UNSW Course Outline

MANF4150 Design of Intelligent Manufacturing Systems - 2024

Published on the 08 Feb 2024

General Course Information

Course Code : MANF4150
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Mechanical and Manufacturing Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate, Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course introduces the key concepts of Industry 4.0, which focuses on integrating physical elements of production systems with information and communication technologies.

Industry 4.0 reflects the ongoing fourth industrial revolution and is one of the most popular research and industry topics. In the context of industry 4.0, the digitalisation of factory and production elements and associated communication transforms today's factories into smart ones. This offers great business opportunities and economic potential, including increasing production system productivity, improving product quality and customisation, shorter lead times, and reduced environmental footprints. Smart factories are sprouting up all over the globe and they can range in size from the very small to the very large. Many of these systems are now being established in Australia. This discipline is therefore becoming increasingly important in industrial and manufacturing engineering.

This course aims to educate our students in the best state of research and practice in design, planning and control of cyber-physical production systems that interconnect intelligent products, machines, networks, and autonomous systems that continuously communicate and cooperate.

This course provides students with a comprehensive understanding of key concepts and enabling technologies of industry 4.0 such as artificial intelligence, cloud computing, Big Data analytics, adaptive robotics, augmented reality, simulation, additive manufacturing, digital twin, and Internet of Things (IoT). The course integrates systems engineering concepts and norms (VDI2221-2206), system architectures and data modelling approaches, data sensing techniques, communication and cyber-security protocols, real-time simulation and optimisation methods for the design and deployment of a digital twin of an intelligent manufacturing system. The course analyses the social aspect of smart factories equipped with the industrial internet of things and investigate the offering opportunities and possible risks.

Course Aims

This course introduces the key concepts of Industry 4.0, which focuses on integrating physical elements of production systems with information and communication technologies. This has evolved the design and control of manufacturing systems. This course is therefore a core requirement for the UG program in Mechanical and Manufacturing Engineering and it builds on knowledge gained from MANF3510 and MANF4100. This course is equally important for PG students studying for a ME/MEngSc in Manufacturing Engineering and Engineering Management.

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ones. This offers great business opportunities and economic potential, including increasing production system productivity, improving product quality and customization, shortening lead time, and reducing environmental footprint. Smart factories are sprouting up all over the globe and they can range in size from the very small to the very large. Many of these systems are now being established in Australia. This discipline is therefore becoming increasingly important to our students, both here in Australia as well as overseas.

This course aims to educate our students in the best state of research and practice in design, planning and control of cyber-physical production systems that interconnect intelligent products, machines, networks, and autonomous systems that continuously communicate and cooperate.

This course provides students with a comprehensive understanding of key concepts and enabling technologies of industry 4.0 such as artificial intelligence, cloud computing, Big Data analytics, adaptive robotics, augmented reality, simulation, additive manufacturing, digital twin, and Internet of Things (IoT). The course integrates systems engineering concepts and norms (VDI2221-2206), system architecting and data modelling approaches, data sensing techniques, communication and cybersecurity protocols, real-time simulation and optimization methods for the design and deployment of a digital twin of an intelligent manufacturing system. The course analyses the social aspect of smart factories equipped with the industrial internet of things and investigate the offering opportunities and possible risks.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : List and describe the major categories of smart devices and individual building blocks of manufacturing systems and their associated characteristics and performance measures, as well as their role in the design and control of smart factories in an Industry 4.0 context.
CLO2 : Be able to identify and work with available standards and protocols of system design, data communication/ transmission, and cyber security in the context of the Internet of Things.
CLO3 : List, describe and explain different data acquisition strategies and protocols as well as decision-making strategies based on knowledge gained in key analytical techniques including data visualisation and big data analytics.
CLO4 : Identify and define issues relating to the challenges in designing smart factories and have the ability to make and communicate decisions in the design and planning of these factories, based on validated engineering methods and an understanding of different stakeholders.

Course Learning Outcomes	Assessment Item
CLO1 : List and describe the major categories of smart devices and individual building blocks of manufacturing systems and their associated characteristics and performance measures, as well as their role in the design and control of smart factories in an Industry 4.0 context.	• Individual Online Quiz 1 • Individual Project • Final Exam
CLO2 : Be able to identify and work with available standards and protocols of system design, data communication/ transmission, and cyber security in the context of the Internet of Things.	• Group Assignment • Individual Project • Final Exam
CLO3 : List, describe and explain different data acquisition strategies and protocols as well as decision-making strategies based on knowledge gained in key analytical techniques including data visualisation and big data analytics.	• Group Assignment • Individual Project • Final Exam
CLO4 : Identify and define issues relating to the challenges in designing smart factories and have the ability to make and communicate decisions in the design and planning of these factories, based on validated engineering methods and an understanding of different stakeholders.	• Individual Project • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Individual Online Quiz 1 Assessment Format: Individual	15%	Start Date: 07/03/2024 09:00 AM Due Date: 07/03/2024 11:59 PM
Individual Project Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: 19/04/2024 11:59 PM
Final Exam Assessment Format: Individual	50%	Start Date: Not Applicable Due Date: Not Applicable
Group Assignment Assessment Format: Group	15%	Start Date: Not Applicable Due Date: 05/04/2024 11:59 PM

Assessment Details

Individual Online Quiz 1

Assessment Overview

The first online quiz will deal with lecture material and problems from Week 1-3 inclusive. It will be held online. Feedback will be available shortly after the quiz has finished.

Assessment length: 10 questions

Assessment criteria

The questions require a sound understanding of the explained frameworks and being able to contextualize them in the explained environment in the questions.

The quiz is online and will be accessible via Moodle. The link for the exam will be provided on Moodle.

Course Learning Outcomes

- CLO1 : List and describe the major categories of smart devices and individual building blocks of manufacturing systems and their associated characteristics and performance measures, as well as their role in the design and control of smart factories in an Industry 4.0 context.

Detailed Assessment Description

It includes descriptive, short answer questions, multiple choice, and filling the gaps.

Assessment Length

10 questions

Assignment submission Turnitin type

This is not a Turnitin assignment

Individual Project

Assessment Overview

Assessment length: 1500 words

The individual project addresses including the industry 4.0 technologies in the design of a specific manufacturing system.

Assessment criteria

This project requires the proper application of industry 4.0 technologies in the context of system design.

The students need to demonstrate how various Industry 4.0 technologies address various design requirements and contribute to satisfy the functional requirements and objectives.

The students need to submit their report (in pdf or word format) on Moodle. A submission link will be provided on Moodle.

The feedback will be given within two weeks after the submission deadline.

Course Learning Outcomes

- CLO1 : List and describe the major categories of smart devices and individual building blocks of manufacturing systems and their associated characteristics and performance measures, as well as their role in the design and control of smart factories in an Industry 4.0 context.
- CLO2 : Be able to identify and work with available standards and protocols of system design, data communication/ transmission, and cyber security in the context of the Internet of Things.
- CLO3 : List, describe and explain different data acquisition strategies and protocols as well as decision-making strategies based on knowledge gained in key analytical techniques including data visualisation and big data analytics.
- CLO4 : Identify and define issues relating to the challenges in designing smart factories and have the ability to make and communicate decisions in the design and planning of these factories, based on validated engineering methods and an understanding of different stakeholders.

Assessment Length

1000 words

Assignment submission Turnitin type

This is not a Turnitin assignment

Final Exam

Assessment Overview

Assessment length: 2 hours exam

This is the final exam of the subject.

The exam covers all the content delivered in the course.

Assessment criteria

The exam includes theoretical, short answers and problem solving questions.

The students need to demonstrate their sound understanding of the covered frameworks, methods and standards on explained scenarios and/or use them for problem solving.

Course Learning Outcomes

- CLO1 : List and describe the major categories of smart devices and individual building blocks of manufacturing systems and their associated characteristics and performance measures, as well as their role in the design and control of smart factories in an Industry 4.0 context.
- CLO2 : Be able to identify and work with available standards and protocols of system design, data communication/ transmission, and cyber security in the context of the Internet of Things.
- CLO3 : List, describe and explain different data acquisition strategies and protocols as well as decision-making strategies based on knowledge gained in key analytical techniques including data visualisation and big data analytics.
- CLO4 : Identify and define issues relating to the challenges in designing smart factories and have the ability to make and communicate decisions in the design and planning of these factories, based on validated engineering methods and an understanding of different stakeholders.

Assessment Length

2 hours

Assignment submission Turnitin type

This is not a Turnitin assignment

Group Assignment

Assessment Overview

Assessment length: 1000 words

The students will do a group activity in designing manufacturing systems in groups of 3-4 students.

Assessment criteria

The students apply the modeling concepts to design a manufacturing system. The students need to demonstrate their skill in developing the conceptual architecture of manufacturing systems embodying its functions and the design requirements.

The students need to submit their report (in pdf or word format) on Moodle. A submission link will be provided on Moodle.

The feedback will be given within two weeks after the submission deadline.

Course Learning Outcomes

- CLO2 : Be able to identify and work with available standards and protocols of system design, data communication/ transmission, and cyber security in the context of the Internet of Things.
- CLO3 : List, describe and explain different data acquisition strategies and protocols as well as decision-making strategies based on knowledge gained in key analytical techniques including data visualisation and big data analytics.

Assignment submission Turnitin type

This is not a Turnitin assignment

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	Introduction and definitions
Week 2 : 19 February - 25 February	Lecture	Manufacturing system characteristics and design methods
Week 3 : 26 February - 3 March	Lecture	Modeling and Systems Engineering
Week 4 : 4 March - 10 March	Lecture	Digital Twin and Simulation
	Assessment	Online quiz in 07/03/2024
Week 5 : 11 March - 17 March	Lecture	Internet of Things
Week 6 : 18 March - 24 March	Reading	Readings are provided in the Flexibility week.
Week 7 : 25 March - 31 March	Lecture	Artifical Intelligence and Big data
Week 8 : 1 April - 7 April	Lecture	Industrial Robotics
Week 9 : 8 April - 14 April	Lecture	3D Printing
Week 10 : 15 April - 21 April	Lecture	Industry Speaker

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Resources

Prescribed Resources

Lecture slides, lecture notes and articles are provided for the students.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Shiva Abdoli		Ainsworth Building (J17)	(02) 9385 6851	Consultation concerning this course is available on Monday 12:00 –15:00 whenever the lecturer is not otherwise engaged.	No	Yes
	Leo Wu					No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or

within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the

University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/ Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way

through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

Short Extensions

Short extensions are not currently applicable to Mechanical and Manufacturing Engineering Courses.

Review of Results

The purpose of a review of results is if there was a marking error. Review of results is for when you have cause to believe that there is a marking error. Review of Results cannot be used to get feedback. If you would like feedback for assessments prior to the final exam, you are welcome to contact the course convenor directly. No feedback will be provided on final exams.

Use of AI

The use of AI is prohibited unless explicitly permitted by the course convenor. Please respect this and be aware that penalties will apply when unauthorised use is detected, such as through Turnitin. If the use of generative AI, such as ChatGPT, is allowed in a specific assessment, they must be properly credited, and your submissions must be substantially your own work.

School Contact Information

Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

Hours

9:00–5:00pm, Monday–Friday*

*Closed on public holidays, School scheduled events and University Shutdown

Web

School of Mechanical and Manufacturing Engineering

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

(+61 2) 9385 4097 – School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

School Office – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries. The School will only be able to refer students on to the relevant team if contacted

Important Links

- Student Wellbeing
- Urgent Mental Health & Support
- Equitable Learning Services

- Faculty Transitional Arrangements for COVID-19
- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Makerspace
- UNSW Timetable
- UNSW Handbook