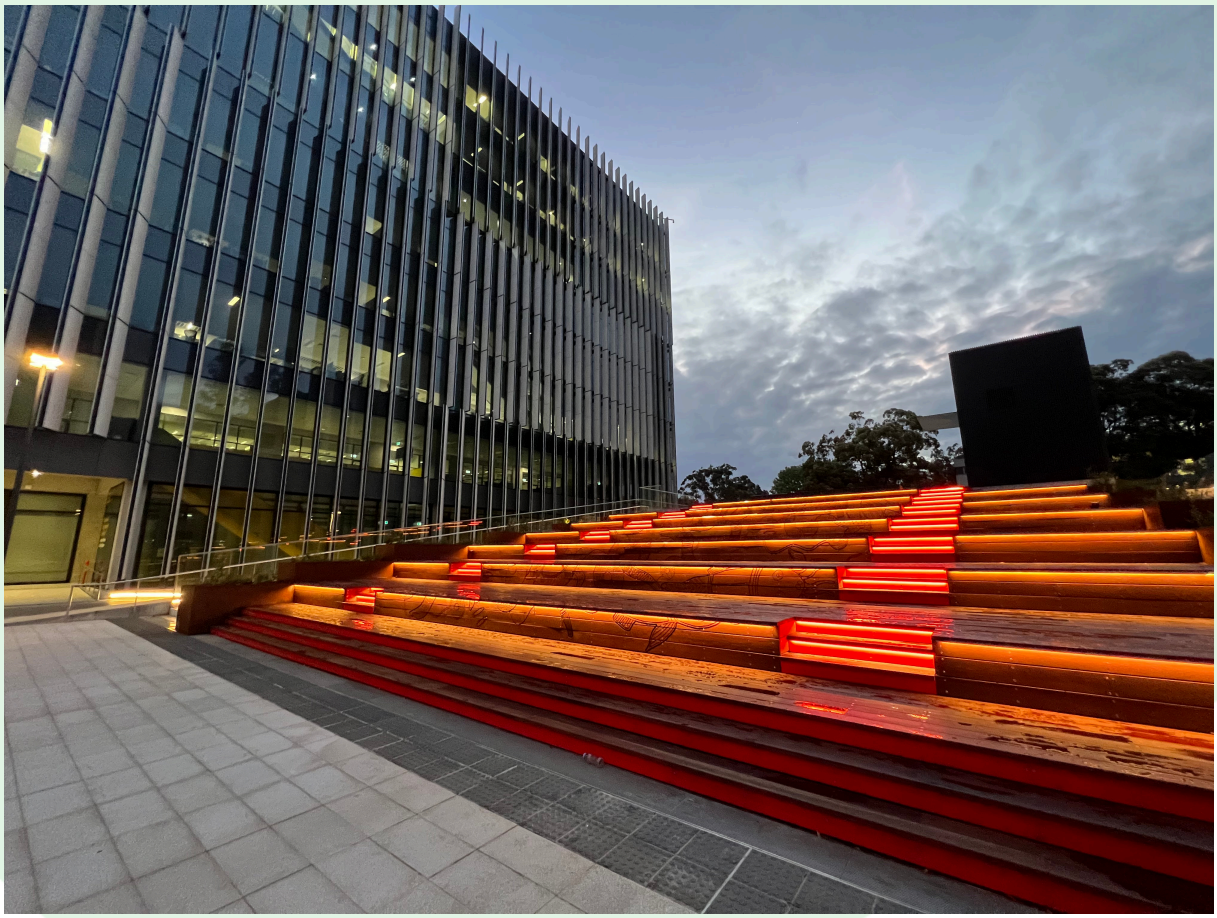
School of Chemical Engineering

UNSW Engineering

CEIC4001

Process Design Project

Term 1, 2022



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Pierre Le-Clech	p.le-clech@unsw.edu.au	Mondays 12-2 or by appointment	Hilmer Building, 521	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.

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. 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. While students are required to develop the skills required for professional accreditation, they are also encouraged to develop skills in areas of specialisation or interest related to the broad design issues for the selected project.

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. The students will have the opportunity to develop skills in team work, interpersonal relationships, decision making and technical capabilities.

The project includes a combination of individual and team-based assessment.

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 ENGG1000, 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 in a chemical process industry. Working in groups of 5, students are required to complete the tasks generally associated with preliminary design activities in order to 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	PE1.5, PE1.6

Learning Outcome	EA Stage 1 Competencies
functional brief	
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 School's approach to Design Project is to provide students with the basic requirements of a design problem. The assessment for the course is based on interviews and written assignments carefully evaluated by the mentors.

The students 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 resolve specific questions. Students and Mentors will determine the time and venue of the meetings. The academic mentors will be responsible for marking some or all of the reports for a given week (see course assessment) and providing feedback. Design is a group effort and it is essential that students quickly establish a routine for group meetings and coordinating the work.

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

Your final mark is based on a group component (50 out of 100 marks) and individual component (50 out of 100 marks).The assessment consists of written submissions (reports and design portfolio) and *viva voce* examination (interviews).

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%	Not Applicable	1, 2, 3, 4
2. Design Reports	55%	Not Applicable	1, 2, 3, 4

Assessment 1: Design Interviews

A series of group and individual interviews will be organised during the term (last interview 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.

This is not a Turnitin assignment

Assessment 2: Design Reports

A series of group and individual reports will be required during the term. 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)

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: 7 February - 11 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: 14 February - 18 February	Seminar	Welcome and introduction to project
Week 2: 21 February - 25 February	Seminar	Welcome and introduction to project
Week 3: 28 February - 4 March	Seminar	Getting ready for Group interview 1
	Presentation	Interview with Mentor
Week 4: 7 March - 11 March	Seminar	Design documentation, MEB through to P&ID
Week 5: 14 March - 18 March	Seminar	How to complete Report 1
	Assessment	Group report #1 due on Friday
Week 6: 21 March - 25 March	Seminar	Preparing for individual interviews
Week 7: 28 March - 1 April	Seminar	General Q&A
Week 8: 4 April - 8 April	Presentation	Interview with Mentor
Week 9: 11 April - 15 April	Seminar	Preparing for individual interviews and report
	Assessment	Individual report due on Tuesday
Week 10: 18 April - 22 April	Seminar	Preparing for final report and group interviews
Study Week: 25 April - 28 April	Assessment	Second group report due on Tuesday 28th April
	Assessment	Group interview with industry panel: Tuesday 10th May, between 8.30am to 1pm
	Assessment	Final recommendations and rejoinder due on

		Thursday 12th May

Resources

Recommended Resources

A number of resources will be posted on Moodle. In addition you can refer to the following texts in the library for help on different aspects of process design

- R.H. Perry and D.W. Green Chemical Engineers' Handbook, McGraw-Hill.
- Coulson and Richardson Chemical Engineering,Vol 6, Pergamon Press
- W.D. Seider, J.D. Seader and D.R. Lewin Process Design Principles: Synthesis, Analysis and Evaluation, Wiley.
- G. Voland, Engineering By Design, 2nd Edition, Pearson/Prentice Hall.

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 generally not required; 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 due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

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). For some activities including Moodle quizzes 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 students will need to provide some documentary evidence to support absences from any assessments missed because of COVID-19 public health measures such as isolation. UNSW will **not** be insisting on medical certificates for COVID-related absences of 7 days or less, with the positive PCR or RAT result being sufficient. Longer absences due to self-isolation or COVID-related illness will still need documentation such as a medical certificate.

Applications for special consideration **will still be required** for assessment and participation absences related to COVID-19. Special consideration requests should not be lodged for missing classes if there are no assessment activities in that class.

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.

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.

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
- Engineering Current Student Resources
- Student Support and Success
- Academic Skills
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- IT Service Centre

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.

On-campus class attendance

Physical distancing recommendations must be followed for all face-to-face classes. To ensure this, only students enrolled in those 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 class. Students enrolled in online classes can swap their enrolment from online to a **limited** number of on-campus classes by Sunday, Week 1.

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 are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. Do not come to campus if you have any of the following symptoms: fever (37.5 °C or higher), cough, sore throat, shortness of breath (difficulty breathing), runny nose, loss of taste, or loss of smell. If you need to have a COVID-19 test, you must not come to campus and remain in self-isolation until you receive the results of your test.

You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-

isolate. We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed. Further information is available on any course Moodle or Teams site.
For more information, please refer to the FAQs: https://www.covid-19.unsw.edu.au/safe-return-campus-faqs

Image Credit

Dr Peter Wich

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	✓