



## Power System Design Fundamentals for Electrical Engineers - E-41

### COURSE

#### About the Course

This course is targeted towards early career electrical engineers in the oil and gas industry.

It has been developed through a collaboration with PetroSkills Alliance member Shell Global and is focused on getting electrical engineers up to speed with the essential principles of electrical safety, power system design, studies, protection and equipment specification as well as operations support and maintenance. Additionally, this course introduces the participants to the critical elements of industry and typical company standards as well common project execution and project assurance principles.

The course focuses on foundational concepts rather than regional code and standard requirements, but does address the typical equipment, requirements and methods used in both international (IEC, EN, BS, etc.) and North American (NEC, IEEE) standards related to design and safe operation.

This intensive program is typically held over 10, 8-hour sessions in two weeks, and has been designed to be delivered virtually or in-person. As such, the expectation is that participants to fully engage online, ask and answer questions posed in the course and participate in meaningful discussions related to the concepts, implications and application of the concepts. A sample project will be completed in phases throughout the course, giving the participants an opportunity to work with their peers in solving typical design challenges and applying concepts. Off-line time will be allotted prior to, during and after the course to allow participants to complete assignments at their own pace.

At the end of the course the participants will complete a formal written final exam.

#### Target Audience

This course has been designed for Electrical Engineers with a bachelor's or master's degree (or equivalent) in electrical engineering and 1-3 years' experience on the job and Senior Electrical and Instrument Technicians or Supervisor whose activities include work on electrical equipment in refineries, gas and chemical plants or oil field installations.

It is assumed that participants will come to the course with academic background in the fundamentals of AC and DC electricity, 3 phase power systems, basic electrical mathematic principles (Ohm's Law, Kirchhoff's laws, etc.), phasor math, basic understanding of the role of common industrial power system equipment and components (Substations, Generators, transformers, switchgear, protective devices, cables, conduit, etc.).

Basic knowledge of locating Company and Industry standards is expected.

It is beneficial if students have some practical experience working in industrial facilities so that they can understand the context of the material presented.

This course will be held in English. Participants should be fluent in English with proficiency such that they can participate in technical discussions.

## You Will Learn

By the end of the course, participants should be able to:

- Describe the role of an Electrical Engineer in Electrical Safety
- Discuss the considerations and methods used to determine hazardous area classifications.
- Determine the requirements for electrical equipment installed in hazardous (classified) locations
- Explain the typical requirements of company standards for executing electrical projects, as well as ongoing maintenance and operation of a facility
- Design a simple facility starting from a load list and produce a single line diagram indicating the basic arrangements and key specification parameters of electrical equipment.
- Incorporate appropriate levels of contingency and considerations for future growth
- Describe the effect on power system behavior when operating in various configurations (e.g. Ties Closed or Open, Dual or Single feed)
- Calculate fault levels and short circuit currents including motor contribution by hand using the per unit method
- Calculate voltage drop during motor start by hand using the per unit method
- Calculate the load flow and voltage profile (regulation) of a power system under various operating conditions.
- Describe the various purposes and installation requirements for earthing and bonding systems.
- Describe the various system earthing arrangements including unearthed, solidly earthed and impedance earthed systems and their applications, advantages and disadvantages.
- Describe the basic operation, and key specification parameters/ratings for switching devices, switchgear, transformers, generators, UPS systems, circuit and equipment protection, motors and motor starters (including VSDs) for common applications
- Size and select cables based on voltage, steady state load, voltage drop, de-rating factors, fault conditions and environmental factors using both IEC and NEC methods.
- Describe the basic operation, control, synchronization and load sharing of Generators in a power system.
- Introduce the fundamental principles and construction of power system protection including fuses, circuit breakers and protective relays including basic selection and sizing parameters, and the use of time-current curves to evaluate protection and coordination issues.
- Explain various types of backup power systems including generation and UPS systems, configurations, and key specification parameters.
- Discuss various battery types, their characteristics, selection factors, sizing and maintenance considerations.
- Determine basic maintenance needs of electrical equipment and power systems per typical company and industry standards

- Optional Content - Describe the considerations for an effective lighting design
- Optional Content - Describe the considerations for an effective Electrical Heat Tracing design

## Course Content

- Electrical Safety
- Principles of Good Electrical Design
- Hazardous Locations
- Earthing (Grounding) and Bonding
- Initial System Design Fundamentals
- Initial Electrical System Studies
- Cables and Cable Sizing
- Switchgear
- Transformers
- Motors and Motor Starting
- Variable Speed Drives
- Generators and Prime Movers
- Battery and UPS Systems
- Basic Principles of Protection
- Heat Tracing Systems (Optional Content)
- Lighting Systems (Optional Content)
- Final Exam

## Product Details

Categories: [Upstream](#)

Disciplines: [Instrumentation, Controls & Electrical](#)

Levels: [Intermediate](#)

Product Type: [Course](#)

Formats Available: [In-Classroom](#) [Virtual](#)

Instructors: [Jason Pingnot](#)