School of Chemical Engineering

UNSW Engineering

CEIC4001

Process Design Project

Term 1, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Pierre Le-Clech	p.le-clech@unsw.edu.au	Mondays 2-4 or by appointment	Science and Engineering Building (SEB), 532	0293855762

School Contact Information

For assistance with enrolment, class registration, progression checks and other administrative matters, please see the Nucleus: Student Hub. They are located inside the Library – first right as you enter the main library entrance. You can also contact them via http://unsw.to/webforms or reserve a place in the face-to-face queue using the UniVerse app.

If circumstances outside your control impact on submitting assessments, Special Consideration may be granted, usually in the form of an extension or a supplementary assessment. Applications for Special Consideration must be submitted online.

For course administration matters, please contact the Course Coordinator.

Questions about the this course should normally be asked during the scheduled class so that everyone can benefit from the answer and discussion.

Course Details

Units of Credit 12

Summary of the Course

The Process Design Project covers the engineering of all or part of a process plant. The design brief you will work on has a strong focus on sustainability and the circular economy for a real-world operation. It requires the application of material covered in the entire undergraduate Chemical Engineering program and its integration to address the given design brief including technical and non-technical objectives and considerations.

The project includes: conceptual design of a process; development and evaluation of the process flow sheet; design of facilities for processing, transport and storage of materials within the plant; plant sizing; equipment selection and cost estimation including utility requirements; plant location and layout; evaluation of economic viability of the plant; control scheme development; hazard and risk assessment; preparation of an environmental impact statement; preparation of a piping and instrumentation diagram. All aspects of the design are completed with regard to statutory requirements. You will have the opportunity to develop skills in team work, interpersonal relationships, decision making and technical capabilities.

Assumed knowledge from previous courses includes: DESN1000 (design process), CEIC2000 (material balances), CEIC2005 (reaction engineering), CEIC3004 (equipment design), CEIC3005 (process design, process simulation, process safety, process economics), CEIC3006 (process control, instrumentation, drawing). Team work and project management skills developed across DESN1000, CEIC2005, CEIC3005 are also essential.

Course Aims

The aim of the course is to allow the student to demonstrate competency with the basic tasks that constitute the design process as practiced by chemical engineers and industrial chemists.

Students are presented with a hypothetical problem based on real world problems in a chemical process industry. Working in groups of around 5, students are required to complete the tasks generally associated with preliminary design activities in order toto generate information required to make a decision on the viability of a design solution based on a preliminary assessment of plant size and complexity, capital and operating costs, hazard analysis and operational safety.

Students will quickly appreciate that there is always more than one answer to a design problem. Consequently, students must use creativity and judgement, which involves trade offs and compromises, while respecting that the boundaries of environmental and process safety cannot be crossed.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Propose a suite of conceptual engineering solutions to meet a functional brief	PE1.5, PE1.6
2. Select a conceptual engineering solution and design the details for a project including layout, sizing, costing, control and safety systems	PE2.3, PE2.4
3. Identify and cost measures to mitigate negative social and environmental impacts and ensure that the engineering project will not cause harm to people or damage to buildings, infrastructure or the environment	PE3.1
4. Synthesise the key aspects of the engineering design to assess and communicate (in written form, graphically and verbally) a recommendation on technical feasibility and financial viability of the project	PE3.2, PE3.3, PE3.4, PE3.6

Teaching Strategies

The design project is intended to challenge your abilities as an (almost) graduate engineer and so you will be presented with a very broad design problem.

You will receive basic instruction each week on the requirements for each interview and report and are expected to research and develop the essential information that will feature in each report.

Weekly meetings with a group mentor will help you resolve specific questions. With the guidance of your academic mentor, yous will be responsible for all aspects of the management of your design team, including providing regular progress updates to the team and seeking advice on your design approach. Your mentor will provide regular and prompt feedback on your progress and on the reports you write. Design is a group effort and it is essential that students you quickly establish a routine for group meetings and coordinating the work.

The assessment for the course is based on interviews and written assignments carefully evaluated by the mentors and industry representatives.

Additional Course Information

This course considers the design of all or part of a process plant. It requires the application of material covered in the entire undergraduate Chemical Engineering /Industrial Chemistry program. Students apply the experience gained in the preceding years of study to a given problem in order to develop technical and non-technical aspects of a particular solution. While the students are required to develop the skills required for professional accreditation, the students are also encouraged to develop skills in areas of specialisation or interest related to the broad design issues for the selected project.

Design project builds on CEIC3004, CEIC3005 and CEIC3006. These courses cover the core design subjects of developing flowsheets, designing and estimating the size of unit processes, estimating capital and operating costs, determining the return on investment, simulation a chemical process, the basics of process control and the development of P&ID's and identifying and managing potential hazards. The course also requires an ability to develop chemical pathways, design reactor vessels and implement appropriate separation and purification steps for common industrial processes.

The project includes: conceptual design of a process; development and evaluation of the process flow sheet; design of facilities for processing, transport and storage of materials within the plant; plant sizing; equipment selection and cost estimation including utility requirements; plant location and layout; evaluation of economic viability of the plant; control scheme development; hazard and risk assessment; preparation of a piping and instrumentation diagram. The students will have the opportunity to develop skills in teamwork, interpersonal relationships, decision making and technical capabilities.

Assessment

Assessment includes:

- Group interview 1 (Technical Feasibility: Option Evaluation), **By arrangement with mentor in Week 3** *(10 individual)*
- Group Report 1 (Technical Feasibility: Option Evaluation; selected process narrative and Process Flow Diagram (PFD), Mass & Energy Balance), **Friday, 9pm, Week 5** *(20 Group)*
- Individual report and interview (Individual process: Equipment Sizing; Process Simulation; P&ID, Hazard Analysis (HAZOP); Process control table), Interview: **By arrangement with mentor in Week 8**; Report: **Tuesday 9pm, Week 9** *(Interview: 10 Individual, Report: 20 Individual)*
- Group Report 2 (Financial Viability & Environmental Impact (+ plant layout)), **Thursday, 9pm, Week 11** *(15 Group)*
- Group Interview 2 (Interview with industry panel (90 min)) **Monday 9th May** *(10 Group, 10 Individual)*
- Rejoinder for final report (Change log to include comments from mentors and interview) **Wednesday 11th May***, 9pm (5 Group)*

Notes:

- Your final mark is based on a group component (50 out of 100 marks) and individual component (50 out of 100 marks). You must pass each component to pass the course (score >50% on both individual and group components).
- All submissions will be marked by your academic mentor according to specific marking schemes, available on Moodle.
- By default, email the report to your mentor by the deadline. Other “delivery” arrangements could be organized, but the timeline is final. If needed, special consideration could be requested through the official process (https://student.unsw.edu.au/special-consideration). Please email the course coordinator and your mentor on your situation as soon as possible.
- A more detailed breakdown of the elements of each report along with the marking scheme will be distributed in week 1.
- The schedule for CEIC 4001 is very tight and it is recommended that a continuous effort is made throughout the session. Each group will be assigned an academic mentor to offer advice and guidance for each report. Each group is responsible for arranging a weekly meeting with their academic mentor.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Design Interviews	45%	Week 3, Week 8, Week 11	1, 2, 3, 4
2. Design Reports	55%	Week 5, Week 9, Week 11	1, 2, 3, 4

Assessment 1: Design Interviews

Due date: Week 3, Week 8, Week 11
Deadline for absolute fail: 10 days after the due date
Marks returned: Generally, a week after submission

A series of group and individual interviews will be organised during the term (last interview is organised during exam period) around a range of topics. Interview topics will be organised in the form of presentation plus question time, or around a range of scripted questions. Group-derived marks will be moderated by a peer-feedback mechanism.

This is not a Turnitin assignment

Assessment 2: Design Reports

Due date: Week 5, Week 9, Week 11
Deadline for absolute fail: 10 days after due date
Marks returned: Generally, 1 week after submission

A series of group and individual reports will be required during the trimester. They will build on the topics discussed during the previous interviews and present detailed considerations for a range of design items (from design selection to economic assessment and final recommendations). Group-derived marks will be moderated by a peer-feedback mechanism.

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Attendance Requirements

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

Course Schedule

View class timetable

Timetable

Date	Type	Content
O-Week: 6 February - 10 February	Reading	All information about the project is available on Moodle. The students are encouraged to browse through the teaching materials and start brain-storming ideas with their team members.
Week 1: 13 February - 17 February	Seminar	Welcome and introduction to project. Free lunch included!
Week 2: 20 February - 24 February	Seminar	Guest lecture from the industry partner. Learn where the wastewater comes from and current management of the stream.
Week 3: 27 February - 3 March	Seminar	Getting ready for Group interview 1
	Presentation	Interview with Mentor
Week 4: 6 March - 10 March	Seminar	Design documentation, MEB through to P&ID
Week 5: 13 March - 17 March	Seminar	How to complete Report 1
	Assessment	Group report #1 due on Friday
Week 6: 20 March - 24 March	Seminar	Preparing for individual interviews
Week 7: 27 March - 31 March	Seminar	General Q&A
Week 8: 3 April - 7 April	Seminar	Preparing for indiviudal interview and report
	Presentation	Interview with Mentor about individual design
Week 9: 10 April - 14 April	Assessment	Individual report due on Tuesday
Week 10: 17 April - 21 April	Seminar	Preparing for final report and group interviews
Stuvac: 22 April - 27 April	Assessment	Second group report due on Tuesday - week 11
	Assessment	Group interview with industry panel: Tuesday

		9th May, between 8.30am to 1pm. Free lunch and awards ceremony from 1pm.
	Assessment	Final recommendations and rejoinder due on Wednesday 10th May, 9pm.

Resources

Recommended Resources

A number of resources will be posted on Moodle. In addition you can refer to the textbooks listed on Leganto for help on different aspects of process design.

Course Evaluation and Development

Course evaluation and development feedback is welcome any time but is primarily sought through the myExperience survey run at the end of term.

Based on previous feedback, we have spent a lot of effort making what you need to do for each assignment (through clearer marking rebrics), and give you much more immediate feedback on your progress during the interviews.

Changes since the course last ran:

Change	Need for change	Identified from
Reweighting of marks between interviews and reports, and between group reports 1 and 2.	Better recognition of work requested	Student feedback
All assessment details and marking criteria provided at the beginning of the course	Better understanding of the tasks ahead	Student feedback

Submission of Assessment Tasks

In the School of Chemical Engineering, all written work will be submitted for assessment via Moodle unless otherwise specified. Attaching cover sheets to uploaded work is not required unless specifically requested for an individual assessment task; when you submit work through Moodle for assessment you are agreeing to uphold the Student Code.

Some assessments will require you to complete the work online and it may be difficult for the course coordinator to intervene in the system after the due date. You should ensure that you are familiar with assessment systems well before the due date. If you do this, you will have time to get assistance before the assessment closes.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect. Please make it easy for the markers who are looking at your work to see your achievement and give you due credit.

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Late penalties

Unless otherwise specified, submissions received after the due date and time will be penalised at a rate of 5% per day or part thereof (including weekends) and will not be accepted more than 5 days late. For some activities including Exams, Quizzes, Peer Feedback, and Team Evaluation surveys, extensions and late submissions are not possible.

Special consideration

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 submitting an assessment or sitting an exam.

UNSW has a Fit to Sit / Submit rule, which means that if you attempt an exam or submit a piece of assessment, 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.

Please note that for **all** special consideration requests (including COVID-19-related requests), students will need documentary evidence to support absences from any classes or assessments.

Academic Honesty and Plagiarism

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage (International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013). At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and plagiarism can be located at:

- The Current Students site
- The ELISE training site

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

To help describe what we are looking for, here are some things that we consider to be quite acceptable (even desirable!) actions for many assessments, and some that we consider to be unacceptable in most circumstances. Please check with the instructions for your assessments and your course coordinator if you're unsure. As a rule of thumb, if you don't think you could look the lecturer in the eye and say "this is my own work", then it's not acceptable.

Acceptable actions	Unacceptable actions
✓ reading/searching through material we have given you, including lecture slides, course notes, sample problems, workshop problem solutions	✗ asking for help with an assessment from other students, friends, family
✓ reading/searching lecture transcripts	✗ asking for help on Q&A or homework help websites
✓ reading/searching resources that we have pointed you to as part of this course, including textbooks, journal articles, websites	✗ searching for answers to the specific assessment questions online or in shared documents
✓ reading/searching through your own notes for this course	✗ copying material from any source into your answers
✓ all of the above, for any previous courses	✗ using generative AI tools to complete or substantially complete an assessment for you
✓ using spell checkers, grammar checkers etc to improve the quality of your writing	✗ paying someone else to do the assessment for you
✓ studying course material with other students	

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism. Further information about referencing styles can be located at https://student.unsw.edu.au/referencing.

For assessments in the School of Chemical Engineering, we recommend the use of referencing software such as Mendeley or EndNote for managing references and citations. Unless required otherwise

specified (i.e. in the assignment instructions) students in the School of Chemical Engineering should use either the APA 7th edition, or the American Chemical Society (ACS) referencing style as canonical author-date and numbered styles respectively.

Artificial intelligence tools such as ChatGPT, CodePilot, and built-in tools within Word are modern tools that are useful in some circumstances. In your degree at UNSW, we're teaching you skills that are needed for your professional life, which will include how to use AI tools responsibly plus lots of things that AI tools cannot do for you. AI tools already are (or will soon be) part of professional practice for all of us. However, if we were only teaching you things that AI could do, your degree would be worthless, and you wouldn't have a job in 5 years.

Whether the use of AI tools in an assessment is appropriate will depend on the goals of that assessment. As ever, you should discuss this with your lecturers – there will certainly be assessments where the use of AI tools is encouraged, as well as others where it would interfere with your learning and place you at a disadvantage later. Our goal is to help you learn how to ethically and professionally use the tools available to you. To learn more about the use of AI, see this discussion we have written where we analyse the strengths and weaknesses of generative AI tools and discuss when it is professionally and ethically appropriate to use them.

While AI may might provide useful tools to help with some assessments, UNSW's policy is quite clear that taking the output of generative AI and submitting it as your own work will never be appropriate, just as paying someone else to complete an assessment for you is serious misconduct.

Academic Information

To help you plan your degree, assistance is available from academic advisors in The Nucleus and also in the School of Chemical Engineering.

Additional support for students

- Current Student Gateway for information about key dates, access to services, and lots more information
- Engineering Student Life - Current Student Resources for information about everything from getting to campus to our first year guide
- Student Support and Success for our UNSW team dedicated to helping with university life, visas, wellbeing, and academic performance
- Academic Skills to brush up on some study skills, time management skills, get one-on-one support in developing good learning habits, or join workshops on skills development
- Student Wellbeing, Health and Safety for information on the UNSW health services, mental health support, and lots of other useful wellbeing resources
- Equitable Learning Services for assistance with long term conditions that impact on your studies
- IT Service Centre for everything to do with computing, including installing UNSW licensed software, access to computing systems, on-campus WIFI and off-campus VPNs

Course workload

Course workload is calculated using the Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete, for both regular and intensive terms. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations. Most 6 UoC courses will involve approximately 10-12 hours per week of work on your part. If you're not sure what to do in these hours of independent study, the resources on the UNSW Academic Skills pages offer some suggestions including: making summaries of lectures, read/summarise sections from the textbook, attempt workshop problems, reattempting workshop problems with some hints from the solutions, looking for additional problems in the textbook.

Full-time enrolment at university means that it is a *full-time* occupation for you and so you would typically need to devote 35 hours per week to your studies to suceed. Full-time enrolment at university is definitely incompatible with full-time employment. Part-time/casual employment can certainly fit into your study schedule but you will have to carefully balance your study obligations with that work and decide how much time for leisure, family, and sleep you want left after fullfilling your commitments to study and work. Everyone only gets 168 hours per week; overloading yourself with both study commitments and work commitments leads to poor outcomes and dissatisfaction with both, overtiredness, mental health issues, and general poor quality of life.

On-campus class attendance

In 2023, most classes at UNSW are running in a face-to-face mode only. Attendance is expected as is

participation in the classes. As an evidence-driven engineer or scientist, you'll be interested to know that education research has shown students learn more effectively when they come to class, and less effectively from lecture catch-up recordings. If you have to miss a class due to illness, for example, we expect you to catch up in your time, and within the coming couple of days.

For most courses that are running in an "in person" mode:

- Lectures are normally recorded to provide an opportunity to review material after the lecture; lecture recordings are not a substitute for attending and engaging with the live class.
- Workshops/tutorials are not normally recorded as the activities that are run within those sessions normally cannot be captured by a recording. These activities may also include assessable activities in some or all weeks of the term.
- Laboratories are not recorded and require in-person attendance. Missing laboratory sessions may require you to do a make-up session later in the term; if you miss too many laboratory sessions, it may be necessary to seek a Permitted Withdrawal from the course and reattempt it next year, or end up with an Unsatisfactory Fail for the course.
- Assessments will often require in-person attendance in a timetabled class or a scheduled examination.

This course outline will have further details in the Course Schedule and Assessment sections.

Class numbers are capped in each class to ensure appropriate facilities are available, to maintain student:staff ratios, and to help maintain adequate ventilation in the spaces. Only students enrolled in each specific classes will be allowed in the room. Class rosters will be attached to corresponding rooms and circulated among lab demonstrators and tutors. No over-enrolment is allowed in face-to-face classes.

In certain classroom and laboratory situations where physical distancing cannot be maintained or the staff running the session believe that it will not be maintained, face masks will be designated by the course coordinator as **mandatory PPE** for students and staff. Students are required to bring and use their own face mask. Mask can be purchased from IGA Supermarket (Map B8, Lower Campus), campus pharmacy (Map F14, Middle Campus), the post office (Map F22, Upper Campus) and a vending machine in the foyer of the Biological Sciences Building (Map E26, Upper Campus).

Your health and the health of those in your class is critically important. You must stay at home if you have COVID-19 or have been advised to self-isolate by NSW health or government authorities.

Asking Questions

Asking questions is an important part of learning. Learning to ask good questions and building the confidence to do so in front of others is an important professional skill that you need to develop. The best place to ask questions is during the scheduled classes for this course, with the obvious exception being questions that are private in nature such as special consideration or equitable learning plans. Between classes, you might also think of questions — some of those you might save up for the next class (write them down!), and some of them you might ask in a Q&A channel on Teams or a Q&A forum on Moodle. Please understand that staff won't be able to answer questions on Teams/Moodle immediately but will endeavour to do so during their regular working hours (i.e. probably not at midnight!) and when they are next working on this particular course (i.e. it might be a day or two). Please respect that staff are juggling multiple work responsibilities (teaching more than one course, supervising research students, doing experiments, writing grants, …) and also need to have balance between work and the rest of their life.

Note: This course outline sets out 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 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 (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Pilot Hall with experiment rigs // UNSW Chemical Engineering

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	
PE2.2 Fluent application of engineering techniques, tools and resources	
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	✓
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	✓
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	✓
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	✓