of attendance for the evening classes and for both the morning and afternoon sessions of the day classes. Absences for which a medical or court excuse is provided will be recorded but will not affect the attendance grade. Likewise, one absence for which advance notice is given by phone or in person will not be figured in the attendance grade. Any significant tardy or early departure from class will be counted as a half absence.

A tardy is defined as arriving in the classroom after the designated time for the beginning of the class or for the continuation of class after breaks. Five tardies to class will be counted as one absence. All tests missed due to the absence of a student must be taken on the first day of attendance after the student's absence.

Make-up work for absences shall:

a. be completed within one month of the original absence;
b. be supervised by an instructor approved for the class being made up;
c. require the student to demonstrate substantially the same level of knowledge or competence expected of a student who attended the scheduled class session;
d. be completed within two weeks of the end of the grading period during which the absence occurred;
e. be documented by the school as being completed, recording the date, time, duration of the make-up session, and the name of the supervising instructor; and
f. be signed and dated by the student to acknowledge the make-up session.

Leave of Absence

The school director may grant a leave of absence after determining that good cause is shown. School attendance records will clearly define the dates of the student's leave of absence. A written statement of the reason(s) leave of absence was granted, signed by both the student and the school director indicating approval, will be placed in the student's permanent file.

STUDENT CONDUCT EXPECTATIONS

Students at PAC WORKS are expected to behave in a manner that will create a safe and orderly academic environment for themselves and others. Appropriate dress for academic and laboratory activities includes but is not limited to closed toe shoes. Personal protective equipment will be supplied as needed and must be worn when instructed to do so. Students found in violation of these conduct expectations will be subject to disciplinary action which may include written warning, suspension, dismissal, and/or referral to law enforcement officials. Below is a list of inappropriate behaviors that will be subject to disciplinary action. This list is not all-inclusive.

1. Academic dishonesty, including any form of plagiarism, cheating, falsification of records, or collaboration with others to defraud.
2. Actions that disrupt teaching, learning, administration, or interfere with the rights of others.
3. Non-compliance with the directives of school faculty and staff.
4. Violation of written policies, rules, or procedures.
5. Theft of any kind, and related behaviors such as possessing stolen property or using the property of others without their permission.
6. Damage to property or destruction of property.
7. Creation of unsafe conditions.
8. Cell Phones should be in silent mode during class. Talking on a cellphone is prohibited during class. If there is an emergency that requires your attention on the phone, leave the classroom area.
9. Carrying out a false alarm or creating an emergency situation such as a fire or a bomb threat.
10. Hurting others, threatening others, or engaging in behavior that may result in harm to others.
11. Selling, consuming, and/or possessing alcoholic beverages.
12. Possessing or using drugs not prescribed for the student by a physician; selling any drugs; possessing or using illegal drugs or narcotics.
13. Possessing a firearm or other deadly or dangerous weapons such as knives, knuckles, clubs, baseball bats, and hammers while on the property of the school or in any part of the school building.
14. Sexual harassment in any form by students or any member of the administration, faculty, or staff is prohibited. The school is committed to creating and maintaining an environment for all school personnel and students that is free of harassment, forced sexual activity, or any other sexual communication or conduct that interferes with performance in the classroom or the workplace.

Sexual Harassment Defined

Unwelcomed sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitute sexual harassment when:

a. submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment,
b. submission to or rejection of such conduct by an individual is used as the basis for employment decisions affecting such individuals, or
c. such conduct has the purpose or effect of unreasonably interfering with an individual's work performance or creating an intimidating, hostile, or offensive working environment.

Reenrollment after Dismissal for Violation of Student Conduct Expectations

After one sixteen-week term has elapsed, a student whose enrollment was terminated for violation of student conduct expectations that did not result in the involvement of law enforcement officials will have one opportunity for reenrollment in a subsequent term in the next 12 calendar months.

SCHOOL'S PLACEMENT POLICY

While we do not have direct placement assistance, we do have a Facebook page dedicated to PAC Works Training Facility student, in which job leads are posted weekly. We also provide resume assistance for the student.

CERTIFICATE REQUIREMENTS

A Certificate of Completion will be awarded to each student who completes all the subjects of the course of study, maintains a numeric grade average above 70.

A student who has completed the course of study but does not meet course completion requirements can contact the business office for one opportunity to repeat subject classes with unsatisfactory grades in a subsequent term beginning no later than 12 calendar months after the end of the term in which the student was originally enrolled. There will be no additional administrative or tuition fees charged for students who exercise this option; however, there may be additional fees for handouts, books, supplies, and fees.

Resume assistance is available at no charge for all students who are awarded the NCCER Instrumentation Technician and/or the NCCER Industrial Maintenance, E&I Technician Certification.

STUDENT COMPLAINTS

Grievance Procedure - Complaints are defined as any student concern regarding the school programs, services, or staff. A student who has a concern about a school-related issue is encouraged to schedule a conference with the school director to find resolution. If an issue is not resolved to a student's satisfaction through the conference, the student can file a formal complaint in writing with the school director who will formally investigate the complaint, take appropriate action, and provide a written response to the student by the 10th business day after the day the formal written complaint is received by member of the school faculty or staff. Note: a conference with the director is not required before a student files a formal written complaint.

A student who is dissatisfied with the school director's response can file a complaint with the Texas Workforce Commission:

Texas Workforce Commission
Career Schools and Colleges, Room 226T
101 East 15th Street
Austin, Texas 78778-0001
Phone: (512) 936-3100

Information on filing a complaint with TWC can be found on TWC's Career Schools and Colleges Website at texasworkforce.org/careerschools.

A student may also file a written complaint with the NCCER. Complaints to NCCER must be in writing and sent to:

NCCER
13614 Progress Boulevard
Alachua, FL 32615

TRUE AND CORRECT STATEMENT

I hereby certify that the statements and information in this catalog are true and correct to the best of my knowledge and belief.

Roxann Inniss, PACWORKS Representative