School of Chemical Engineering

UNSW Engineering

FOOD8450

Advanced Food Engineering

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Cordelia Selomulya	cordelia.selomulya@unsw.edu.au	via Teams channel or Moodle forum	Science and Engineering Building (SEB)	

Lecturers

Name	Email	Availability	Location	Phone
Francisco Trujillo	francisco.trujillo@unsw.edu.au	via Teams channel or Moodle forum	Science and Engineering Building (SEB)	
Yong Wang	yong.wang2@unsw.edu.au	via Teams channel or Moodle forum	Science and Engineering Building (SEB)	

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

Food engineering principles (heat and mass transfer) are the basis of food processing. In this course, important aspects of food engineering are explored in greater depth, including selected unit operations (drying, spray drying, distillation, liquid-liquid extraction, membrane filtration and radiation).

The course covers:

- Heat and mass transfer in food processing, including steady state and transient heat and mass transfer.
- Radiation theory is covered in some depth, including theory, and application to temperature measurement, ovens, microwave, radiofrequency and infrared cooking.
- Drying and dehydration: these important unit operations are presented at a more advanced and practical level, including drying rate modelling, prediction of drying times, and spray drying.
- Chemical separations: this covers two key unit operations, distillation and liquid-liquid extraction, which were not included in FOOD8801 (Unit Operations).
- Membrane separation theory is briefly covered as it is a unit operation intensively used by the dairy industry.

At the end of this course, you should have a greater knowledge of these advanced unit operations, and how they might interact with food and its quality. In addition, you should have improved problem-solving skills and the ability to bring analytical techniques to each operation. You should also have a greater awareness of where to find resources to help with unit operation analysis.

Course Aims

The course objectives are:

- To complete the coverage of additional more advanced unit operations used in the food industry, specifically spray drying, distillation, liquid-liquid extraction, membrane filtration and radiation.
- To train students in analytical thinking skills.
- To provide essential background for student projects in Food Engineering.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Understand and apply the principles of heat and mass transfer in food processing.	PE1.1
2. Understand and apply the principles of radiation heat transfer in processing.	PE1.1
3. Describe drying modelling and current research.	PE1.4

Learning Outcome	EA Stage 1 Competencies
4. Understand and apply chemical separations in a food line.	PE1.2
5. Apply correct membrane processes to physical separation.	PE1.2

At the successful completion of this course you (the student) should be able to:

1. Understand and apply the principles of heat and mass transfer in food processing.
2. Understand and apply the principles of radiation heat transfer in processing.
3. Describe drying modelling and current research.
4. Understand and apply chemical separations in a food line.
5. Apply correct membrane processes to physical separation.

Teaching Strategies

The central thread behind the lecture series is the idea of problem solving, one of the key attributes expected from employers in a modern food plant. To develop this skill, students will be given certain theory components, linked by the idea of models (for example, the heat transfer equation) and asked to apply the theory. The concept of design problems is also introduced.

In order to do this with each topic, the following steps are followed:

- communication of the basic theory,
- simple worked problems,
- more advanced examples,
- assisted problems (tutorials), and
- transfer of ownership of the concepts through assignments.

A clear distinction is made between learning the body of knowledge (comprehension) and applying the knowledge (problem-solving).

Any student is welcome to give the lecturer feedback on his or her individual needs. If there is some issue you want to have addressed, it is best not to wait for the formal survey carried out through My Experience via Moodle at the end of session. This formal survey is designed to improve lecturing and course design in subsequent years. The current course has taken account of previous surveys.

Additional Course Information

The course is designed for students with an interest in the application of engineering principles to food processing. Before delving into dehydration and spray drying, a review of heat and mass transfer is considered because both phenomena (heat and mass transfer) occur simultaneously during drying. Radiation, which explains oven heating and baking, is also covered in this course. Then, chemical separation unit operations such as distillation, liquid-liquid extraction, and membrane filtration are covered. If you have an interest in a more advanced food engineering project, working in the food industry, or simply enjoy finding out more about how food is processed, this unit is for you.

Disclaimer: This course is part of UNSW Food Science specialisations approved (2021-2026) by the Institute of Food Technologists Higher Education Review Board (IFT HERB).

Assessment

Submission of assessment tasks

- Assignments are due as per unit schedule and due dates in Moodle. Unless a valid medical certificate is presented, assignments submitted after the due date will receive a 5% deduction in marks for every day that they are late.
- Unless otherwise specified, collaboration on assignments with other students is not permitted.
- The final exam will be held at the allocated time during the exam period.

If you are unable to meet the due date for one or more of your assessment tasks, you will need to submit a special consideration request via MyUNSW. You may receive an extension on your assignment or supplementary exam as deemed appropriate.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quiz 1 (online)	10%	Week 4	1, 2
2. Quiz 2 (online)	10%	Week 9	2, 3, 4
3. Assignment 1	15%	Week 5	1, 2
4. Assignment 2	15%	Week 10	1, 2, 3, 4
5. Final Exam	50%	Exam Period	1, 2, 3, 4, 5

Assessment 1: Quiz 1 (online)

Due date: Week 4

The online quizzes intend to provide feedback on progress with the course. It may contain questions on comprehension and problem solving.

The quizzes will be conducted on-line and must be undertaken by the due date to gain marks. Questions will test two learning aspects, knowledge of unit operations and simple problems.

Assessment 2: Quiz 2 (online)

Due date: Week 9

The online quizzes intend to provide feedback on progress with the course. It may contain questions on comprehension and problem solving.

The quizzes will be conducted on-line and must be undertaken by the due date to gain marks. Questions will test two learning aspects, knowledge of unit operations and simple problems.

Assessment 3: Assignment 1

Due date: Week 5

Assignments give feedback on your ability to apply classroom theory, and so help prepare for the final exam. They should also encourage you to review the material in each topic. They are summative, meaning that they will account for the final marks, and formative, meaning that they should help your learning process.

Students will be randomly paired with a peer to work as a team to submit the assignment. The purpose of this style of submission is to enhance learning with peer review and teamwork. If there is an odd number of students in the class, there will be one group of three members.
Clear neat problem solutions should be presented, starting a new problem on a new page.

Assignments must be submitted online through Moodle. Answers to essay-type questions should be maximum one page.

Assessment 4: Assignment 2

Due date: Week 10

Assignments give feedback on your ability to apply classroom theory, and so help prepare for the final exam. They should also encourage you to review the material in each topic. They are summative, meaning that they will account for the final marks, and formative, meaning that they should help your learning process.

Students will be randomly paired with a peer to work as a team to submit the assignment. The purpose of this style of submission is to enhance learning with peer review and teamwork. If there is an odd number of students in the class, there will be one group of three members.
Clear neat problem solutions should be presented, starting a new problem on a new page.

Assignments must be submitted online through Moodle. Answers to essay-type questions should be maximum one page.

Assessment 5: Final Exam

Due date: Exam Period

A final exam is given because the course learning outcomes include a significant level of technical learning which can be effectively assessed in an exam environment and because exams have high reliability. It is primarily designed to align with UNSW graduate attributes 2 and 3.

The exam tests both understanding of technology, and problem-solving skills related to the topics covered in the course.

Attendance Requirements

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

Course Schedule

Most of the teaching will be done through lectures. In particular, the first and second lectures each week will be lecture presentations.

Embedded in the lectures are interactive examples, where you can practice immediately the theory that has been presented. This gives you a chance to ask questions and so ensure that you fully understand each step before we move on to the next.

More generally, all students are welcome to interrupt and ask questions at any time as we go along, and we value these questions as indications of how well you are understanding the concepts that are presented.

This course is rightly called Advanced Food Engineering. The pace will be faster, the concepts more difficult and expectations are higher. You are in a good position to cope with this more advanced material, because we are building on knowledge that you already have.

Certain lectures in each week allows interactive problem solving, where you can form groups and tackle tutorial worksheets. The time during lectures will never be adequate to complete all questions. You will be expected to look at the tutorial worksheets before lectures and complete them in your own time after the tutorial. You will need to do this to keep pace with the theory. Solutions will be put online a few days after the tutorial.

Attendance in class (face to face or online) is required, and you will need to do some work and study for yourselves outside of the formal meeting times. Pre-reading of the lecture slides and recommended book chapters (even with only partial understanding) is massively helpful. To stress that again, read the slides in advance, but you do not have to understand them. I expect you could do this in about 20 minutes per topic.

When using the online discussion forums, it is expected that students follow UNSW's Online Participation Guidelines, found at: https://student.unsw.edu.au/online-study.

View class timetable

Timetable

Date	Type	Content
O-Week: 5 September - 9 September	Online Activity	Online survey via Moodle. The survey is designed to inform us about your educational background and interest (if any) of pursuing a career in the food and related industry.
Week 1: 12 September - 16 September	Lecture	Introduction to food materials and properties

		Heat transfer in food processing (steady state and unsteady state)
Week 2: 19 September - 23 September	Lecture	Mass transfer in food systems Dehydration: review of psychrometrics Dehydration: basic drying processes
Week 3: 26 September - 30 September	Lecture	Radiation: Theory 1 Radiation: Application 1 Radiation: Theory 2
Week 4: 3 October - 7 October	Lecture	Radiation: Application 2 Radiation: Application 3 Fundamentals of food drying
	Assessment	Online Quiz 1 (10%) covering materials from week 1 to week 3.
	Assessment	Quiz 1 (online)
Week 5: 10 October - 14 October	Lecture	The stages of drying: prediction of drying time Drying: general modelling approaches Drying technologies and applications in food processing
	Assessment	Assignment 1 (15%) Students will be randomly grouped with their peers to work as a team to submit the assignment. Extra questions may be provided for the postgraduate co-horts of this course. Answers to essay-type questions should be maximum one page.
	Assessment	Assignment 1
Week 6: 17 October - 21 October	Online Activity	Online activity designed for the postgraduate co-horts of this course. Undergraduate co-horts are

		welcome to join, otherwise they can use this week as equivalent to flexibility week.
Week 7: 24 October - 28 October	Lecture	Fundamentals of droplet drying Spray drying of food materials Spray drying and microencapsulation
Week 8: 31 October - 4 November	Lecture	Introduction to chemical separation Distillation 1 and 2
Week 9: 7 November - 11 November	Lecture	Liq-Liq Extraction 1 & 2 Sol-Liq-Liq Extraction
	Assessment	Online Quiz 2 (10%) covering materials from week 4 to week 8.
	Assessment	Quiz 2 (online)
Week 10: 14 November - 18 November	Lecture	Membrane separation 1 & 2 Membranes in food application
	Assessment	Assignment 2 (15%) Students will be randomly grouped with their peers to work as a team to submit the assignment. Extra questions may be provided for the postgraduate co-horts of this course. Answers to essay-type questions should be maximum one page.
	Assessment	Assignment 2

Resources

Prescribed Resources

Textbooks: Singh and Heldman: Introduction to Food Engineering

Chen and Mujumdar: Drying Technologies in Food Processing

References: Perry and Green: Chemical Engineers Handbook, CRC Press

Fellows: Food Processing Principles

Arvanitoyannis: Irradiation of Food Commodities

Library services:http://www.library.unsw.edu.au/servicesfor/students.html

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	