School of Chemical Engineering

UNSW Engineering

CEIC3001

Advanced Thermodynamics and Separation

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Nicholas Bedford	n.bedford@unsw.edu.au			

Lecturers

Name	Email	Availability	Location	Phone
Sarah Grundy	s.grundy@unsw.edu.au			

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 6

Summary of the Course

In this course, the student will learn to apply his or her fundamental knowledge of transport phenomena with concepts in thermodynamics to develop models for industrial separation operations, in conjunction with additional study of thermodynamics of phase equilibria for multi-component systems. The modelling will include graphical, shortcut, and rigorous models for stagewise operations. Separation operations examined include liquid-liquid extraction, binary and multicomponent distillation, azeotropic, extractive and reactive distillation; solid-liquid extraction and absorption. The student will learn how to synthesize separation sequences in a way to conserve energy and minimise capital losses.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Identify thermodynamic properties and models that is relevant in solving separation problems, and select these from a set of information which may include different sources.	PE3.4
2. Describe the principles and select the appropriate separation technology for a given problem.	PE2.2
3. Apply thermodynamic models (for example, to calculate phase equilibria) applicable to a range of separation technologies.	PE2.2
4. Select and apply both simplified and graphical methods to analyse and design stagewise separation operations, and exercise good judgement as to when different approaches, assumptions and approximations are justified.	PE1.3

Teaching Strategies

Please refer to the information in Moodle

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quizzes	25%	Week 2, Week 5, Week 7, Week 8	1
2. Design Report	50%	Week 5, Week 8, Week 10	2, 4
3. Final Exam	25%	Exam Period	2, 4

Assessment 1: Quizzes

Due date: Week 2, Week 5, Week 7, Week 8

Quiz 1: Check-in summative quiz include topics on pre-assumed knowledge and Week 2 [CLO1]

Quiz 2: Summative assessment of topics covered in weeks 2-4. 120 minutes duration. [CLO1]

Quiz 3/4: Prompt quizzes of topics in weeks 7–8 (CLO3, CLO4].

Assessment 2: Design Report

Due date: Week 5, Week 8, Week 10

Design Report - Scaffolding approach assessment task to ensure students' in depth understand.

Task #1: Analysis Report Task #1 - Separation analysis report. Select a separation process and analyse the thermodynamics and equilibria using journal papers published in the last 12months. Individual contribution statement [LO1, LO3]

Task #2: Separation design presentation – preliminary update of the design report. Presentation style format (powerpoint). [LO2, LO4]. Low stakes formative assessment with the purpose to provide feedback to students for the final report (individual and group component).

Task #3 Final Design Report. [LO1, LO2, LO3, LO4]. Select a separation (from prescribed list), select a (fluid) separation process and evaluate design considerations. Develop design guidelines for your selected separation process. (group). Reflection on Design Task 2, Individual separation design report, Perform example selected analysis and design calculations. (individual)

Assessment 3: Final Exam

Due date: Exam Period

Summative assessment of topics covered in weeks 7-10. Formal exam because it has high reliability and precision. Assessed based on technical accuracy of calculations, speed of calculation and clarity of presentation and being able to exercise good engineering judgement. 120 minutes. [CLO2, CLO4]

Attendance Requirements

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

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 12 September - 16 September	Topic	Course Introduction, Equipment of vapour-liquid separations, Introduction to assignment
	Tutorial	Assignment tutorial – Getting started workshop
Week 2: 19 September - 23 September	Topic	Introduction to phase equilibria
	Tutorial	Recall thermodynamics principles, Introduction to phase equilibria
	Assessment	Quiz 1
Week 3: 26 September - 30 September	Topic	Simple models for vapour-liquid equilibria (VLE). Introduction to non-ideality
	Tutorial	Simple models for VLE
Week 4: 3 October - 7 October	Topic	Non-ideality in the gas and liquid phase, Ideal Solutions
	Tutorial	Non-ideality in gas & liquid phase
Week 5: 10 October - 14 October	Tutorial	Ideal Solutions
	Assessment	Mid-term quiz; Analysis Report Task 1
Week 6: 17 October - 21 October	Screening	Flexible week (dedicated to course consultation)
Week 7: 24 October - 28 October	Topic	Equipment for Vapour-liquid separations, Absorption and Stripping
	Tutorial	Absorption and stripping
	Assessment	Quiz 3
Week 8: 31 October - 4 November	Topic	Graphical McCabe-Thiele,Binary distillation
	Tutorial	Preliminary Report assessment (presentation)
	Assessment	Quiz 4; Presentation Task 2
Week 9: 7 November -	Topic	Liquid-liquid extraction,Ternary diagrams

11 November	Tutorial	Graphical McCabe-Thiele,Binary Distillation
Week 10: 14 November - 18 November	Topic	Final design workshop
	Tutorial	Liquid-liquid extraction,Ternary diagrams
	Assessment	Final Report Task 3

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.

Note: UNSW does not require a medical certificate for COVID-related absences of 7 days or less, however you must provide formal evidence from your local/state health provider (e.g. NSW Health) that clearly states your name and the date you tested positive (i.e. confirmation of your RAT registration, PCR test result). Longer absences due to extended 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 advice 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

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

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	