

# SYE4027: OCCUPATIONAL SAFETY FOR INTELLIGENT MANUFACTURING SYSTEMS

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**Effective Term**

Semester A 2024/25

## Part I Course Overview

**Course Title**

Occupational Safety for Intelligent Manufacturing Systems

**Subject Code**

SYE - Systems Engineering

**Course Number**

4027

**Academic Unit**

Systems Engineering (SYE)

**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**

Nil

**Precursors**

Nil

**Equivalent Courses**

SEEM4023 Occupational Health and Safety Management or  
ADSE4027 Occupational Safety for Intelligent Manufacturing Systems

**Exclusive Courses**

N/A

## Part II Course Details

### Abstract

In this course, students will learn various essential organizational and psychological factors in occupational safety and work design for the Cyber-Physical Systems (CPS) characterised in intelligent manufacturing and learn as well to develop an understanding of related organizational management principles, social-technical integration, changes in skills and competence requirements of workers, effects of advanced equipment and system characteristics on personnel performance, risk and safety management, evaluation of OHS consequences of Industry 4.0, integration of OHS into Industry 4.0, challenges of Safety Assurance for Industry 4.0 and the desirable organizational design and collaboration on a smooth transition towards Industry 4.0. They will also gain an overview of technical and management techniques used to prevent and investigate industrial accidents and develop a broad appreciation of the management responsibility and practices for the health and safety of the employee.

### Course Intended Learning Outcomes (CILOs)

| CILOs |                                                                                                                   | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|-------|-------------------------------------------------------------------------------------------------------------------|---------------------|--------|--------|--------|
| 1     | describe the basic psychological and organizational factors related to occupational safety and work design in CPS | 10                  | x      | x      |        |
| 2     | diagnose the problems associated with occupational safety and work design in CPS                                  | 20                  |        | x      |        |
| 3     | apply relevant psychological and organizational principles and factors to the solutions of given CPS environment  | 30                  |        | x      |        |
| 4     | present analyses and results of experiments and mini- projects in an appropriate written report format            | 30                  |        | x      |        |
| 5     | work effectively as a team member in the mini-project and laboratory activities                                   | 10                  | 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    | Large class activities | The large class activities include mainly lectures. Each student needs to conduct a mini-project. | 1, 2, 3, 4, 5 | 39 hours/semester          |

|   |                 |                                                                                                                                                            |               |                  |
|---|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|
| 2 | Laboratory Work | The first laboratory is about the measurement and evaluation of the lighting conditions. The second laboratory is about the indoor air quality assessment. | 1, 2, 3, 4, 5 | 6 hours/semester |
|---|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|

#### Additional Information for LTAs

Students are provided with learning tasks of laboratory activities and mini projects. Selected laboratory activities and tutorial works are offered. On mini-projects, brief information of possible work topics, effective team working skills, reporting requirements and format will be given. They could choose any cases of occupational safety and work design for investigation, diagnosis, and solving of real-life organizational problems in the context of CPS characterised in Smart Manufacturing. They need to form groups of four to five members and are required to submit a final group project report at the end of semester. Each member should explicitly state in the project report about his/her effort and contribution to the overall project achievement, and how effectively he/she works effectively as a team member. Similar information on team working and requirements for laboratory work will also be provided in laboratory sessions.

#### Assessment Tasks / Activities (ATs)

| ATs                                                                                                                                                                                                                                                                                                                              | CILO No.      | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|----------------------------------------|
| 1<br>Laboratory Work<br>Two laboratory activities will be well designed to develop students' understanding and interests of the course materials in improving the design of work system.                                                                                                                                         | 1, 2, 3, 4, 5 | 20            |                                        |
| 2<br>Mini-project Report<br>Students need to form working groups of four to five members for the mini-project. They may choose any topics related to the course syllabus. Advices will be given on the feasibility, approach, methodology, and expected deliverables of the mini project. An oral presentation will be required. | 1, 2, 3, 4, 5 | 20            |                                        |
| 3<br>Test: Mid Term Quiz                                                                                                                                                                                                                                                                                                         | 1, 2          | 10            |                                        |

#### Continuous Assessment (%)

50

#### Examination (%)

50

#### Examination Duration (Hours)

2

### **Additional Information for ATs**

Examination: Students will be assessed via a 2-hr written examination on their understanding of concepts learned in class, textbooks, reading materials and their ability to apply subject-related knowledge.

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

### **Assessment Rubrics (AR)**

#### **Assessment Task**

Laboratory Work

#### **Criterion**

ABILITY to CONDUCT experiments and EXPLAIN the methodology and procedure, and PREPARE technical reports.

#### **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

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#### **Assessment Task**

Mini-project

#### **Criterion**

CAPACITY for SELF-DIRECTED ACTION LEARNING to understand and apply the principles of organizational design and occupational health and safety.

#### **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

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#### **Assessment Task**

Test

**Criterion**

ABILITY to understand the fundamental principles and knowledge of organizational design and occupational health and safety. It is a mid-term test, which includes multiple choice questions, True/False questions and long questions covering the first part of the course teaching material.

**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

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**Assessment Task**

Examination

**Criterion**

ABILITY to DIAGNOSE and GIVE SOLUTIONS to organizational design and occupational health and safety.

**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

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## Part III Other Information

**Keyword Syllabus**

- Cyber Physical Systems (CPS) and Smart Manufacturing
- Changes in Skills and Competence Requirements demanded of Workers in CPS
- Occupational Safety and Health in the context of CPS
- Safety and Health Management System
- Liabilities and Safety Legislation

- Safety Inspection and Audit
- Accident Prevention and Investigation
- Indoor Air Quality Management
- Industrial Noise Control and Management
- Hazardous Waste Management
- Evaluation of OHS consequences of Industry 4.0
- Integration of OHS into Industry 4.0
- Innovative Organizational Design and Management in CPS
- Innovative Work Organization and Work Design in the digital industrial age

## Reading List

### Compulsory Readings

| Title |                                                                                                                                                                             |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Fundamentals of Occupational Safety and Health (Fundamentals of Occupational Safety & Health) (English) Mark A. Friend and James P. Kohn, Bernan Press, Fifth Edition, 2014 |
| 2     | Industrial Safety and Health Management, Asfahl, C. R., Pearson Prentice Hall, Sixth Edition, 2009.                                                                         |
| 3     | Occupational Safety Management and Engineering, Willie Hammer and Dennis Price, Prentice Hall, Fifth Ed., 2001.                                                             |
| 4     | “Occupational health and safety in the industry 4.0 era: A cause for major concern?” 2018, Safety Science, Volume 109, Pages 403-411                                        |
| 5     | “Challenges of Safety Assurance for Industry 4.0” , 2017. <a href="https://ieeexplore.ieee.org/document/8123559">https://ieeexplore.ieee.org/document/8123559</a>           |

### Additional Readings

| Title |                                  |
|-------|----------------------------------|
| 1     | Journal of Safety Research       |
| 2     | Safety Science                   |
| 3     | Accident Analysis and Prevention |