ADVANCED DIPLOMA OF ELECTRICAL AND INSTRUMENTATION (E&I)
ENGINEERING FOR OIL AND GAS FACILITIES

MODULE DETAILS

MODULE 9: Electrical Safety, Grounding/Earthing, Bonding, and Lightning Protection

Nominal duration: 4 weeks (32 hours total time commitment)

This time commitment includes the preparation reading, attendance at each webinar (1 hour plus 15-30 minutes for discussion), and the time necessary to complete the assignments and further study.

MODULE PURPOSE

Electrical grounding/earthing plays a vital role in safety of personnel and equipment. This module explains the basics thereof in a simple way so that safety in oil and gas installations can be assured by correct application of first principles. Electrical safety is an extensively legislated subject, as the handling of electrical equipment has several inherent hazards. A brief overview of electrical safety legislation will also be given. It is a well-established fact that lightning is the second-most dangerous of all natural phenomena, (the first being flash floods) based on reported fatalities on a long-term average basis. Lightning can also cause extensive damage when it strikes buildings and facilities. Equipment failures and disruption of services on account of lightning strikes on electrical lines and substations is a matter of constant worry to T&D system managers. Protection of structures by lightning protection systems and electrical lines and substations by shielding are discussed in elaborate detail, as well as protection measures for offshore facilities.

PRE-REQUISITE MODULES/UNIT(S)

Module 1: Fundamentals of Electrical Engineering

Module 4: Power Distribution.

ASSESSMENT STRATEGY

To evaluate the achievement of the learning outcomes; written assignments, group projects and practical exercises are set.

SUMMARY OF LEARNING OUTCOMES

1. Describe the use of earthing and bonding to avoid electric shock hazards [9.1]
2. Explain the nature of arc flash and means of mitigating it [9.2]
3. Outline electrical safety principles [9.3]
4. Describe methods for lightning protection of structures and

other installations [9.4]

Learning Outcome 1 **Describe the use of earthing and bonding to avoid electric shock hazards [9.1]**

Assessment Criteria

1. Describe the various types of system earthing [9.1.1]
2. Discuss the use of protective earthing and bonding for mitigation of shock hazard [9.1.2]
3. Examine and discuss the use of earth electrodes including (a) installation and (b) environmental considerations [9.1.3]

Learning Outcome 2 **Explain the nature of arc flash and means of mitigating it [9.2]**

Assessment Criteria

1. Examine and discuss arc flash in terms of:
   (a) Causes [9.2.1]
   (b) Effects [9.2.2]
   (c) Hazard assessment and mitigation approaches [9.2.3]

Learning Outcome 3 **Outline electrical safety principles [9.3]**

Assessment Criteria

1. Discuss the concept of safety through design [9.3.1]
2. Discuss electrical safety in operation and maintenance [9.3.2]
3. Describe safety measures for substations [9.3.3]
4. Examine and discuss safety rules, enterprise procedures and organizational measures for electrical safety [9.3.4]

Learning Outcome 4 **Describe methods for lightning protection of structures and other installations [9.4]**

Assessment Criteria

1. Examine and discuss (a) the physics of lightning, as well as (b) hazards and (c) risks associated with lightning [9.4.1]
2. Describe methods used for lightning protection [9.4.2]

Delivery Mode
A combination of asynchronous and synchronous e-learning delivery comprising a judicious mix of interactive online web conferencing, simulation (virtual labs) software, remote online labs, online videos, Power Points, notes, reading and study materials (in pdf, html and word format) accessed through the Moodle Learning Management System (LMS).