City University of Hong Kong

Information on a Course
offered by Department of Mechanical and Biomedical Engineering
with effect from Semester A in 2013/2014

Part I

Course Title: Risk and Reliability Engineering (including Nuclear Applications)

Course Code: MBE5103

Course Duration: One Semester

No. of Credit Units: 3

Level: P5

Medium of Instruction: English

Prerequisites: Nil

Precursors: SEEM 3101 Basic Methodologies and Tools for Risk Engineering
or equivalent

Equivalent Courses: Nil

Exclusive Courses: Nil

Note:
Students may repeat a course, or an equivalent course, to improve course grade only if the previous course grade obtained is C or below.

Part II

1. Course Aims

This course aims to present the mathematical modelling and system simulation methods for evaluating, managing and controlling the reliability, safety and risk of complex engineering systems such as the nuclear systems. The objective is to provide the students with the adequate tools for handling with scientific rigor the complexities and uncertainties associated to the problem. Previous knowledge on basic probability theory and statistics is helpful.
The expertise offered is part of the background knowledge of safety, reliability and risk analysts, operators and managers, in the industrial sector, including in particular nuclear.
Practical examples and numerical exercises will be provided in support to the comprehension of the material covered in class.

2. Course Intended Learning Outcomes (CILOs)

Upon successful completion of this course, students should be able to:

No.	CILOs	Weighting* (if applicable)
1.	**Explain** the key aspects of reliability and risk engineering	1
2.	**Apply** effectively some of the methods of risk assessment (e.g. hazard identification, fault tree and event tree analyses, etc.)	1
3.	**Identify** the risk-critical points of a system and optimally decide on their elimination or protection of the systems' environment	2
4.	**Understand** the risk assessment in the nuclear industry	1

***Weighting ranging from 1,2,3 to indicate the relative level of importance in an ascending order.**

3. Teaching and Learning Activities (TLAs)

(Indicative of likely activities and tasks designed to facilitate students' achievement of the CILOs. Final details will be provided to students in their first week of attendance in this course)

Activity Type	Timetabled Activity (Hours per week)
Lecture/Tutorial Mix	Lecture mixed with tutorial (3)

TLAs	Large class Activities (Lecture)	Individual work Activities (Self study)	Total Hours L (+S)
CILO 1	4	(2)	4(+ 2) = 6
CILO 2	18	(10)	18(+ 10) = 28
CILO 3	8	(4)	8(+ 4) = 12
CILO 4	9	(4)	9(+ 4) = 13
Total (hrs)	**39**	**(20)**	**39 (+ 20) = 59**

Large class activities:

Lectures on the topics of the keyword syllabus

Individual work activities

Students are required to carry out self study on webs and search appropriatel information/data in conjunction with the lecturing materials to accomplish a set of given requirements. The work of the self study will be presented as an individual report for assessment.

4. Assessment Tasks/Activities

(Indicative of likely activities and tasks designed to assess how well the students achieve the CILOs. Final details will be provided to students in their first week of attendance in this course)

ATs	Final Examination (2 hrs)	Mid-term Examination	Total (%)
CILO 1	5	5	10
CILO 2	23	22	45
CILO 3	10	10	20
CILO 4	13	12	25
Total (%)	**51**	**49**	**100**

For a student to pass the course, at least 30% of the maximum mark for the examination should be obtained.

5. Grading of Student Achievement:

Midterm test: 50%
Final exam: 50%

Grade Table

Letter Grade	Grade Point	Grade Definitions
A+	4.3	Excellent
A	4.0	
A-	3.7	
B+	3.3	Good
B	3.0	
B-	2.7	
C+	2.3	Adequate
C	2.0	
C-	1.7	
D	1.0	Marginal
F	0.0	Failure
P	-	Pass

Please refer the SGS's website:
http://www.sgs.cityu.edu.hk/student/tpg/assessment/coursegrades#01 for more details.

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Part III

Keyword Syllabus

- Definition of reliability, availability, safety, risk; structure of risk analysis
- Probabilistic Risk Assessment (PRA)
- Hazard identification: functional analysis, Hazard Operability (HAZOP) analysis and Failure Modes, Effects and Criticality Analysis (FMECA)
- Reliability and availability of simple systems
- Fault tree and event tree analysis
- Markov models for reliability and availability analysis
- Monte Carlo simulation for reliability and risk analysis
- Common cause failures
- Important measures
- Industrial examples

Recommended Reading:

Text(s)

- Zio E., An introduction to the basics of reliability and risk analysis, World Scientific, 2007.
- Zio E., Computational methods of reliability and risk analysis, World Scientific, 2009.
- Zio, E. Baraldi, P. and Cadini F., Basics of reliability and risk analysis: Worked Out Problems and Solutions, World Scientific, 2011.
- Kroger, W. and E. Zio, Vulnerable systems, Springer, 2011.