ADSE4005: INDUSTRIAL DATA AND MANUFACTURING ANALYTICS

Effective Term
Semester B 2023/24

Part I Course Overview

Course Title
Industrial Data and Manufacturing Analytics

Subject Code
ADSE - Advanced Design and System Engineering
Course Number
4005

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
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

Manufacturing and industrial operations generate large quantities of data; new generations analytical tools allow factories and service providers to harness the power of data and to generate information and knowledge to enhance products and services. In this course, students will learn the essential skills in data analytics including data mining, processing, analysis, visualization, and interpretation. Through lectures, assignments, and projects, students gain techniques and master tools related to large data collections, high-velocity data streams, cloud computing systems, edge devices, and parallel computing. Students will use Python to perform big data integration and processing. Examples and exercises will be drawn from industrial applications and deployments for various fields, e.g. manufacturing, robotics, logistics, unmanned systems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand basic concept of exploratory data analysis and its relationship to statistical learning, data mining, and potential applications	30	x		
2	Recognize and apply statistical methods for exploratory analysis in high-dimensional data	20	x	x	
3	Familiarize the principle of perception and be able to select suitable visualization techniques and methods for diverse types of datasets	20	x	x	
4	Demonstrate how exploratory data analytics and visualization can be applied to manufacturing and industrial problems	30	x	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 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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Formal lectures	1, 2, 3, 4	39 hours/semester
2	Final project	Group-based term project for students to apply the methods and techniques on a real-world problem.	1, 2, 3, 4	9 hours/semester
3	Laboratory work	Visualization tools and software package usage training	2, 3, 4	9 hours/semester

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Project	1, 2, 3, 4	15	
2	Course assignments	2, 3, 4	15	
3	Test	1, 2, 3	10	

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 the examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

Test

Criterion

Based on submitted written work to evaluate understanding of subject matter, evidence of knowledge base, capacity to analyse and synthesize, and evidence of original and critical thinking.

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

Course Assignment

Criterion

Based on submitted written work and lab attendance to evaluate understanding of subject matter, evidence of knowledge base, capacity to analyse and synthesize, and evidence of original and critical thinking.

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
Final Project

Criterion
Based on oral presentation and submitted written report to evaluate understanding of subject matter, evidence of knowledge base, capacity to analyse and synthesize, and evidence of original and critical thinking.

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

- Big data infrastructure; distributed file system; parallel processing; programming framework; cloud storage and computing; knowledge discovery; deep learning
- Software competency in data visualization software, Tableau, and the programming language Python
- Visualization of high-dimensional data, clustering and dimension reduction techniques
- Applications and case studies of data analysis, systems modelling, and optimization.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Nil