FOOD3801

Unit Operations in Food Processing

Term Two // 2021

School of Chemical Engineering // UNSW Engineering

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Francisco Trujillo	francisco.trujillo@unsw.edu.au	Thrusday 11:00-12:00 weeks 1-4 and 10-11	Room 420, Hilmer building (Enter via the Science and Engineering Building SEB E8)	+61 2 9385 5648

Lecturers

Name	Email	Availability	Location	Phone
Cordelia Selomulya	cordelia.selomulya@unsw.edu.au	Thrusday 11:00-12:00 weeks 5-9	Room 501, Science and Engineering Building (E8)	+61 2 9385 6243

Demonstrators

Name	Email	Availability	Location	Phone
Ernest Tse	e.tse@unsw.edu.au			

Lab Staff

Name	Email	Availability	Location	Phone
Richard Li	richard.li@unsw.edu.au			+61 2 9385 7508

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

Credit Points 6

Summary of the Course

Food processing is the transformation of animal, plant, and marine ingredients into intermediate and finished food products. The main aims of food processing are to manufacture foods that are safe to eat and with extended shelf life, provide nutrition, variety, and convenience in diet, and to add value. There is a vast variety of possible food transformation processes. Fortunately, they can be grouped into a smaller and comprehensible group of operations referred as “unit operations”. Even though the sequence on which unit operations are arranged on actual industrial processes my change, they are governed by the same basic principles. Namely, conservation of momentum, mass and energy, heat and mass transfer, and basic concepts of thermodynamics. These fundamental principles are assumed knowledge required to succeed in this course.

This course introduces some of the more important unit operations in the food industry. Students will be able to describe the process, its applications, effects on the food product and requirements, appropriate process diagrams, and to perform mass and heat balances and flows to solve unit operation problems. Unit operations covered are refrigeration, evaporation, packaging, dehydration, extrusion, and physical separations. Given that unit operations are based on the same fundamental principles, student will be able to take on, and rapidly understand, other unit operations not taught in this course. The skills developed in this course will help you to understand, manage, optimize and improve actual industrial food manufacturing processes.

Course Aims

The course is designed to learn some of the main unit operations used in the food processing industry, by describing and then applying basic science and engineering principles to each major processing step. For each unit operation, students should become familiar with:

- Scientific and engineering principles,
- Effects on food materials,
- Solving engineering problems related to each unit operation, and
- Equipment used.

Course Learning Outcomes

1. Understand and apply principles of heat and mass transfer to specific unit operations used in the food industry.
2. Understand basic scientific and engineering principles underpinning each unit operation.
3. Set up and solve problems (including simple design) for each unit operation.
4. Sketch typical examples of equipment used for each unit operation
5. Understand the specific nature and requirements of packaging as used in the food industry.

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

Teaching Strategies

This section of the outline offers students a rationale for the different teaching strategies used in the course and helps establishing their expectations and responsibilities.

1. Lectures: All unit operations are taught firstly by teaching the theory of the unit operation, and secondly, by participation in problem-solving and tutorial activities in class. This develops skills in applying understanding of the unit operations to practical applications. This participation is essential for learning how to use the theoretical ideas of the unit operation. Each topic has required readings from the course textbooks. Students are expected to organise access to the textbooks as they will be used extensively throughout the course.

2. Labs: Demonstration of principles taught in lectures, and further reinforcement of problem solving. There are three labs (refrigeration, packaging, and dehydration), each specific to a unit operation. Students will work in groups and are required to read and complete their lab preparation prior to the laboratory session. Group lab reports will be submitted on the week following the lab sessions.

3. Assignments: They are summative, meaning that they will account for the final marks, and formative, meaning that they should help your learning process. The initial assignments are submitted individually, and students are asked via a “submission-quiz” mode to enter some of the results from the assignments. Then, students will be randomly paired with a peer to assess the quality of each other’s work, provide feedback, and discuss the results. Finally, the pair of students will work as a team to submit together an improved version of the assignment. The purpose of this style of submission is to enhance learning with peer review and teamwork.

The course is based on problem solving, not information presentation. For example, rather than teaching every possible evaporator design, we emphasize how the evaporator works. For this reason, the content of this course is more about concepts, and is generally harder to understand than other courses, thus it will require your close attention and participation to achieve its goals. This is not a subject that you can neglect for a week and expect to catch up easily.

The teaching and learning methods chosen for this course require your active participation in class, especially in practicing problem solving. Tutorials are integrated into the lecture periods and are not separate activities as in most classes. You will be taught a new concept, shown how to solve a problem, then given a problem to solve for yourselves. In this way ownership of the concept is established in you the student. If you do not go through this process, it is unlikely that you will understand how to use the material well enough to pass the course. The textbook provides a second viewpoint on the same material, with worked examples and additional problems.

The classroom is interactive. Questions at all levels are encouraged. The student will not be able to learn adequately by downloading the slide content and missing the lecture. Active participation is essential. Feedback on progress will be given during the session through problem solving, lab reports, and assignments.

Additional Course Information

The course is organized into 9 hours of contact per week over a 10-week trimester. Weeks 1-2, 4-6, 8 and 10 will have three 2-hour lectures, while weeks 3, 7 and 9 will have a 3-hour lab session, a 2-hour lecture and 1-hour lecture. Each lecture block may include such activities as: on-line lecture or lecture presentation, online tutorial, or workshop, solving a set of exercises and/or problems, discussion forums etc. Course materials will be provided through the Moodle course page. Specific details will be given by the lecturer in charge of each unit operation. Any required pre-readings must be completed before the associated session.

You should not be doing this course unless:

1. You have done the pre-requisite courses of either FOOD1360/8360 (Food Processing Principles) or CEIC2001 (Fluid and Particle Mechanics) and CEIC2002 (Heat and Mass Transfer) or
2. You have done equivalent courses covering heat transfer and fluid flow, or
3. You have an adequate background in heat transfer and fluid flow.

The reason for this is because the principles of heat and mass flow are assumed knowledge for this course. A student who has not completed the pre-requisite courses or an equivalent course is unlikely to pass.

Assessment

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Lab reports (3)	15%	Not Applicable	1, 2
Assignments (3)	45%	Not Applicable	1, 2
Final Exam	40%	Not Applicable	1, 2, 3, 4, 5

Assessment Details

Assessment 1: Lab reports (3)

Start date: Not Applicable

Details:

Group lab reports assess understanding of lab goals, methods, results, and analysis. The topics will be on refrigeration, packaging, and dehydration, corresponding to three lab sessions. The lab reports must be submitted a week after the lab session. Each lab report accounts for 5% of the final mark.

Assessment 2: Assignments (3)

Start date: Not Applicable

Details:

The assignments will assess problem-solving skills for refrigeration, evaporation, and packaging. There are three assignments, each one accounting for 15% of the final mark. The mark of the assignment is composed of three parts: 1) an individual submission (5% of the final mark); 2) a peer assessment (3% of the final mark); and 3) a team submission from paired peers (7% of the final mark).

Individual submission

This individual submission is done via an “assignment Moodle quiz” on which, besides submitting the PDF of the assignment, student must answer some multiple-choice questions on specific and/or numerical answer from the assignment.

Team submission

After the individual submission, students are randomly paired with a peer to assess each other’s work, provide feedback, and discuss the results. Students must provide feedback for the work of your peer and then work together to submit an enhanced version of the assignment.

Peer assessment

Students receiving feedback will assess the quality of the feedback and the overall engagement of your

peer on the teamwork using a rubric.

Assessment 3: Final Exam

Details:

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

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: 31 May - 4 June	Lecture	This week has the following lectures-tutorials on refrigeration: Monday: 11:00 to 13:00 (Lecturer: Francisco Trujillo) Tuesday: 15:00 to 17:00 (Lecturer: Francisco Trujillo) Thursday: 9:00 to 11:00 (Lecturer: Francisco Trujillo)
Week 2: 7 June - 11 June	Lecture	This week has the following lectures-tutorials on refrigeration and evaporation: Monday: 11:00 to 13:00 (refrigeration) (Lecturer: Francisco Trujillo) Tuesday: 15:00 to 17:00 (refrigeration) (Lecturer: Francisco Trujillo) Thursday: 9:00 to 11:00 (refrigeration/evaporation) (Lecturer: Francisco Trujillo)
Week 3: 14 June - 18 June	Lecture	This week has the following lectures-tutorials on evaporation: Monday: 11:00 to 13:00 (Lecturer: Francisco Trujillo) Thursday: 10:00 to 11:00 (Lecturer: Francisco Trujillo)
	Workshop	This week has a 3 hour lab session about refrigeration on Tuesday from 15:00 to 18:00 at Science & Engineering building (SEB) 123 (K-E8-123).
Week 4: 21 June - 25 June	Lecture	This week has the following lectures-tutorials on evaporation and packaging: Monday: 11:00 to 13:00 (evaporation) (Lecturer: Francisco Trujillo)

		Tuesday: 15:00 to 17:00 (evaporation) (Lecturer: Francisco Trujillo) Thursday: 9:00 to 11:00 (packaging) (Lecturer: Cordelia Selomulya)
	Assessment	This week has the following assessments: Lab report 1 - Refrigeration: due date on Tuesday at 7 pm. Assignment 1 - Individual submission: due date on Friday at 7 pm.
Week 5: 28 June - 2 July	Lecture	This week has the following lectures-tutorials on packaging: Monday: 11:00 to 13:00 (Lecturer: Cordelia Selomulya) Tuesday: 15:00 to 17:00 (Lecturer: Cordelia Selomulya) Thursday: 9:00 to 11:00 (Lecturer: Cordelia Selomulya)
	Assessment	This week has the following assessments: Assignment 1 – Team submission & Peer assessment: due date on Friday at 7 pm.
Week 7: 12 July - 16 July	Lecture	This week has the following lectures-tutorials on packaging & dehydration: Monday: 12:00 to 13:00 (packaging) (Lecturer: Cordelia Selomulya) Thursday: 9:00 to 11:00 (dehydration) (Lecturer: Cordelia Selomulya)
	Workshop	This week has a 3 hour lab session about packaging on Tuesday from 15:00 to 18:00 at Science & Engineering building (SEB) 123 (K-E8-123).
	Assessment	This week has the following assessments: Assignment 2 - Individual submission: due date on Friday at 7 pm.
Week 8: 19 July - 23 July	Lecture	This week has the following lectures-tutorials on dehydration: Monday: 11:00 to 13:00 (Lecturer: Cordelia Selomulya) Tuesday: 15:00 to 17:00 (Lecturer: Cordelia

		Selomulya) Thursday: 9:00 to 11:00 (Lecturer: Cordelia Selomulya)
	Assessment	This week has the following assessments: Lab report 2 - Packaging: due date on Tuesday at 7 pm. Assignment 2 - Team submission & Peer assessment: due date on Friday at 7 pm.
Week 9: 26 July - 30 July	Lecture	This week has the following lectures-tutorials on dehydration and extrusion: Monday: 12:00 to 13:00 (dehydration) (Lecturer: Cordelia Selomulya) Thursday: 9:00 to 11:00 (extrusion) (Lecturer: Francisco Trujillo)
	Workshop	This week has a 3 hour lab session about dehydration on Tuesday from 15:00 to 18:00 at Science & Engineering building (SEB) 123 (K-E8-123).
	Assessment	This week has the following assessments: Assignment 3 - Individual submission: due date on Friday at 7 pm
Week 10: 2 August - 6 August	Lecture	This week has the following lectures-tutorials on extrusion and physical separations: Monday: 11:00 to 13:00 (extrusion) (Lecturer: Francisco Trujillo) Tuesday: 15:00 to 17:00 (physical separations) (Lecturer: Francisco Trujillo) Thursday: 9:00 to 11:00 (physical separations) (Lecturer: Francisco Trujillo)
	Assessment	This week has the following assessments: Lab report 3 - Dehydration: due date on Tuesday at 7 pm. Assignment 3 - Team submission & Peer assessment: due date on Friday at 7 pm.

Resources

Prescribed Resources

Textbooks:

- Singh, R.P. and Heldman, D.R., 2013. *Introduction to Food Engineering, Enhanced*. Academic Press. https://www.sciencedirect.com/science/article/pii/B9780123985309000218
- Fellows, P.J., 2009. *Food processing technology: principles and practice*. Elsevier. https://www.sciencedirect.com/book/9781845692162/food-processing-technology

Recommended Resources

Other Recommended Textbooks:

- Toledo, R.T., Singh, R.K. and Kong, F., 2007. *Fundamentals of food process engineering* (Vol. 297). New York: Springer. https://ebookcentral.proquest.com/lib/unsw/detail.action?docID=323605
- Varzakas, T. and Tzia, C. eds., 2014. Food Engineering Handbook, Two Volume Set (Vol. 31). CRC Press. https://ebookcentral.proquest.com/lib/unsw/detail.action?docID=1731942
- Berk, Z., 2018. *Food process engineering and technology*. Academic press. Second edition available online via the UNSW library: https://www.sciencedirect.com/book/9780124159235/food-process-engineering-and-technology
- Clark, S., Jung, S. and Lamsal, B. eds., 2014. *Food processing: principles and applications*. John Wiley & Sons. https://ebookcentral.proquest.com/lib/unsw/detail.action?docID=1662196
- Earle, R.L., 2013. *Unit operations in food processing*. Elsevier. https://www.sciencedirect.com/book/9780080255361/unit-operations-in-food-processing https://nzifst.org.nz/resources/unitoperations/index.htm
- Heldman, D.R., 2011. *Food preservation process design*. Academic Press. https://www.sciencedirect.com/book/9780123724861/food-preservation-process-design

Refrigeration:

- Cleland, Andrew C.,1990. Food Refrigeration Processes: Analysis, Design, and Simulation. Elsevier.

Packaging:

- Robertson, G.L., 1998. Food packaging. Marcel Dekker.

Extrusion and Scale-Up:

- Sharma, S., Mulvaney, S.H. and Rizvi, S.S., 2000. *Food process engineering: theory and laboratory experiments*

Course Evaluation and Development

Student feedback is extremely valuable, and you are expected to provide feedback on the course. A

Moodle tool has been created on the course web page which will become visible late in the session and allow you to evaluate the course.

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 10% 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.