

MNE3109: HAZARD EFFECT MANAGEMENT PROCESS

Effective Term

Semester B 2024/25

Part I Course Overview

Course Title

Hazard Effect Management Process

Subject Code

MNE - Mechanical Engineering

Course Number

3109

Academic Unit

Mechanical Engineering (MNE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

SYE3101 Basic Methodologies and Tools for Risk Engineering

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course aims to introduce the basic principles of HEMP (Hazard Effect Management Process) in order to develop our students' professional knowledge and skills in HSSE (Health Safety Security Environment). HEMP is the systematic hazard analysis process used by the risk management profession to identify the HSSE hazards present in business or operations, assess the risk of their release and identify the controls and recovery measures that need to be in place to manage that hazard if the risk of its release is significant. HEMP is at the "heart" of the Operation (HSSE) Risk Management Systems. Safety critical businesses, such as petrochemical or nuclear, need to show that they have applied the HEMP process and have put in place the necessary hazard control and recovery barriers to manage their operation risks in HSSE.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Apply RAM (Risk Assessment Management Matrix) definition and application for ranking and assessing the risks qualitatively.			x	
2	Apply HEMP (Hazard Effect Management Process) framework for providing a structured approach to managing the hazards and potential effects throughout the life cycle of an asset and its activities, especially related to HSE (Health, Safety and Environmental) hazards.			x	
3	Explain Swiss Cheese Model of accidents, especially related to human errors, for risk analysis and risk management, and also its role behind layered barriers and defence in depth principle.			x	
4	Apply Barrier Thinking Concept to develop effective barriers aiming at reducing risk of a major accident to acceptable levels or even from occurring.			x	
5	Describe ALARP (As Low As Reasonably Practicable) concept, which lies at the heart of the many health and safety systems adopted in many large corporations around the world, for balancing risk and expenditure.		x		
6	Describe Management Handshake Assurance Process from Risk Assessments, Management of Changes, Incident Investigations, Audits, etc.		x		

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Delivery of the course will be achieved through a series of formal lectures supported by practical case studies.	1, 2, 3, 4, 5, 6	3hrs/week

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes	1, 2, 3, 4, 5, 6	10	
2	Mini-project and Presentations	1, 2, 3, 4	30	Report and Presentation files (2-3) to be submitted by students

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Additional Information for ATs

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

Assessment Rubrics (AR)**Assessment Task**

1. Quizzes

Criterion

- 1.1 Ability to Explain RAM definition and application.
- 1.2 Ability to Explain HEMP framework.
- 1.3 Ability to Explain Swiss Cheese Model.
- 1.4 Ability to Explain Barrier Thinking Concept.
- 1.5 Ability to Describe ALARP concept.
- 1.6 Ability to Describe Management Handshake Assurance Process.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

2. Mini-project and Presentations

Criterion

- 2.1 Ability to Apply RAM definition and application.
- 2.2 Ability to Apply HEMP framework.
- 2.3 Ability to Explain Swiss Cheese Model.
- 2.4 Ability to Apply Barrier Thinking Concept.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

3. Examination

Criterion

- 3.1 Ability to Apply RAM definition and application.
- 3.2 Ability to Apply HEMP framework.
- 3.3 Ability to Explain Swiss Cheese Model.
- 3.4 Ability to Apply Barrier Thinking Concept.
- 3.5 Ability to Describe ALARP concept.
- 3.6 Ability to Describe Management Handshake Assurance Process.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Additional Information for AR

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

Part III Other Information

Keyword Syllabus

- Why need HEMP for operation excellence: incident, Lost Time Incidents, First Aid Cases, Medical Treatment Cases, Risk Tolerance Criteria, etc
- Hazard Classification: personal safety, process safety, environmental, health, and security
- Hazard Identification: Fall & trip, moving machinery, fire and explosion, oil spill, LOPC etc.
- Bowtie Model: Barrier, Control, Escalation, recovery etc.
- Risk Assessment Management Matrix (RAM): Likelihood, severity, rating, colour scheme, management requirement
- Tripod Investigation: Framework, Latent failure, Precondition, unsafe act and condition
- HEMP (Hazard Effect Management Process): Handshake, framework, Management process etc.
- Barrier and Control Measures: Barrier thinking, Deep dive concept
- Swiss Cheese Concept: Cheese holes, barrier failure, human error
- Hierarchy of control: Elimination, substitution, engineering, procedure, training and PPE
- Bowtie Analysis and Control Effectiveness: Validity, Effective etc.
- Hazard Control Sheet: Hazard control effectiveness, exposure and control
- ALARP (As Low As Reasonable and Practical): Optimal level, Impractical level

Reading List

Compulsory Readings

Title	
1	T. Aven, Quantitative Risk Assessment: The Scientific Platform, Cambridge University Press, ISBN-10: 0521760577 or latest edition.

Additional Readings

Title	
1	Colin Bayliss and Kevin Langley, Nuclear Decommissioning, Waste Management, and Environmental Site Remediation, A Butterworth Heinemann Title, ISBN-10: 0750677449.
2	Richard Maguire, Safety Cases and Safety Reports: Meaning, Motivation and Management, Ashgate Pub Co, ISBN-10: 9780754646495.
3	David J. Smith and Kenneth G. L. Simpson, Safety Critical Systems Handbook: A Straightforward Guide to Functional Safety, IEC 61508 (2010 Edition) and Related Standards, including Process IEC 61511 and Machinery IEC 62061 and ISO 13849, Butterworth-Heinemann, ISBN-10: 0080967817.
4	Ian T. Cameron and R. Raman, Process Systems Risk Management, Volume 6 (Process Systems Engineering), Academic Press, ISBN-10: 9780121569327.
5	Terje Aven and Ortwin Renn, Risk Management and Governance: Concepts, Guidelines and Applications (Risk, Governance and Society), Springer, ISBN-10: 9783642139253.
6	Online Resources Online learning material is provided via University computer network http://www.pdo.co.om/hseforcontractors/safety/tripod.html http://www.hse.gov.uk/risk/theory/alarp.htm http://www.hse.gov.uk/pubns/indg163.pdf http://www.hse.gov.uk/risk/theory/alarp3.htm