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	• 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	Upon completion of the subject, students will be able to: 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	**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. 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. **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.

<table>
<tr><td></td><td>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.

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.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>• Lectures/seminars
• Student seminars/tutorials</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a.</td><td>b.</td><td>c.</td><td>d.</td><td></td><td></td></tr>
<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>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Based on examination mark (60%) and continuous assessment mark (40%). The continuous assessment is made up of course work, seminar and case study.

Tutorial Work

Tutorial periods average every three weeks. Tutorial work will mainly focus on problem solving based on examination type questions and practical examples.</td></tr>
<tr><td>Reading List and References</td><td>Boyle T. (2015), Health & Safety: Risk Management, Taylor and Francis.

Mansdorf, S.Z. (2019). Handbook of Occupational Safety and Health, 3rd Ed., John Wiley & Sons, Inc., New York, NY, USA.

Ericson, Clifton A., II. (2016). Hazard Analysis Techniques for System Safety, 2nd Ed., John Wiley & Sons, Inc.

Ferry T.S. (2007). Modern Accident Investigation and Analysis, 2nd Ed., John Wiley & Sons, Inc.

Leveson, N.G. (1995). Safeware: System Safety and Computers, Addison-Wesley, New York, NY, USA.

MIL-STD-882E (2012). Standard Practice for System Safety, Department of Defense, USA. Wiley

Mroszczyk J.W. (2013). Safety Engineering, 4th Ed., American Society of Safety Engineers, Des Plaines, IL, USA.</td></tr>
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	National Institute for Occupational Safety and Health (2010). *A systematic review of the effectiveness of training & education for the protection of workers*, USA. National Safety Council (2015). Accident Prevention Manual for Business & Industry: Administration and Programs, 14th Ed. (Occupational Safety & Health Series), Philip Hagan, John Montgomery, and James O'Reilly (Ed), Chicago. Raheja, D.G. & Allocco, M. (2006). *Assurance Technologies: Principles and Practices: a product, process and system safety perspective, 2nd Ed., John Wiley & Sons, Inc., NJ,* USA. Reese, C.D. (2017). *Accident/incident Prevention Techniques*, 2nd Ed., Taylor & Francis, London, UK. Stephans, R.A. & Talso, W.W. (Ed.), (1999). *System Safety Analysis Handbook, A Source Book for Safety Practitioners*, 2nd Ed., System Safety Society, Albuquerque, NM, USA. Yates W.D., (2015). Safety Professional's Reference and Study Guide, 2nd Ed., CRC Press.