

## Liverpool John Moores University

Title: Functional Safety (including Safety Integrity Level (SIL))  
Status: Definitive  
Code: **7551RTC** (120384)  
Version Start Date: 01-08-2019

Owning School/Faculty: Maritime and Mechanical Engineering  
Teaching School/Faculty: Risktec Solutions

Team	Leader
Alan Wall	Y

**Academic Level:** FHEQ7      **Credit Value:** 10      **Total Delivered Hours:** 16.5  
**Total Learning Hours:** 100      **Private Study:** 83.5

### Delivery Options

Course typically offered: Semester 1

Component	Contact Hours
Lecture	8
Online	.5
Tutorial	8

**Grading Basis:** 40 %

### Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Essay	AS1	An essay question comprising several component parts, based around a case study, up to 4,000 words long.	95	
Test	AS2	Individual and group activities e. g. quiz, forum.	5	

### Aims

*To understand the role of functional safety in reducing risks, and to devise and apply Safety Integrity Level (SIL) targets and the methods appropriate to assessing the degree of risk reduction achieved, when implementing protection systems.*

## Learning Outcomes

After completing the module the student should be able to:

- 1 Identify and critically review hazards and consequences and define safety functions and target Safety Integrity Level (SIL) requirements which will reduce the associated risks to a tolerable level.
- 2 Apply the analysis methodologies for each of the principal safety lifecycle phases associated with the development of safety systems, to ensure that, when implemented, they achieve specified risk reduction targets.
- 3 Critically review safety systems to establish and demonstrate the degree of risk reduction actually achieved.
- 4 Logically deduce how the level of risk reduction achieved by a safety system could be improved and when risk has been reduced to As Low As Reasonably Practicable (ALARP).

## Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

4000 word essay	2	3	4
Individual and group work	1		

## Outline Syllabus

### *Introduction to Functional Safety*

*What is Functional Safety*

*Safety Lifecycle Overview*

*Definition of Terms*

*Functional Safety Standards*

### *The Safety Lifecycle (IEC 61508)*

*Lifecycle Phases*

*Management and Planning*

*Verification & Validation*

*Application to New-build and to Modified plant*

### *Hazard & Risk Analysis*

*Overview*

*Hazard Identification & Consequence Analysis*

*Identifying Risk Reduction Mechanisms*

*Identifying Protection Functions*

*Defining Tolerable Risk Limits*

*The ALARP Principle*

*Tutorial 1 – Identifying Hazards & Risk Reduction Measures*

### *SIL Selection (setting targets)*

*Why set targets*

*Overview of SIL selection methods*

*Layers of Protection Analysis (LOPA)*

*Tutorial 2 – Selecting SIL Targets using LOPA*  
*Safety Requirements Specification*  
*Role of Safety Requirements Specification*  
*Safety Requirements – scope and content*  
*Tutorial 3 – Defining Safety Requirements*  
*SIL and the Design Process*  
*The importance of architecture*  
*Programmable and non-programmable technology*  
*Defence against random failure mechanisms*  
*Defence against systematic errors*  
*Defence against common mode /common cause failure*  
*Tutorial 4 – Safety System Design*  
*Beyond Design Lifecycle Phases*  
*Installation and Commissioning*  
*Validation*  
*Operation and Maintenance*  
*Compliance Demonstration*  
*Compliance Overview*  
*Quantitative SIL verification*  
*Qualitative SIL verification*  
*Functional Safety Assessment*  
*Tutorial 5 – SIL Assessment / Verification*  
*Safety Lifecycle Management*  
*Responsibilities*  
*Competence*  
*Summary and concluding remarks.*

## **Learning Activities**

A combination of lectures, exercises and supported self study.

## **Notes**

The module aims to enable students to understand and apply the principles of functional safety to the development and assessment of safety systems and is based around the important IEC 61508 functional safety standard.

The module illustrates the primary elements of the safety lifecycle and how these are applied to the development of safety systems which serve to reduce the risks associated with hazardous equipment or processes to a tolerable level.

The module also covers the assessment of safety systems to confirm that the functional requirements and risk reduction targets set for the system have been achieved.

The module allows the students to develop expertise in the application of the techniques necessary to specify, implement and assess safety systems to meet the

requirements of IEC 61508.

Assessment is in the form of an essay combined with activities (e.g. exercises, discussions, etc.).

The delivery modes for the module elements are explained below.

Lecture (using slides and notes): will be delivered by classroom based teacher (face to face) or online self-study (distance learning) or mixture of the two (blended learning).

Tutorial/Activities (exercises and reviews): will be delivered by classroom based teacher (face to face) or online activities with teacher feedback/virtual classroom (distance learning) or mixture of the two (blended learning).

Tutor supported online: will be delivered by email support prior to assessment submission (face to face) or tutor feedback activities, virtual classrooms and email support (distance learning) or mixture of the two (blended learning).