



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

### **MODULE DETAILS**

### **MODULE 12: Electrical Equipment in Hazardous Areas**

Nominal duration: 3 weeks (24 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**

During the phases of extraction and processing, prior to eventual use as fuels or feed-stocks, the oil and gas industry handles ignitable substances. Inadvertent combustion can cause, and has caused, major disasters and loss of life. This module provides instruction on how explosion protection is applied. It looks at hazardous area terminology, together with the many basic principles involved, and some applications to explain the subject. The processes of area classification in plant design are introduced by examining the characteristics of flammable gasses and vapours. This forms the basis of the classification systems for equipment (i.e. grouping and temperature rating) such that suitably rated equipment can be selected for a given hazard. The requirements of installation, operation, inspection and maintenance aspects of such equipment used in hazardous areas are subsequently explained. The information is taken from the harmonized International Standard Series IEC60079. Engineers in this industry must understand the workings of explosion protection systems and how they are implemented with respect to process plant control and instrumentation, and other electrical equipment. This is so that safety is designed into the process plant and is managed technically and organizationally for the operational life of the plant.

### **PRE-REQUISITE MODULES/UNIT(S)**

Module 1: Fundamentals of Electrical Engineering

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

### **ASSESSMENT STRATEGY**

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

### **SUMMARY OF LEARNING OUTCOMES**

1. Examine and discuss the basic concepts of hazardous areas [12.1]

2. Describe the principles of the various types of Ex protection [12.2]



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3. Outline end user practices for hazardous areas [12.3]

**Learning Outcome 1**                      **Examine and discuss the basic concepts of hazardous areas** [12.1]

- Assessment Criteria**
1. Discuss the background to hazardous areas in terms of (a) standards, (b) testing, (c) authorities and (d) equipment certification [12.1.1]
  2. Describe the characteristics of flammable gases [12.1.2]
  3. Discuss the concept of hazardous zones and associated definitions [12.1.3]
  4. Describe the equipment classification systems used for hazardous areas [12.1.4]

**Learning Outcome 2**                      **Describe the principles of the various types of Ex protection** [12.2]

- Assessment Criteria**
1. Discuss explosion protection concepts in terms of (a) definitions, (b) principles, and (c) applications [12.2.1]
  2. Explain the following flameproof concepts:
    - (a) Ex d [12.2.2.a]
    - (b) Ex e [12.2.2.b]
    - (c) Ex n [12.2.2.c]
    - (d) Ex l [12.2.2.d]
    - (e) Ex p [12.2.2.e]
    - (f) Lesser known types: Ex o, q, m and s [12.2.2.f]
  3. Discuss the use of combined protection methods [12.2.3]

**Learning Outcome 3**                      **Outline installer and end user practices for hazardous areas** [12.3]

- Assessment Criteria**
1. Discuss the mitigation of electrical hazards through earthing and bonding [12.3.1]
  2. Describe the code of practice for selection and installation of Ex equipment [12.3.2]
  3. Discuss issues related to standards, certification, marking,



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and the ATEX directive [12.3.3]

4. Discuss the inspection and maintenance of Ex equipment in accordance with ATEX directives [12.3.4]

**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).