Master Class

Electrical and Instrumentation (E &I) Engineering for Oil and Gas Facilities

What you will learn:

- Skills and competencies in E&I oil and gas engineering
- Knowledge of the latest technologies in E&I oil and gas engineering
- Key techniques in operating your facility to the highest level of safety and in protecting the environment
- Decades of real experience distilled into the course presentations and materials
- Guidance from real E&I oil and gas experts in the field
- Hands-on, practical knowledge from the extensive experience of instructors, rather than the theoretical information from books and colleges
- Networking contacts in the oil and gas industry

Course overview

There are excellent opportunities for employment in the oil, chemical, gas and related industries due to the growing shortage of instrumentation/electrical (E&I) technicians, technologists and engineers. This is mainly due to the resumption of growth in these industries, the increasing need for higher technology methods of obtaining and processing oil and gas along with the retirement of the current ‘baby-boomer’ generation of engineers, technologists and technicians.

Unfortunately (or perhaps, fortunately for everyone working in these industries), as it is a finite declining resource, the price of oil is heading upwards steadily, thus making personnel and their associated oil and gas expertise in these industries even more valuable. The technical challenges of extracting oil and gas are becoming ever more demanding, with increasing emphasis on more marginal fields and previously inaccessible zones such as deep oceans, Polar Regions, Falkland Islands and Greenland.

Despite the significantly more sophisticated technology, oil and gas disasters are still happening throughout the world with horrendous environmental impact and there is now enormous governmental pressure on companies to reduce the risk of these major accidents happening. The instrumentation and electrical engineering professional has a significant role to play here in minimising these accidents and improving safety further.
This course provides a practical treatment of electrical power systems and instrumentation within the oil, gas, petrochemical and offshore industries. Whilst there is some theory this is used in a practical context giving you the necessary tools to ensure that the Electrical and Instrumentation hardware is delivering the results intended. No matter whether you are a new electrical, instrumentation or control technician/technologist/graduate engineer or indeed, even a practising facilities engineer, you will find this course beneficial in improving your understanding, skills and knowledge. The course covers a whole spectrum of activities ranging from basic electrical and instrumentation engineering to advanced practice including hazardous areas, data communications along with a vast array of E&I equipment utilised in an oil and gas environment.

**Study in further depth**

Bear in mind that this is a 5-day course and we are compressing a considerable amount of material into this time frame. If you want to get a far higher level of knowledge and competencies, you can undertake our 18 month in-depth advanced diploma in oil and gas (E&I); or indeed our Graduate Diploma which goes into further depth. You can use attendance at this course to gain credits towards the advanced diploma course (and indeed also a reduction in the course fee).

**Course content**

This valuable oil and gas course has five threads in the E& I areas running through it:

1. Electrical engineering
2. Instrumentation and control engineering
3. General oil and gas engineering (onshore and offshore)
4. Subsea instrumentation and control
5. Floating Production, Storage and Offloading (FPSO) Facilities

**Oil and Gas Electrical Engineering – Design, Installation, Commissioning and Maintenance**

Electrical power systems within the oil, gas, petrochemical and offshore industries have significantly different engineering characteristics to a typical power utility plant and associated consumers of electricity. This course provides an excellent balance between basic applicable mathematical theory and practical know-how which is so essential in applying this immediately to your work. Solid practical know-how is provided in the electrical systems equipment used in off-shore production platforms, on-shore separation and production plants, drilling rigs, pipelines, refineries and even general petrochemical plants. Because of the hazardous nature of oil and gas plant criticality there is particular emphasis on the design, installation, commissioning and maintenance use of electrical equipment in hazardous areas. You will gain confidence in basic design, selection, and operation of the typical electrical equipment used in these areas. Numerous practical rule-of-thumb examples are given to enable you to make quick estimates and assessments whilst engaged in your work.

**Oil and Gas Instrumentation and Control Engineering – Design, Installation, Commissioning and Maintenance**

Instrumentation and Control Engineering is the most diversified and challenging area in the oil and gas industry. It covers a whole gamut of engineering such as:
**Instrumentation Engineering** - You will learn about design documentation and specification, field measurement devices, control elements, condition and machine monitoring, fieldbus, actuators, control valves, severe service valves, solenoids, hydraulics, testing and calibration, wireless instrumentation, instrument fittings/monoflanges/manifolds/tubing and accessories, “on line” process analysers and sample systems, pressure relief valves, choke valves and associated “real world” applications.

**Control System Engineering** – This extremely interesting area covers Programmable Logic Controllers (PLCs), Supervisory Control and Data Acquisition (SCADA), Distributed Control Systems (DCS), Control System Tuning, Basics of Advanced Process Control, Control Applications, Compressor Surge Control, Pneumatic Controllers, Programmable Automation Controllers, Process Control Security, OPC and Smart Plant Concepts.

**Safety Instrumented Systems** – SIS is a very important part of any oil and gas plant in that these systems provide the most important safety layer necessary to protect a facility. You will learn about Safety Integrity Levels (SIL), the importance of maintaining SIS Instrumentation, Safety logic, Burner Management Systems (BMS), Emergency Shutdown Systems and their certification, Shutdown and Blowdown Valves, SIS Standards, Fire and Gas detection and protection systems and devices along with Combined Safety Systems.

In addition you will get some insight into High Integrity Pipeline Protection Systems (HIPPS).

**General Oil and Gas engineering**

This covers critical aspects which are applicable across all disciplines associated with oil and gas engineering including;

- Corrosion – as many Oil and Gas installations are either on the coast or in offshore locations a basic understanding of corrosion and how to mitigate against its effects is very important. By just installing a fitting of the wrong material, the safety of a multimillion dollar facility can be compromised.
- Health, Safety and Environment, including facility safety cases, legislation, spill reporting, hazards, work permits, safe working practices, working with high pressure hydraulics and Job Safety Analysis (JSA) documentation.
- Basics of Oil and Gas Process Plant, the importance of understanding how a plant works with real examples of an offshore oil and gas platform, refinery and LNG plant.

You will then work through a project such as a three-phase inlet separator, its components, design, operation, control and instrumentation and maintenance. You will gain a strong introduction to Front End Engineering Design (FEED) with coverage of flow diagrams, P&IDs, control system philosophy, safety instrumented system logic, specification, cost estimates and design approval. You will then be exposed to final design activities including authorisation for expenditure, specifications, power systems, wiring and connection diagrams, logic diagrams and bill of materials. Finally, the construction, installation and commissioning phase will be covered with an emphasis on factory acceptance testing (FAT), commissioning, start up and maintenance.

**Subsea Control Systems Engineering**
Subsea manifolds are commonly utilised in offshore applications, these are either tied back to platforms or piped onshore. These have instrumentation and control systems that are specifically designed for deepwater use. You will learn about the basic concepts and how these systems are monitored, controlled and maintained.

**Floating production, storage and offloading (FPSO) facilities**

Floating production, storage and offloading facilities receive crude oil and gas from deepwater wells and store it until the crude oil can be pumped into other vessels for transport to shore. These facilities are especially useful for extending extraction processes into deep water areas previously inaccessible. The processing facilities onboard the FPSO separate the produced oil, water and gas. Floating LNG (FLNG) facilities are the latest oil and gas facilities being deployed around the world. The electrical and instrumentation systems relevant to FPSO’s and FLNG will be examined during this course.

**Who Should Attend**

This course would be ideal for you if you are seeking expertise in the oil and gas business and are an:

- Instrument and process control technician or technologist
- Instrument fitter
- Chemical and mechanical engineer
- Electrical engineer currently working in a different area to oil and gas
- Instrument and control systems engineer
- Fire and gas engineer
- Experienced electrician
- A recent graduate electrical, instrumentation or mechanical engineer

Even if you are highly experienced you will find this a great way to become familiar with the oil and gas technology as quickly as possible.

**Comprehensive Manuals**

Together with the course materials, you will receive four of our up-to-date technical manuals to add to your personal library. Together these texts contain over 1200 pages of valuable know-how distilled from years of training in engineering and technical subjects.
Day One

Introduction – Setting the scene in oil and gas E&I engineering

- Fundamentals of electrical engineering
- Fundamentals of instrumentation, measurement and process control engineering

Electrical engineering in oil and gas

- Electrical drawings, documentation and schematics
- Transformers
- Troubleshooting, maintenance and protection of AC electrical motors
- Power distribution
- Power system protection and co-ordination (incl. fault calculations/stability and protective relays)

Day Two

Electrical engineering in oil and gas (continued)

- Switchgear and distribution systems
- Cables and wires – maintenance and installation practice
- Variable (or adjustable) speed drives (VSDs) for instrumentation and control systems
- Electrical safety
- Earthing/grounding, power system harmonics and power quality – onshore/offshore

Electrical engineering in oil and gas (continued)

- Lightning and surge protection
- Uninterruptible Power Supplies (UPSs), batteries and battery chargers
- Emergency power supplies

Day Three

Electrical engineering in oil and gas (continued)

- Electrical equipment in hazardous areas
- Electrical applications to an oil and gas platform and site

Instrumentation and control

- General instrumentation standards in oil and gas
- Best practice in process, electrical and instrumentation drawings and documentation
- Process instrumentation
- Calibration, installation and maintenance of instruments

Day Four

Instrumentation and control (continued)

- Process control basics
- Control valves sizing, selection and maintenance (incl. pressure relief valves)
- Programmable logic controllers
- SCADA systems
• Distributed control systems

**Instrumentation and control (continued)**

• Industrial data communications (incl. Fieldbus and industrial Ethernet)
• Safety instrumentation and emergency shutdown systems for oil and gas (IEC 61511 and IEC 61508) – basic introduction

**Day Five**
**Instrumentation and control (continued)**

• Wellhead and flowline control – control systems
• Emergency wellhead blowout controls

**Specialised applications in oil and gas E&I**

• Power generation
• Cathodic protection
• Compressor control (incl. surge control)
• Drilling control systems and instrumentation
• Subsea instrumentation and control systems
• Pig Launcher/receiver systems
• Critical flare knock out drum controls and instrumentation
• Flare flame front generator and ignition monitoring system