

# Electrical & Instrumentation Design, Installation & Operation

## INTRODUCTION

- This highly participative training course is designed to provide you with the skills to understand how Electrical and Instrument systems are designed, installed and operated in industrial process plants, particularly in the oil and gas, mining and minerals processing and heavy industries.
- This Electrical and Instrumentation training course is interactive and encourages delegates to participate through questions and answers, along with opportunities to discuss with the presenter specific issues which may result in appropriate solutions.

Participants will learn:

- A brief revision the fundamentals of electricity
- How to read single-line diagrams
- The key requirements of plant and facilities power distribution
- The selection of motors and motor control for various applications
- How hazardous areas are classified
- How electrical equipment is selected for hazardous areas
- The fundamentals of control systems and instrumentation
- How to read loop diagrams
- The importance of secure earthing and bonding
- The operation and maintenance of electrical, instrumentation and control equipment to ensure Plant Safety

## PROGRAMME OBJECTIVES

- Review the fundamentals of electricity
- Understand fundamental safety requirements for personnel and equipment
- To read single line drawings and identify components of electrical equipment
- Understand the types of equipment used in electrical power systems
- Learn about electrical distribution systems and how they are configured
- Understand the importance of hazardous area requirements
- Learn the basics of instrumentation and control systems in a plant or facility
- The importance that instrumentation and control in the safe and reliable operation of the facility
- Understand earthing and bonding to ensure safety
- Understand the importance of operating EIC equipment with its design limits

## WHO SHOULD ATTEND?

- This Electrical and Instrumentation training course is designed to provide a practical insight for personnel who interface with electrical systems in the Oil and Gas, Minerals Processing, Mining and Heavy Industries, or work in the engineering consulting industry servicing these clients.
- It is specifically tailored to suit those who have a basic understanding of electrical principals and require further knowledge of electrical and instrument systems to more effectively manage their work and where necessary execute multi-discipline projects.

Personnel who should attend are:

- Project Professionals and Engineers
- Facilities Engineers
- Process and Chemical Engineers
- Mechanical Engineers
- Maintenance Technicians
- It is also a useful introduction for inexperienced Electrical and I&C engineers (i.e. graduates and the like) to gain an understanding of the practical issues that they will face in their careers.

## TRAINING METHODOLOGY

- This training course will combine presentations with interactive practical exercises, supported by video materials, activities and case studies. Delegates will be encouraged to participate actively in relating their particular protection requirements at their workplace.
- There will be adequate time given for group discussion during and at the end of each session, including detailed case studies and anecdotes on based on the subject matter and the facilitator's own experience in the field.

## PROGRAMME SUMMARY

- This Electrical and Instrumentation training course covers a wide range of topics relating to Electrical, Control and Instrumentation Design and Installation, from basic principles to the complex application of such systems in large plants and facilities, including their Operation and Maintenance.
- It is designed to be beneficial for professionals with a non-electrical or instrumentation background who require an understanding of IC&E for their work or project execution, as well as graduates in the instrumentation, control and electrical field who wish to gain practical knowledge in their field.

## PROGRAM OUTLINE

### Fundamentals of Electricity

- Generation of electricity technologies including renewable energy
- Alternating current generation characteristics
- Transmission and distribution of electricity

## Application of Major Equipment

- Major components and equipment of a power system
- The transformer operations and characteristics
- The grid system, overhead and underground
- Circuit breaker functionalities and types
- Low voltage and high voltage motors
- Motor control centres

## Safety, Earthing (Grounding) and Bonding, Hazardous Area Requirements

- Electrical Safety in Industrial Facilities
- Importance of earthing
- Earthing and bonding
- Network earthing
- Clean earth for instrumentation and controls
- Earth fault path and earth resistance measurement

## Electrical Protection and Instrument Control

- Importance of protection in instrumentation, control and electrical installation
- Protection relays and instrument transformers
- Field Measurement of Physical Parameters (Flow, Pressure, Temperature, Density, Level, pH, Turbidity etc.) and associated Control Devices
- Programmable Electronic Systems (PLC, DCS, SIS, SCADA, EID)
- Power System Protection and Co-ordination
- Hazardous area classification

## Reliability and Security of Electrical and Control Systems

- Power Supplies: Main, Standby, Back-up and Emergency
- The modern uninterruptible power supply
- Standby diesel generators
- Redundancy in power supplies, distribution networks, communication and control networks and safety systems
- System Security, Including Denial of Service and Sabotage from External Sources