

Subject Description Form

Subject Code	BSE558
Subject Title	Accident Prevention, Hazard Assessment and Control
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	<ul style="list-style-type: none"> • To understand risk, reliability engineering and safety concepts; and to understand concepts of hazard assessment, risk assessment and safety of engineering system. • To understand system safety engineering and models, Preliminary Hazard Analysis (PHA), Failure Modes, Effect and Criticality Analysis (FMECA), Fault Tree Analysis (FTA), Hazards and Operability Analysis (HAZOP) etc. • To understand theories of accident causation and control strategies to prevent accident, accident case analysis and investigation technique. • To understand the hazard control measures, elimination and reduction, accident control measures, failure minimization and safety factors.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. have a clear understanding of risk, reliability engineering and safety concepts; and to understand concepts of hazard assessment, risk assessment and safety of engineering system; b. use system safety engineering and models such as Preliminary Hazard Analysis (PHA), Failure Modes, Effect and Criticality Analysis (FMECA), Fault Tree Analysis (FTA), Hazards and Operability Analysis (HAZOP) etc.; c. appreciate theories of accident causation and control strategies to prevent accident, accident case analysis and investigation technique; d. do the hazard control measures, elimination and reduction, accident control measures, failure minimization and safety factors.
Subject Synopsis/ Indicative Syllabus	<p>Basic hazard analysis, risk assessment and safety concepts: Revision of elementary risk, hazard, safety and reliability concepts: definitions; Measures of risk, safety and reliability; Reliability theory and human reliability, safety and reliability analysis of engineering systems, accident and failure statistics; Fatal accident and serious injury rates; Societal risks.</p> <p>Introduction to hazard analysis and risk assessment techniques; Simulation methods; Introduction to modelling of engineering systems as series and parallel systems; Redundancy etc.; Qualitative and quantitative assessment on typical hazards such as fire and explosion, toxic releases.</p> <p>System safety engineering: Introduction to concepts of system safety, Preliminary Hazard Analysis (PHA), Failure Modes and Effects Analysis (FMEA), common technique for analyzing causes of hazards - Fault Tree Analysis (FTA), Management Oversight and Risk Tree Analysis (MORT), Event Tree Analysis, Hazards and Operability Analysis (HAZOP), Cause-Consequence Analysis and Loss Incident Causation Models.</p>

	<p>Accident prevention: Theories of accident causation and management strategies to prevent accident, accident case analysis, accident sequence models and investigation technique, prevention of accident and ill-health at work; Natural and man-made hazards; Review of occupational accident and ill-health data and its relevant to accident control and safety management systems.</p> <p>Hazard control measures: Introduction to hazard control measures and hierarchy, hazard elimination, substitution, simplification, passive and active safeguards, fail-safe design, protection systems, isolation and containment barriers, lockouts, interlocks, failure minimization, safety-factors/margins, redundancy.</p>																																						
<p>Teaching/Learning Methodology</p>	<ul style="list-style-type: none"> • Lectures/seminars • Student seminars/tutorials 																																						
<p>Assessment Methods in Alignment with Intended Learning Outcomes</p>	<table border="1"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a.</th> <th>b.</th> <th>c.</th> <th>d.</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>60%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2. Continuous assessment</td> <td>40%</td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="6"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Based on examination mark (60%) and continuous assessment mark (40%). The continuous assessment is made up of course work, seminar and case study.</p> <p>Tutorial Work</p> <p>Tutorial periods average every three weeks. Tutorial work will mainly focus on problem solving based on examination type questions and practical examples.</p>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						a.	b.	c.	d.			1. Examination	60%	✓	✓	✓				2. Continuous assessment	40%		✓		✓			Total	100%						
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<p>Reading List and References</p>	<p>Boyle T. (2015), <i>Health & Safety: Risk Management</i>, Taylor and Francis.</p> <p>DiBerardinis, L.J. (1999). <i>Handbook of Occupational Safety and Health</i>, 2nd Ed., John Wiley & Sons, Inc., New York, NY, USA.</p> <p>Ericson, Clifton A., II. (2016). <i>Hazard Analysis Techniques for System Safety</i>, 2nd Ed., John Wiley & Sons, Inc.</p> <p>Ferry T.S. (2007). <i>Modern Accident Investigation and Analysis</i>, 2nd Ed., John Wiley & Sons, Inc.</p> <p>Leveson, N.G. (1995). <i>Safeware: System Safety and Computers</i>, Addison-Wesley, New York, NY, USA.</p> <p>MIL-STD-882E (2012). <i>Standard Practice for System Safety</i>, Department of Defense, USA. Wiley</p> <p>Mroszczyk J.W. (2013). <i>Safety Engineering</i>, 4th Ed., American Society of Safety Engineers, Des Plaines, IL, USA.</p>																																						

	<p>National Institute for Occupational Safety and Health (2010). <i>A systematic review of the effectiveness of training & education for the protection of workers</i>, USA.</p> <p>National Safety Council (2015). <i>Accident Prevention Manual for Business & Industry: Administration and Programs</i>, 14th Ed. (Occupational Safety & Health Series), Philip Hagan, John Montgomery, and James O'Reilly (Ed), Chicago.</p> <p>Raheja, D.G. & Allocco, M. (2006). <i>Assurance Technologies: Principles and Practices: a product, process and system safety perspective</i>, 2nd Ed., John Wiley & Sons, Inc., NJ, USA.</p> <p>Reese, C.D. (2017). <i>Accident/incident Prevention Techniques</i>, 2nd Ed., Taylor & Francis, London, UK.</p> <p>Stephans, R.A. & Talso, W.W. (Ed.), (1999). <i>System Safety Analysis Handbook, A Source Book for Safety Practitioners</i>, 2nd Ed., System Safety Society, Albuquerque, NM, USA.</p> <p>Yates W.D., (2015). <i>Safety Professional's Reference and Study Guide</i>, 2nd Ed., CRC Press.</p>
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