Subject Description Form

Subject Code	CSE40483
Subject Title	System Safety Engineering
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with an understanding of the principles and techniques in the practical applications of system safety engineering, enabling students to perform various system safety techniques in providing safety assurance to engineering systems.
Intended Learning Outcomes (Note 1)	Upon completion of the subject, students will be able to: a. demonstrate a basic knowledge of the essential concepts of system safety management, process safety management, safe design principles, and safety assurance; b. describe and select the appropriate methodologies and tools for analysing safety and providing safety assurance in engineering systems; c. conduct system safety assessments for engineering systems using appropriate data and parameters; d. understand the capabilities and applications of system safety tools and the three-lines-of-defence concept; e. recognise the positive impacts of implementing system safety in all phases of a system's life cycle.
Subject Synopsis/ Indicative Syllabus (Note 2)	1. <u>Introduction</u> An overview of the origin and principles of system safety, basic terminology, safety assurance, lessons learned from accidents, and applications of system safety engineering. 2. <u>System Safety Assessment Techniques</u> Application of hazard and safety assessment techniques, including but not limited to, preliminary hazard analysis; failure modes, effects, and criticality analysis; hazard and operability studies; system hazard analysis; interface hazard analysis; operating & support hazard analysis, management oversight and risk tree, fault tree and event tree analysis. 3. <u>Human Factors Safety Principles</u> An overview of human factors supports to safety-related system design and engineering projects, human error

identification, human error shaping factors and error rates, and human reliability analysis.

4. Security for Safety-Critical Systems
   An understanding of security principles, interrelationships between safety and security, data protection, and threats and vulnerability analysis.

5. Systems Engineering for Safety
   An introduction to through-life safety, lifecycle systems analysis, and modelling, safety integrity level assignments and applications, common cause analysis, and safety hazard analysis on complex systems.

6. Integrated System Safety Assessments
   An introduction and overview of the applications of system safety assessments in the design process, system safety management activities, system safety program plan, safety assurance plan, process safety management, safety case development and review, three line-of-defence assurance, and operating and managing safety-critical systems and projects.

Teaching/Learning Methodology (Note 3)

A series of lectures and tutorials will be provided to introduce the principles of knowledge of the application of system safety engineering principles. Students will be required to relate the lecture materials with assignments and through the study of pragmatic examples and case studies, project presentations, and reports.

Self-study by students, including literature review and information searching, is required to achieve all the intended learning outcomes of the subject.

Assessment Methods in Alignment with Intended Learning Outcomes (Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Class discussion	5	√	√	√	√	√
2. Quiz 1	10	√	√	√		
3. Quiz 2	10			√	√	√
4. Assignment 1	10	√	√	√		
5. Assignment 2	15	√	√	√	√	√
6. Examination	50	√	√	√	√	√
Total	100 %					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The students' knowledge of Outcomes a through e and their performance are monitored and assessed through class discussion, tutorials, continuous assessments, and final examination.

<table>
<tr><td></td><td colspan="2">For continuous assessments, the students are assessed in the form of quizzes through problem-solving, as well as assignments where students will submit short essays and make presentations to reflect their understanding of the module through case studies and short projects.

Written examination at the end of the semester will be used to test the understanding and application of principles related to Outcomes a through e.

A letter grading system will be used to assess students' performance. Students must attain at least a grade of D to achieve a passing grade.</td></tr>
<tr><td rowspan="6">Student Study Effort Expected</td><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td>▪ Lectures / Tutorials</td><td>3 Hrs.</td></tr>
<tr><td>Other student study efforts:</td><td></td></tr>
<tr><td>▪ Course work</td><td>3 Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>3 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>9 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Essential Textbooks:

Ericson, C. A. (2016). Hazard Analysis Techniques for System Safety, 2nd Edition, New York: Wiley.

Bahr, N, (2015). System Safety Engineering and Risk Assessment, A Practical Approach, 2nd Edition, CRC Press, Boca Raton.

Reference Textbooks:

Zio E. (2009). Computational Methods for Reliability and Risk Analysis, World Scientific Publishing Co.

Zio E. (2009). An Introduction to the Basics of Reliability and Risk Analysis, World Scientific Publishing Co.

Vincoli, J.W. (2014) Basic Guide to System Safety, 3rd Edition, New York: Wiley.

Lewis, C. and Haug, H. (1999). The System Safety Handbook, https://www.ukfsc.co.uk/files/SMS%20Material/System%20Safety%20Handbook%20Aug%202009.pdf</td></tr>
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