IHRDC

International Human Resources Development Corporation

V.2.0

IHRDC's Competency-Based e-Learning **Pathways** for Refinery Personnel

COMPETENCY-BASED TRAINING **PATHWAYS** FOR REFINERY TECHNICIANS

Our highly regarded competency-based e-Learning **Pathways** have been designed to meet the competency development needs of petroleum technicians in the four traditional O&M specialties: Electrical, Mechanical, Instrumentation and Controls Technicians, and Operators, who work in a variety of petroleum sectors: Refining, Petrochemicals, Midstream Gas, Upstream Oil, and Upstream Gas. This guide has been prepared for the training of Refinery technicians.

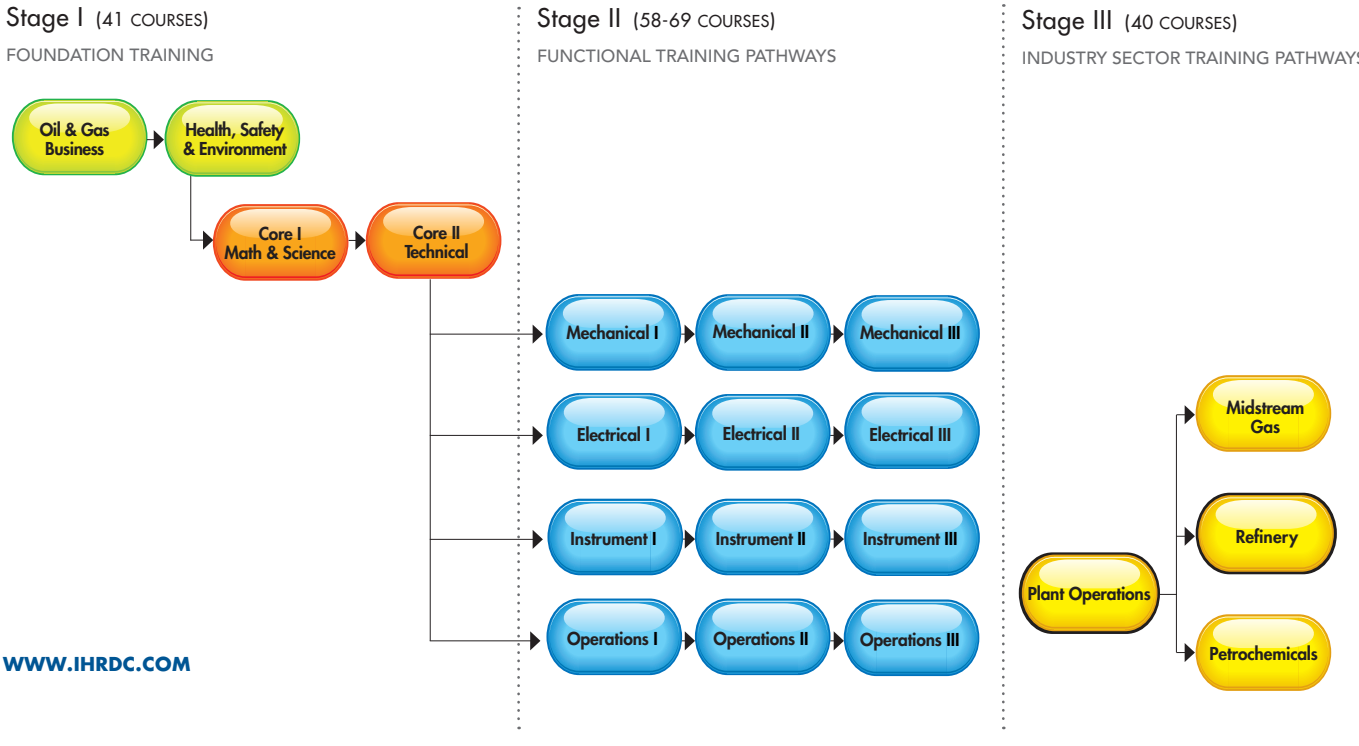
The Training Pathways are divided into three progressively challenging Stages, as shown below.

Stage I: Foundation Training provides the background learning required for all new O&M personnel.

Stage II: Functional Training Pathways are divided into four paths, one for each functional area.

Stage III: Industry Sector Training Pathways provide the specific training in each industry sector; in this example, Refinery Technicians.

Sequential lists of e-Learning courses for each of the three Stages are shown on the following pages. The content of each course may be found in our online catalog, www.ihrdc.com/e-learningsolutions.



Stage I
Foundation Training

Learning Summary: Stage I

	COURSES	LEARNING HOURS
OIL & GAS BUSINESS	1 COURSE	3 HRS
HSE	12 COURSES	9 HRS
CORE 1: MATH, SCIENCE	12 COURSES	12 HRS
CORE 2: FUNDAMENTALS	16 COURSES	16 HRS

OIL & GAS BUSINESS

Oil & Gas Business 3 hr

All Sectors
- Oil and Gas Industry Overview

HEALTH, SAFETY, & ENVIRONMENT

Health, Safety & Environment 9 hr

Chemical Safety
- Chemical Health Hazards

Electrical Safety
- Introduction to Electrical Safety
- Advanced Electrical Safety

Fire Protection
- Fire Safety

Hazardous Waste Operations
- Hazardous Waste First Responder - Awareness

Health
- Hearing Conservation

Introduction to Safety
- Safety Basics
- Safety Orientation

Materials Handling and Storage
- Warning Signs and Labels

Personal Protection Equipment
- Personal Protection Equipment

Workplace Safety
- Confined Space Entry
- Lockout/Tagout

CORE 1: MATH, SCIENCE, & DIAGRAMS

Core I Math & Science 12 hr

Math
- Basics of Math
- Basic Mathematical Operations 1
- Basic Mathematical Operations 2
- Formulas, Graphs, and Trends
- Algebra

Chemistry
- Basic Principles of Chemistry 1
- Basic Principles of Chemistry 2
- Material Balancing
- Reaction Rates

Drawings & Diagrams
- Basic Diagrams and Symbols 1
- Basic Diagrams and Symbols 2
- Flow and Electrical Diagrams

CORE 2: FUNDAMENTALS

Core II Technical 16 hr

Workplace Safety
- Ladders and Scaffolds

Tools
- Introduction to Hand Tools
- Precision Measurement Instruments
- Introduction to Power Tools

Electrical Wiring
- Fasteners

Lubrication & Bearings
- Lubrication - Basics
- Bearings - Fundamentals

Basic & Heavy Lifting
- Overview of Rigging
- Basic Lifting
- Heavy Lifting

Measurement Devices
- Introduction to Vibration Analysis

Drawings & Diagrams
- Industrial Process Systems
- Blueprints
- Electrical Diagrams
- Piping and Instrumentation Diagrams

Gears, Equipment Drive Components, & Shaft Alignment
- Shaft Alignment - Fundamentals

Stage II Functional Training Pathways

Learning Summary: Stage II

	COURSES	LEARNING HOURS
MECHANICAL I	22 COURSES	22 HRS
MECHANICAL II	22 COURSES	22 HRS
MECHANICAL III	25 COURSES	25 HRS

MECHANICAL TECHNICIAN

Mechanical I

Mechanical I
22 hr

Chemistry
- Gases and Flowing Liquids
- Heat
- Heat Transfer
- Solids and Liquids

Electrical
- Basic Electrical Circuits
- Basic Electrical Principles

Lubrication & Bearings
- Lubricants and Bearings
- Lubrication - Using Lubricants

Materials Handling & Storage
- Tank Trucks

Physics
- Basic Principles of Physics
- Fluid Systems
- Forces and Machines

Pipes, Piping, & Auxiliaries
- Pipes and Pipe Fittings
- Piping - Basic Components and Functions
- Piping - System Components and Operation

Process Control
- Process Dynamics and Measurement

Pumps and Seals
- Seals - Gaskets and Packing
- Seals - Mechanical

Turbines & Steam Systems
- Steam Traps

Valves
- Safety Valves 1
- Safety Valves 2
- Valve Types and Operation

Mechanical II

Mechanical II
22 hr

Actuator, Valve, & Motor Controllers
- Electric and Hydraulic Actuators
- Introduction of Actuators
- Motor Operators

Heat Exchangers
- Condensers and Reboilers
- Cooling Towers
- Introduction to Heat Exchangers
- Operation of Shell- and Tube-Type Heat Exchangers

Hydraulic Systems
- Hydraulic Actuators
- Hydraulic Component Inspection and Replacement
- Hydraulic Diagrams
- Hydraulic Fluid and Reservoirs
- Hydraulic Principles and Circuits
- Hydraulic Pumps
- Hydraulic Valves 1
- Hydraulic Valves 2
- Routine Maintenance of Hydraulic Systems
- Troubleshooting of Hydraulic Systems

Valves
- Basic Types and Operation of Valves 1
- Basic Types and Operation of Valves 2
- Safety Valves, Part I
- Safety Valves, Part II
- Valve Maintenance

Mechanical III

Mechanical III
25 hr

Compressors
- Centrifugal Compressors
- Introduction to Compressors
- Operation of Centrifugal and Axial Compressors
- Positive Displacement Compressors
- Reciprocating Compressors
- Types of Compressors - Centrifugal and Axial

Gears, Equipment Drive Components, & Shaft Alignment
- Drive Component Operations
- Gear, Belt, and Chain Drives
- Gears - Overhauls
- Gears - Types and Characteristics
- Shaft Alignment - Reverse Dial and Laser
- Shaft Alignment - Rim and Face

Lubrication & Bearings
- Bearings - Rolling Contact
- Bearings - Sliding Surface

Other Systems & Equipment
- Fans

Pumps
- Basic Pump Types and Operations
- Fundamentals of Centrifugal Pumps
- Operation of Centrifugal Pumps
- Performance and Inspection of Pumps
- Reciprocating Positive Displacement Pumps
- Rotary Positive Displacement Pumps

Pumps & Seals
- Centrifugal Pump Basics and Troubleshooting
- Centrifugal Pump Overhaul
- Multistage Centrifugal Pumps
- Positive Displacement Pumps

Learning Summary: Stage II

	COURSES	LEARNING HOURS
ELECTRICAL I	20 COURSES	20 HRS
ELECTRICAL II	17 COURSES	17 HRS
ELECTRICAL III	21 COURSES	21 HRS

ELECTRICAL TECHNICIAN

Electrical I

Electrical I
20 hr

Circuits
- Parallel Circuits
- Series Circuits
- Series-Parallel Circuits
- Use of Ohm's and Kirchhoff's Laws in DC Circuits

Electrical
- AC Circuits
- Basic Electrical Circuits
- Basic Electrical Principles
- Basic Electrical Test Equipment
- Basic Electricity Review
- Sources of Electricity
- Voltage and Current Principles

Electrical Generation & Storage
- Battery Systems

Electrical Safety
- Electrostatic Discharge Precautions

Electrical Theory
- Kirchhoff's Law
- Magnets and Magnetic Fields
- Ohm's Law

Electrical Wiring
- Cables and Conductors
- Conduit Installation
- Introduction to the NEC

Measurement Devices
- Digital and Analog Oscilloscope

Electrical II

Electrical II
17 hr

Actuator, Valve, & Motor Controllers
- Basic Functions of AC Motor Controllers
- Troubleshooting of AC Motor Controllers
- Motor Controllers and Operation

Electrical Components
- SCRs and TRIACs

Electrical Generation & Storage
- Power Supplies

Electrical Wiring
- Splices and Terminations

Motors
- AC and DC Motors
- DC Motors
- Motor Branch Circuit Protection
- Three-Phase Motors

Transformers, Breakers, & Switches
- Fuses

Variable Speed Drives
- Applications of VSDs
- Troubleshooting VSD Controllers
- Introduction to VSDs
- Programming Controllers
- System Troubleshooting of VSDs
- Systems and Integration of VSDs

Electrical III

Electrical III
21hr

Circuits
- Troubleshooting Electrical Circuits
- J-K Flip-Flops
- Troubleshooting Operational Amplifier Circuits
- Filter Circuits

Electrical Components
- Inductors, Part 1
- Inductors, Part 2
- Capacitors, Part 1
- Capacitors, Part 2
- Specialized Electronic Devices
- Transistor Configurations

Electrical Generation & Storage
- AC Generator Maintenance
- Electrical Production and Distribution

Electrical Wiring
- Grounding

Transformers, Breakers, & Switches
- High Voltage Breakers and Switchgears
- Electromagnetic Relays
- Ground Fault Interrupters
- Introduction to Transformers, Breakers, and Switches
- Maintenance of Low-Voltage Circuit Breakers
- Relays 1
- Relays 2
- Transformers

Learning Summary: Stage II

	COURSES	LEARNING HOURS
INSTRUMENTATION & CONTROLS I	23 COURSES	23 HRS
INSTRUMENTATION & CONTROLS II	21 COURSES	21 HRS
INSTRUMENTATION & CONTROLS III	18 COURSES	18 HRS

INSTRUMENTATION & CONTROLS TECHNICIAN

Instrument I

Instrument I
23 hr

Actuator, Valve, & Motor Controllers
- Pneumatic Control
- Principles of Controllers

Circuits
- Parallel Circuits
- Series Circuits
- Series-Parallel Circuits
- Use of Ohm's and Kirchhoff's Laws in DC Circuits

Distributed Control Systems
- Troubleshooting DCS I/Os: Practices

Electrical
- Voltage and Current Principles
- Basic Electrical Test Equipment

Electrical Components
- Operational Amplifiers, Part 1
- Operational Amplifiers, Part 2
- Specialized Electronic Devices

Electrical Safety
- Electrostatic Discharge Precautions

Electrical Theory
- Kirchhoff's Law
- Magnets and Magnetic Fields
- Ohm's Law

Human-Machine Interface & Plant Protection Systems
- The Human-Machine Interface

Measurement Devices
- Digital and Analog Oscilloscopes
- Principles of Calibration

Networks
- Introduction to Control and Data Systems

Process Control
- Introduction to Process Control
- Principles of Process Control

Instrument II

Instrument II
21 hr

Actuator, Valve, & Motor Controllers
- Introduction to Actuators
- Electric and Hydraulic Actuators
- Smart Controllers

Field Device Configuration
- Field Devices: Analog Configuration
- Field Devices: Configuring with a Laptop PC

Measurement Devices
- Field Devices: Using Field Communicators
- Field Devices: Analyzers
- Field Devices: Level and Flow
- Field Devices: Pressure, Temperature, and Weight
- Measurement of Concentration
- Measurement of Density, Clarity, and Moisture
- Measurement of Level and Flow
- Measurement of Pressure and Temperature

Process Control
- Automatic Process Control 1
- Automatic Process Control 2
- Single Loop Control
- Multiple Loop Control
- Tuning Loops
- Troubleshooting Loops

Valves
- Basic Types and Operation of Valves 1
- Basic Types and Operation of Valves 2

Instrument III

Instrument III
18 hr

Distributed Control Systems
- Introduction to Distributed Control Systems
- Troubleshooting DCS I/Os: Practices
- Troubleshooting DCS I/Os: Procedures

Field Device Configuration
- Field Devices: Digital Configuration with a DCS

Human-Machine Interface & Plant Protection Systems
- Human Machine Interface and Troubleshooting

Math
- Binary, Octal, and Hexadecimal Numbers

Networks
- Introduction to Networks
- Setting Up and Troubleshooting Networks
- Fiber Optic Systems

Programmable Logic Controllers
- Installing and Maintaining PLCs
- Architecture, Types, and Networks
- I/O Communication
- Troubleshooting Hardware
- Introduction to Programming PLCs
- Programming Common Functions
- Program Entry, Testing, and Modification
- Ladder Logic and Symbology
- Troubleshooting Software and Networks

Learning Summary: Stage II

	COURSES	LEARNING HOURS
OPERATIONS I	19 COURSES	19 HRS
OPERATIONS II	24 COURSES	24 HRS
OPERATIONS III	17 COURSES	17 HRS

PLANT OPERATOR

Operations I

Operations I
19 hr

Chemistry
- Gases and Flowing Liquids
- Heat
- Heat Transfer
- Solids and Liquids

Electrical
- Basic Electrical Circuits
- Basic Electrical Principles

Materials Handling & Storage
- Tank Trucks

Operations Fundamentals
- Introduction to Operation Fundamentals
- Plant Production and Safety
- Trends, Maintenance, and Emergencies
- Communication in Process Operations

Other Systems & Equipment
- Auxiliary Vessels

Physics
- Basic Principles of Physics
- Fluid Systems
- Forces and Machines

Pipes, Piping, & Auxiliaries
- Piping - Basic Components and Functions
- Piping - System Components and Operation

Process Control
- Process Dynamics and Measurement

Storage Tank Operations
- Above Ground Storage Tanks, Part 1

Operations II

Operations II
24 hr

Compressors
- Introduction to Compressors
- Types of Compressors - Centrifugal and Axial
- Operation of Centrifugal and Axial Compressors
- Positive Displacement Compressors

Environmental Protection
- Air Pollution
- Pollution Control in Plants
- Water Pollution and Waste Disposal

Operations Fundamentals
- Obtaining Samples
- Testing Samples

Other Systems & Equipment
- Filtration and Screening Unit Operations
- Fundamentals of Process Solubility

Physics
- Power and Energy

Power & Steam Systems
- Power Generation and Hydrogen Cooling

Power Plant Operation
- Basic Principles of Power Plant Operations

Pumps
- Fundamentals of Centrifugal Pumps
- Operation of Centrifugal Pumps
- Performance and Inspection of Pumps
- Reciprocating Positive Displacement Pumps
- Rotary Positive Displacement Pumps

Refining Process Technologies
- Typical Process Reactions, Part 1
- Typical Process Reactions, Part 2

Refrigeration Systems
- Basic Concepts of Refrigeration Systems
- Operations of Refrigeration Systems
- Refrigeration Systems, Part 1

Operations III

Operations III
17 hr

Actuator, Valve, & Motor Controllers
- Introduction of Actuators
- Electric and Hydraulic Actuators

Boilers
- Boilers - Basic Principles and Types
- Boilers - Combustion, Water, and Steam

Distillation
- Basic Distillation System Components and Operation
- Distillation Control Systems
- Distillation Operating Problems

Furnaces
- Furnace Operating Conditions

Operations Fundamentals
- Process Examples

Process Control
- Introduction to Statistical Process Control
- Basic Control Charts
- Process Variations

Valves
- Basic Types and Operation of Valves 1
- Basic Types and Operation of Valves 2

Water Treatment
- Wastewater 2
- Water for Plant Systems 2

Stage III
Refinery Training Pathways

Learning Summary: Stage III

	COURSES	LEARNING HOURS
PLANT OPERATIONS	22 COURSES	22 HRS
REFINERY PROCESS	18 COURSES	18 HRS

PLANT OPERATIONS

Boilers
- Abnormal Conditions and Emergencies
- Combustion and Operation
- Normal Operations
- Startup and Shutdown
- Water and Steam
- Condensate and Feedwater Systems
- Condenser and Circulating Water

Furnaces
- Introduction to Furnaces
- Startup and Shutdown of Furnaces

Operations Fundamentals
- Basic Concepts of Operations
- Operator Responsibilities: Basic Operator Responsibilities
- Operator Responsibilities: Advanced Operator Responsibilities

Other Systems & Equipment
- Material Handling of Bulk Liquids
- Portable and Emergency Equipment
- Flaring, Venting, and Purging

Refrigeration System
- Refrigeration Systems, Part 2

Storage Tank Operations
- Above Ground Storage Tanks, Part 2
- Above Ground Storage Tanks, Part 3

Turbines & Steam Systems
- Boiler and Turbine Protection
- Steam Systems
- Bearings and Operation
- Steam Flow [Steam Turbines]

REFINERY

Refinery Fundamentals
- Refining Basics

Refinery Operations
- Emission Controls

Refining Process Technologies
- Process Reactor Fundamentals
- Typical Process Reactions, Part 1
- Typical Process Reactions, Part 2
- Blending Operations
- Azeotropic, Extractive, and Vacuum Columns
- Crude Distillation Operations
- Fluid Catalytic Cracking Operations
- Hydrotreating and Catalytic Reforming 1
- Hydrotreating and Catalytic Reforming 2
- Treating and Sulfur Recovery Operations

Distillation
- Basic Principles of Distillation
- System Startup and Shutdown in Distillation
- Towers, Reboilers, and Condensers
- Basic System Components and Operation in Distillation
- Control Systems in Distillation
- Operating Problems in Distillation

LICENSING BY STAGES

Clients may license these e-Learning Pathways on a **Stage basis** or as a complete three Stage package. The courses may be installed on a client's server or hosted on IHRDC's LMS.

IHRDC can aggregate our e-Learning courses to meet your training needs: entry level or advanced.

ESTIMATED TIME FOR COMPLETION

The time that it takes to complete the Refinery Training Pathway depends on the learner's pace and the amount of time devoted to training each day or week.
The complete Refinery e-Learning Pathway includes 158-167 courses, that consist of approximately 167 hours of learning.

Be sure to contact us today to discuss this outstanding e-Learning resource, view several typical courses, or obtain a quotation. Please visit **www.ihrdc.com** or contact a **Sales Representative** in your area (see below) by telephone or e-mail. We welcome the opportunity to share this innovative e-Learning system with you.

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