CEIC3001

Advanced Thermodynamics and Separation

Term 3, 2021
Course Overview

Staff Contact Details

Convenors

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Availability</th>
<th>Location</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicholas Bedford</td>
<td><a href="mailto:n.bedford@unsw.edu.au">n.bedford@unsw.edu.au</a></td>
<td></td>
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Lecturers

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Availability</th>
<th>Location</th>
<th>Phone</th>
</tr>
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<tbody>
<tr>
<td>Sarah Grundy</td>
<td><a href="mailto:s.grundy@unsw.edu.au">s.grundy@unsw.edu.au</a></td>
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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 Aims

The aim of this course is to develop your understanding of phase equilibria in binary and ternary systems and to apply this knowledge to the design of separation processes. Particular emphasis is placed on equilibrium-stage separation processes involving vapour and liquid phases. Thermodynamic models for dealing with non-ideality in vapour/liquid phases are introduced. Separations involving a solid phase are introduced via a topic on leaching and washing. In taking this course you should learn enough conceptually and mathematically to analyse other technologies that are not taught explicitly in the course.

Course Learning Outcomes

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

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>EA Stage 1 Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>PE3.4</td>
</tr>
<tr>
<td>2. Describe the principles and select the appropriate separation technology for a given problem.</td>
<td>PE2.2</td>
</tr>
<tr>
<td>3. Apply thermodynamic models (for example, to calculate phase equilibria) applicable to a range of separation technologies.</td>
<td>PE2.2</td>
</tr>
<tr>
<td>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.</td>
<td>PE1.3</td>
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Teaching Strategies

CEIC3001 employs student-centred learning as the basis for its instructional design and emphasises the importance of active learning. The teaching in this course is based on a blended environment philosophy.
Student-centred activities form the basis of the course, including prior knowledge of the students, and allow engagement in relevant and challenging experiences. The classes are designed to be supportive and include meaningful realistic learning and assessment tasks, as well as promote independent and collaborative study and enquiry.

Teaching strategies used during the course will include:

- small group learning, and team-based assessment tasks, to further drive understanding of the importance of teamwork in an engineering context, to demonstrate the use of appropriate collaboration to address research goals, in an increasingly global professional environment;
- explicit teaching/instruction, through a range of teaching materials and approaches, including videos, Q&A forums to foster a supportive learning environment;
- structured environments (formal lecture and tutorial-lecture style face-to-face learning activities), for reinforcement of key concepts, and;
- student as partners learning experience, allowing students the opportunity to demonstrate their capacity to communicate and encourage peer to peer learning.

These activities will occur in 2-3 hours per week in an active learning space environment and 2 hours per week in small class tutorials. The lectures are used partly for introducing the relevant theory on phase equilibria and equilibrium-stage separation processes. A set of numerical problems has been prepared for each tutorial class. Regular quizzes and weekly exercises will be conducted during the lectures, tutorials or on-line to assess your understanding of the topics and to provide you with feedback on your progress.
Assessment

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Weight</th>
<th>Due Date</th>
<th>Course Learning Outcomes Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quizzes</td>
<td>25%</td>
<td>Not Applicable</td>
<td>1</td>
</tr>
<tr>
<td>2. Design Report</td>
<td>50%</td>
<td>Not Applicable</td>
<td>2, 4</td>
</tr>
<tr>
<td>3. Final Exam</td>
<td>25%</td>
<td>Not Applicable</td>
<td>2, 4</td>
</tr>
</tbody>
</table>

Assessment 1: Quizzes

Quiz 1 - Online moodle quiz. 3 attempts. Formative assessment based on course content Week 1-3. The purpose is to check student progress early in the term.

Quiz 2 - Mid-term. In-class summative assessment of topics covered in Week 1-4.

Quiz 3 - Prompt quizzes of topics in weeks 7–8

Assessment 2: Design Report

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 12 months. 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

final exam
Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.
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 not be required to provide any documentary evidence to support absences from any classes missed because of COVID-19 public health measures such as isolation. UNSW will not be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration will be required for assessment and participation absences – but no documentary evidence for COVID 19 illness or isolation will be required.
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.
## Program Intended Learning Outcomes

### Knowledge and skill base

<table>
<thead>
<tr>
<th>PE1.1</th>
<th>Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</th>
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<tbody>
<tr>
<td>PE1.2</td>
<td>Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline</td>
</tr>
<tr>
<td>PE1.3</td>
<td>In-depth understanding of specialist bodies of knowledge within the engineering discipline</td>
</tr>
<tr>
<td>✔ PE1.4</td>
<td>Discernment of knowledge development and research directions within the engineering discipline</td>
</tr>
<tr>
<td>PE1.5</td>
<td>Knowledge of engineering design practice and contextual factors impacting the engineering discipline</td>
</tr>
<tr>
<td>PE1.6</td>
<td>Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline</td>
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### Engineering application ability

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<thead>
<tr>
<th>PE2.1</th>
<th>Application of established engineering methods to complex engineering problem solving</th>
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</thead>
<tbody>
<tr>
<td>✔ PE2.2</td>
<td>Fluent application of engineering techniques, tools and resources</td>
</tr>
<tr>
<td>PE2.3</td>
<td>Application of systematic engineering synthesis and design processes</td>
</tr>
<tr>
<td>PE2.4</td>
<td>Application of systematic approaches to the conduct and management of engineering projects</td>
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</tbody>
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### Professional and personal attributes

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<thead>
<tr>
<th>PE3.1</th>
<th>Ethical conduct and professional accountability</th>
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</thead>
<tbody>
<tr>
<td>PE3.2</td>
<td>Effective oral and written communication in professional and lay domains</td>
</tr>
<tr>
<td>PE3.3</td>
<td>Creative, innovative and pro-active demeanour</td>
</tr>
<tr>
<td>✔ PE3.4</td>
<td>Professional use and management of information</td>
</tr>
<tr>
<td>PE3.5</td>
<td>Orderly management of self, and professional conduct</td>
</tr>
<tr>
<td>PE3.6</td>
<td>Effective team membership and team leadership</td>
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</table>