ADSE4027: OCCUPATIONAL SAFETY FOR INTELLIGENT MANUFACTURING SYSTEMS

Effective Term
Semester A 2023/24

Part I Course Overview

Course Title
Occupational Safety for Intelligent Manufacturing Systems

Subject Code
ADSE - Advanced Design and System 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

Exclusive Courses
N/A

Part II Course Details

Abstract

The aims of the course are to provide students with an overview of various basic organizational and psychological factors in occupational safety and work design for the Cyber Physical Systems (CPS) characterised in smart manufacturing, and 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. Students are also provided with an overview of technical and management techniques that are used to prevent and investigate industrial accidents and to develop a broad appreciation of the management responsibility and practices for the health and safety of the employee.

All these knowhows are critical in facilitating decision-making and designing safe and cost-effective workplaces in smart manufacturing.

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	x
2	diagnose the problems associated with occupational safety and work design in CPS	20		x	x
3	apply relevant psychological and organizational principles and factors to the solutions of given CPS environment	30		x	x
4	present analyses and results of experiments and mini- projects in an appropriate written report format	30		x	x
5	work effectively as a team member in the mini-project and laboratory activities	10	x		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 self-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.

Teaching and Learning Activities (TLAs)

	TLAs	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 TLAs

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
1	Laboratory Work 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	Mini-project Report 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	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

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

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

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

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. https://ieeexplore.ieee.org/document/8123559

Additional Readings

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