

SDSC4109: SMART MANUFACTURING AND AUTOMATION

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Smart Manufacturing and Automation

Subject Code

SDSC - School of Data Science

Course Number

4109

Academic Unit

School of Data Science (DS)

College/School

School of Data Science (DS)

Course Duration

One Semester

Credit Units

3

Level

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

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Students must complete a minimum of 45 CUs to be eligible

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

Students will engage in the statistics and optimization methodologies in smart manufacturing and automation. Students will expand and consolidate their knowledge on learn how the artificial intelligence (AI), machine learning (ML) and optimization techniques can be utilized to solve the real manufacturing problems.

Course Intended Learning Outcomes (CILOs)

| CILOs | | Weighting (if DEC-A1 DEC-A2 DEC-A3 app.) | | | |
|-------|--|--|---|---|---|
| 1 | Describe the basic principles of smart manufacturing and automation strategies. | 20 | x | | |
| 2 | Describe basic machine learning and optimization techniques for smart manufacturing. | 20 | x | | |
| 3 | Apply appropriate models and solution methods to improve the production efficiency. | 30 | x | x | |
| 4 | Apply commercial software for real-world projects. | 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.

Learning and Teaching Activities (LTAs)

| LTAs | | Brief Description | CILO No. | Hours/week (if applicable) |
|------|-----------------------------------|--|------------|----------------------------|
| 1 | Lectures and in-class discussions | Students will engage in lectures, in-class exercises, in-class Q&A and discussions to implement the CILOs. | 1, 2, 3, 4 | 39 hours/semester |
| 2 | Group project | Each group of students working on their group project will discuss and consult with the instructor regarding the progress and the obstacles encountered. | 2, 3, 4 | after-class |

Assessment Tasks / Activities (ATs)

| ATs | | CILO No. | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |
|-----|-------------|------------|---------------|--|
| 1 | Assignments | 1, 2, 3, 4 | 15 | |
| 2 | Project | 3, 4 | 45 | |

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

Note: To pass the course, apart from obtaining a minimum of 40% in the overall mark, a student must also obtain a minimum mark of 30% in both continuous assessment and examination components.

Assessment Rubrics (AR)

Assessment Task

Course work

Criterion

Tutorial exercises and assignments; Term project

Excellent (A+, A, A-)

Strong evidence of capacity to analyse and synthesize; superior grasp of subject matter.

Good (B+, B, B-)

Evidence of grasp of subject, some evidence of critical capacity and analytic ability.

Fair (C+, C, C-)

Student who is profiting from the university experience; understanding of the subject; ability to develop solutions to simple problems in the material.

Marginal (D)

Sufficient familiarity with the subject matter to enable the student to progress without repeating the course.

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills.

Assessment Task

Examination

Criterion

Based on submitted written work

Excellent (A+, A, A-)

Strong evidence of capacity to analyse and synthesize; superior grasp of subject matter.

Good (B+, B, B-)

Evidence of grasp of subject, some evidence of critical capacity and analytic ability.

Fair (C+, C, C-)

Student who is profiting from the university experience; understanding of the subject; ability to develop solutions to simple problems in the material.

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Sufficient familiarity with the subject matter to enable the student to progress without repeating the course.

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills.

Part III Other Information

Keyword Syllabus

Manufacturing and service systems, factory physics, capacity management, neural networks, principal component analysis, association rules, tabu search, simulated annealing

Reading List

Compulsory Readings

| Title | |
|-------|---|
| 1 | Lecture notes and slides provided by the instructor |

Additional Readings

| Title | |
|-------|--|
| 1 | Nahmias, S. (2008), Production and Operations Analysis, 6th ed., McGraw-Hill/Irwin. |
| 2 | Saravanan, R. (2006), Manufacturing Optimization through Intelligent Techniques, CRC Press |