

ADSE3026: CONTEMPORARY HUMAN FACTORS FOR INDUSTRY 4.0

Effective Term

Semester A 2023/24

Part I Course Overview

Course Title

Contemporary Human Factors for Industry 4.0

Subject Code

ADSE - Advanced Design and System Engineering

Course Number

3026

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

SEEM3024 Ergonomics in Workplace Design

Exclusive Courses

Nil

Part II Course Details

Abstract

The aims of the course are to provide students with an overview of various contemporary human factors in the interfaces of man machine systems and workplace in smart manufacturing, and to develop an understanding of related ergonomic principles fundamental to the analysis and design of work systems, Human Machine Interfaces (HMI) like cognitive ergonomics, human information processing model, attention and mental workload, human factors in Virtual Reality (VR) and Augmented Reality (AR). Specific considerations will be given to the design of ergonomic workplace, controls and data entry devices, movement and spatial compatibility, IoT control and display devices, and intelligent user interfaces in the context of Industry 4.0. Students will be able to identify the critical ergonomic factors in ergonomic workplace and human machine interfaces and apply the related principles to design user friendly, safe, and productive work system for Industry 4.0.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1 describe the basic ergonomics factors and related problems in the workplace and interfaces of a human machine system in smart manufacturing	10	x	x	x
2 diagnose the problems of given workplace and human machine interfaces	20		x	x
3 apply relevant ergonomics principles and factors to the solutions of given workplace and human machine interfaces	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		1, 2, 3, 4, 5	39 hours/ semester
2	Laboratory Work	Students are provided with learning tasks of laboratory activities and mini-projects. Selected laboratory activities in manual dexterity, reaction times, industrial lighting, and workplace anthropometry, etc. are offered. Similar information on team working and requirements for laboratory work will also be provided in laboratory sessions.	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 ergonomic cases for investigation, diagnosis, and solving of real-life organizational problems in the context of Human Factors for Industry 4.0. They need to form groups of three to four 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 three to four 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

Miniproject

Criterion

CAPACITY for SELF-DIRECTED ACTION LEARNING to understand and apply the principles of contemporary human factors.

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 contemporary human factors in workplace ergonomics and interface design. 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 workplace and interface ergonomics problems.

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

- Human-machine systems.
- Cognitive Ergonomics.
- Human Information Processing Model.
- Human Factors in Virtual Reality (VR) and Augmented Reality (AR).
- Human Control of Systems and Human Computer Interaction (HCI).
- Design of Controls and Data Entry Devices.
- Conceptual, Movement and Spatial Compatibility.
- IoT Control Devices including Touch Displays, Wearable and Handheld Devices.
- Ergonomic Workplace Design with considerations of Anthropometry, Noise and Lighting

Reading List

Compulsory Readings

	Title
1	Journal of IEEE: "Human Machine Interface in Concept of Industry 4.0" , 2018.
2	Journal of IEEE: "Human-machine-interaction in the industry 4.0 era" . 2014.
3	'An Introduction to Human Factors Engineering' , Christopher D. Wickens, Sallie E. Gordon, and Yili Liu, 1997
4	'Human Factors in Engineering and Design' . McGraw-Hill Book Company, seventh edition, Mark S. Sanders and Ernest J. McCormick, 1992
5	"Fundamentals of Industrial Ergonomics", B. Mustafa Pulat, Prentice Hall, 1992
6	"Human Factors Engineering". Jack A. Adams, Macmillan Publishing Company, 1989
7	"Human Factors Essentials", P. Tillman and B. Tillman, McGraw Hill, 1991.

Additional Readings

	Title
1	International Journal of Industrial Ergonomics
2	Journal of Computers and Industrial Engineering
3	Journal of Human Factors
4	Journal of Human Factors and Ergonomics in Manufacturing
5	Journal of Applied Ergonomics
6	Journal of Man Machine Studies

7	Journal of Safety Research
8	Journal of Ergonomics