City University of Hong Kong
Course Syllabus

offered by Department of Systems Engineering
with effect from Semester A 2024 / 25

Part I Course Overview

Course Title:	Intelligent Manufacturing for Engineering Managers
Course Code:	SYE6106
Course Duration:	One Semester
Credit Units:	3
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	SEEM6106 Intelligent Manufacturing for Engineering Managers (offered until 2021/22) ADSE6106 Intelligent Manufacturing for Engineering Managers (offered until 2023/24)
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

(A 150-word description about the course)

The objective of this course is to provide engineering managers an overview of technologies associated with smart intelligent manufacturing, such that they can make better decisions when exploring smart manufacturing in their own organizations.

The fourth Industrial revolution has brought enormous changes to the manufacturing industry. This course provides an overview of technologies used in smart manufacturing. We focus on key enabling technologies, such as artificial intelligence, data-driven analysis, internet of things, advanced analytics, intelligent quality control, additive manufacturing and process automation. Some time will also be spent to understand the historical context and the business case associated with smart manufacturing implementation.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	**Elaborate on Industry 4.0** and how artificial intelligence, internet of things (IoT), information, technology and data are influencing the development of *intelligent manufacturing*. Understand the historical perspective, from Industry 1.0 to 4.0.	10%	✓		
2.	**Understand various technologies that enable intelligent manufacturing**. This course focusses on the following technologies: • Artificial intelligence • Machine learning and data-driven analysis • Industrial Internet of things (IIoT) • Advanced analytics • Process automation and Lean • Additive manufacturing • Intelligent quality control	50%	✓	✓	
3.	**Discuss and assess** the technologies and their advantages and drawbacks. And the business case, opportunities and threats associated with advanced manufacturing.	20%	✓		
4.	**Apply and analyse,** using a selected manufacturing technology, a case study of intelligent manufacturing	20%		✓	
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Large class activity	Weekly lectures. Lectures will be supplemented by: - Discussions - Cases - Small group exercises - Guest lectures to facilitate conceptual understanding and introduction to applications.	✓	✓	✓			2 hr / week
Small group laboratory	Weekly sessions for discussion of cases, constructing intelligent manufacturing/Industry 4.0 scheme, applying data analytics and presenting case results.			✓	✓	✓	1 hr / week

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 50 %							
Mid-term test	✓		✓	✓		50%	
Examination: 50 % (duration: 2 hours , if applicable)							
** The weightings should add up to 100%.*						100%	

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

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
Mid-term test	Examination questions are designed to assess student's level of achievement of the intended learning outcomes, with emphasis placed on conceptual understanding, math derivation and correct application.	Excellent	Good	Marginal	Failure
Final exam	Examination questions are designed to assess student's level of achievement of the intended learning outcomes, with emphasis placed on conceptual understanding and correct application.	Excellent	Good	Marginal	Failure

The test and examination will be numerically-marked and grades-awarded accordingly.

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
Mid-term test	Examination questions are designed to assess student's level of achievement of the intended learning outcomes, with emphasis placed on conceptual understanding, math derivation and correct application.	High	Significant	Moderate	Basic	Not even reaching marginal levels
Final exam	Examination questions are designed to assess student's level of achievement of the intended learning outcomes, with emphasis placed on conceptual understanding and correct application.	High	Significant	Moderate	Basic	Not even reaching marginal levels

The test and examination will be numerically-marked and grades-awarded accordingly.

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

- Additive manufacturing
- Advanced analytics
- Artificial intelligence and machine learning
- Data driven process analysis and thinking
- Industry 4.0
- Industrial internet of things (IIoT)
- Intelligent quality control
- Intelligent/smart manufacturing
- Process automation and Lean
- Smart enterprise

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Lecture notes and slides
2.	To be announced on canvas
3.	Conway, J. (2016). The Industrial Internet of Things: an evolution to a smart manufacturing enterprise. Schneider Electric.
4.	Achillas, C., Tzetzis, D., & Raimondo, M. O. (2017). Alternative production strategies based on the comparison of additive and traditional manufacturing technologies. International Journal of Production Research, 55(12), 3497-3509.
5.	Gardan, J. (2016). Additive manufacturing technologies: state of the art and trends. International Journal of Production Research, 54(10), 3118-3132.
6.	Sanders, A., Elangeswaran, C., & Wulfsberg, J. P. (2016). Industry 4.0 implies lean manufacturing: Research activities in industry 4.0 function as enablers for lean manufacturing. Journal of Industrial Engineering and Management (JIEM), 9(3), 811-833.

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

To be announced on canvas