### Unit Descriptor

This unit deals with the knowledge required to analyse and design Safety Instrumented Systems for the process industry in compliance with the analysis and realisation phases of the AS61511 safety lifecycle.

### Element | Performance Criteria
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1. Basic Principles of Safety Instrumented Systems | • Differentiate between safety instrumented systems and basic process control systems.  
• Describe how a SIF is defined.  
• Describe the 3 types of failures that need to be considered to make systems functionally safe  
• Identify and describe the breakdown of random hardware failures considered in functional safety.  
• Describe what is meant by common cause failure  
• Describe the relationship between AS61508 and AS61511  
• Define which phases of a project’s lifecycle are covered by the AS61511 standard.  
• Describe the relationship between risk, tolerable risk and SIL.  

2. Process Hazard Analysis | • Define the main requirements of the PHA stage  
• Identify 3 common PHA methods  
• Describe 2 common problems during HAZOPS that could have a negative impact on downstream AS61511 activities  
• Describe 3 sources of information used in the identification of safety instrumented functions  

3. SIL Assessments | • Define the objective of a SIL Assessment  
• Identify common SIL Assessment methods  
• List required information / considerations required for planning a SIL Assessment  
• Identify common likelihood and consequence analysis methods  
• Define the 4 LOPA criteria  
• Identify common problems associated with sharing and the independence principle  
• Describe 3 common layers of protection and their associated limitations  
• Identify essential features of a risk matrix when used for SIL Assessments
4. Safety Requirement Specifications
- Define the purpose of a Safety Requirement Specification (SRS)
- List 5 of the required items of information that should be available in an SRS
- Identify common problems associated with the writing of the SRS

5. Choosing Technology
- Identify the sales pitfalls when selecting instrumentation and final elements
- Describe at least 3 sensor subsystem architectures and the type of failures they protect against
- Differentiate between logic-solver technology
- Describe at least 2 final element subsystem architectures and the type of failures they protect against
- Differentiate between reliability and availability.
- Explain the importance of designing for testability

6. SIL Verification
- Describe the relationship between SIL, PFD and proof test interval
- List 3 methods that can be used for SIL verification
- Demonstrate the use of Hardware Fault Tolerance (HFT) tables when performing SIL Verification
- Identify the 2 main requirements for verifying that a SIL can be achieved
- Categorise which items need to be considered as part of a safety instrumented function’s subsystem

7. Detailed Design
- Identify main features of the software design model
- List 5 of the required items of information that should be available in a Functional Specification
- Describe general requirements of the operator interface
- Describe correct maintenance override philosophy between BPCS and SIS
- Describe general requirements of the maintenance interface
- Identify the requirements of software verification and validation planning
- Categorise independence requirements based on SIL
### 8. Integration
- Define 2 objectives of integration testing
- Describe the requirements of planning integration testing
- Describe one of the integration tests that is required when testing safety instrumented system software
- Identify at what stage management of change control is required
- Identify requirements for record keeping

### 9. Installation & Commissioning
- Describe the requirements of planning installation & commissioning activities.
- Specify where SIS commissioning fits in the overall plant commissioning
- Identify requirements for record keeping

### 10. Validation
- Describe the requirements of planning validation activities
- Describe the difference between verification and validation
- List 5 required validation activities
- Identify the limitations associated with the forcing of SIS IO points
- Identify requirements for record keeping

### 11. Functional Safety Management
- Describe the main objective of implementing Functional Safety Management
- Define the requirements for managing the competencies of persons, departments, organisations involved in the AS61511 safety lifecycle
- Describe the planning requirements
- Identify 2 stages within the safety lifecycle where a FSA should be done
- Describe the independence requirement for Functional Safety Assessments
- Identify what needs to be checked during a functional safety assessment
- Explain what is configuration management