School of Chemical Engineering

UNSW Engineering

FOOD3801, FOOD8801

Unit Operations in Food Processing

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Francisco Trujillo	francisco.trujillo@unsw.edu.au	Tuesday 12:00-13:00 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
Yong Wang	yong.wang2@unsw.edu.au	Tuesday 16:00-17:00 weeks 5-9	Room 218, Hilmer building (Enter via the Science and Engineering Building SEB E8)	

Demonstrators

Name	Email	Availability	Location	Phone
Nikunj Naliyadhara	n.naliyadhara@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.

Questions about the this course should normally be asked during the scheduled class so that everyone can benefit from the answer and discussion.

Course Details

Units of Credit 6

Summary of the Course

Food processing is the transformation of raw ingredients into food products that are safe to eat, provide nutrition, dietary variety and convenience with extended shelf life. This course will give you a foundational understanding of the processes we use to transform food (also known as 'unit operations'). Even though their sequences may change from product to product and plant to plant, they are all governed by the same basic principles. Principles such as the conservation of momentum, mass and energy, heat and mass transfer, and thermodynamics, that you have mastered in earlier courses.

This course introduces some of the more important unit operations in the food industry such as refrigeration, evaporation, dehydration, packaging, extrusion, and physical separations. You will learn to describe the processes, their applications and effects on food products using appropriate process diagrams, and to analyse them using mass and heat balances.

Finally, having completed this course, you will be able to rapidly understand other unit operations not taught in this course, since they are all based on the same fundamental principles. The skills you develop will enable 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
- The equipment used.

Course Learning Outcomes

1. Explain and apply principles of heat and mass transfer to specific unit operations used in the food industry.
2. Apply basic scientific and engineering principles underpinning unit operations.
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. Describe 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

The course is based on problem solving and critical thinking, and thus we will focus on understanding the underlying mechanism of each unit operation. Rather than teaching every possible evaporator

design, for example, we emphasize the principles of how all evaporators work. For this reason, the content of this course is more about applying concepts and is generally challenging. Thus, it will require you to stay up to date, your close attention, and participation to achieve its goals.

The teaching and learning methods chosen for this course require your active participation in class, especially in practicing problem solving. This will involve lectures, labs, and assignments. Problem solving workshops 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, you are responsible for the ownership of the concept. 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. You 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 organised into 6 hours of contact per week over a 10-week trimester. Weeks 1-2, 4-5, 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. Tutorials for problem solving practice will be incorporated within the lectures. Course materials will be provided through the Moodle course page.

You should not be doing this course unless:

1. You have done the pre-requisite courses of either FOOD3060 (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, mass and energy balances and fluid flow, or
3. You have an adequate background in heat transfer, mass and energy balances, and fluid flow.

The reason for this is because those principles are assumed knowledge for this course. A student who has not completed the pre-requisite courses or an equivalent course may be challenged by the content.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Lab Reports (3)	15%	Weeks 4, 8 and 10	1, 2
2. Assignments (3)	45%	Weeks 4, 5, 7, 8, 9, 10	1, 2, 3, 4, 5
3. Final Exam	40%	Exam Period	1, 2, 3, 5

Assessment 1: Lab Reports (3)

Due date: Weeks 4, 8 and 10

Students work in groups to complete experiments on refrigeration, packaging, and dehydration and then write a report to demonstrate their understanding of the lab goals, methods, results, and analysis. Students will receive feedback via Moodle.

Assessment 2: Assignments (3)

Due date: Weeks 4, 5, 7, 8, 9, 10

Students will complete three problem-solving assignments to consolidate their learning about refrigeration, evaporation, dehydration, and packaging. Each assignment will consist of multiple phases:

- an individual submission of the assignment (5 percent each),
- working with a peer prepare a revised assignment submission (7 percent each), and
- assessment of the peer's quality of feedback and engagement (3 percent each).

In addition to the peer feedback, students will receive feedback via a Moodle quiz in the individual submission and via Moodle after the revised peer submission.

Assessment 3: Final Exam

Due date: Exam Period

Summative assessment course learning outcomes. The final exam will test student understanding of both the technology and their problem-solving skills related to the unit operations covered in the course. Students will be required to undertake the final exam in person.

Attendance Requirements

Students must attend the three labs of the course scheduled on Fridays of weeks 3, 7 and 9. Students are also strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 29 May - 2 June	Lecture	This week has lectures-tutorials on refrigeration: Tuesday: 10:00 to 12:00 (introduction to unit operations and refrigeration)(Lecturer: Francisco Trujillo/Yong Wang) Thursday: 12:00 to 14:00 (Lecturer: Francisco Trujillo) Friday: 15:00 to 17:00 (Lecturer: Francisco Trujillo)
Week 2: 5 June - 9 June	Lecture	This week has lectures-tutorials on refrigeration and evaporation: Tuesday: 10:00 to 12:00 (refrigeration) (Lecturer: Francisco Trujillo) Thursday: 12:00 to 14:00 (refrigeration) (Lecturer: Francisco Trujillo) Friday: 15:00 to 17:00 (refrigeration/evaporation) (Lecturer: Francisco Trujillo)
Week 3: 12 June - 16 June	Lecture	This week has lectures-tutorials on evaporation: Tuesday: 10:00 to 12:00 (Lecturer: Francisco Trujillo) Thursday: 12:00 to 13:00 (Lecturer: Francisco Trujillo)
	Tut-Lab	This week has a 3 hour lab session on refrigeration on Friday from 14:00 to 17:00 at Science & Engineering building (SEB) 123 (K-E8-123).
Week 4: 19 June - 23 June	Lecture	This week has the following lectures-tutorials on evaporation and dehydration:

		Tuesday: 10:00 to 12:00 (evaporation) (Lecturer: Francisco Trujillo) Thursday: 12:00 to 14:00 (evaporation) (Lecturer: Francisco Trujillo) Friday: 15:00 to 17:00 (Dehydration) (Lecturer: Yong Wang)
	Assessment	This week has the following assessments: Lab report 1 - Refrigeration: due date on Thursday at 7 pm. Assignment 1 - Individual submission: due date on Friday at 7 pm.
Week 5: 26 June - 30 June	Lecture	This week has the following lectures-tutorials on dehydration: Tuesday: 10:00 to 12:00 (Lecturer: Yong Wang) Thursday: 12:00 to 14:00 (Lecturer: Yong Wang) Friday: 15:00 to 17:00 (Lecturer: Yong Wang)
	Assessment	This week has the following assessments: Assignment 1 – Team submission & Peer assessment: due date on Friday at 7 pm.
Week 7: 10 July - 14 July	Lecture	This week has the following lectures-tutorials on dehydration & packaging: Tuesday: 10:00 to 12:00 (dehydration & packaging) (Lecturer: Yong Wang) Thursday: 12:00 to 13:00 (packaging) (Lecturer: Yong Wang)
	Tut-Lab	This week has a 3 hour lab session on dehydration on Friday from 14:00 to 17:00 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: 17 July - 21 July	Lecture	This week has the following lectures-tutorials on packaging:

		Tuesday: 10:00 to 12:00 (Lecturer: Yong Wang) Thursday: 12:00 to 14:00 (Lecturer: Yong Wang) Friday: 15:00 to 17:00 (Lecturer: Yong Wang)
	Assessment	This week has the following assessments: Lab report 2 - Dehydration: due date on Thursday at 7 pm. Assignment 2 - Team submission & Peer assessment: due date on Friday at 7 pm.
Week 9: 24 July - 28 July	Lecture	This week has the following lectures-tutorials on packaging and extrusion: Tuesday: 10:00 to 12:00 (Packaging/Extrusion) (Lecturer: Yong Wang /Francisco Trujillo) Thursday: 12:00 to 13:00 (extrusion) (Lecturer: Francisco Trujillo)
	Tut-Lab	This week has a 3 hour lab session on packaging on Friday from 14:00 to 17:00 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: 31 July - 4 August	Lecture	This week has the following lectures-tutorials on extrusion and physical separations: Tuesday: 10:00 to 12:00 (extrusion) (Lecturer: Francisco Trujillo) Thursday: 12:00 to 14:00 (physical separations) (Lecturer: Francisco Trujillo) Friday: 15:00 to 17:00 (physical separations) (Lecturer: Francisco Trujillo)
	Assessment	This week has the following assessments: Lab report 3 - Packaging: due date on Thursday 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 not required unless specifically requested for an individual assessment task; 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 respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect. Please make it easy for the markers who are looking at your work to see your achievement and give you due credit.

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) and will not be accepted more than 5 days late. For some activities including Exams, Quizzes, Peer Feedback, 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 for **all** special consideration requests (including COVID-19-related requests), students will need documentary evidence to support absences from any classes or assessments.

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.

To help describe what we are looking for, here are some things that we consider to be quite acceptable (even desirable!) actions for many assessments, and some that we consider to be unacceptable in most circumstances. Please check with the instructions for your assessments and your course coordinator if you're unsure. As a rule of thumb, if you don't think you could look the lecturer in the eye and say "this is my own work", then it's not acceptable.

Acceptable actions	Unacceptable actions
✓ reading/searching through material we have given you, including lecture slides, course notes, sample problems, workshop problem solutions	✗ asking for help with an assessment from other students, friends, family
✓ reading/searching lecture transcripts	✗ asking for help on Q&A or homework help websites
✓ reading/searching resources that we have pointed you to as part of this course, including textbooks, journal articles, websites	✗ searching for answers to the specific assessment questions online or in shared documents
✓ reading/searching through your own notes for this course	✗ copying material from any source into your answers
✓ all of the above, for any previous courses	✗ using generative AI tools to complete or substantially complete an assessment for you
✓ using spell checkers, grammar checkers etc to improve the quality of your writing	✗ paying someone else to do the assessment for you
✓ studying course material with other students	

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.

Artificial intelligence tools such as ChatGPT, CodePilot, and built-in tools within Word are modern tools that are useful in some circumstances. In your degree at UNSW, we're teaching you skills that are needed for your professional life, which will include how to use AI tools responsibly plus lots of things that AI tools cannot do for you. AI tools already are (or will soon be) part of professional practice for all of us. However, if we were only teaching you things that AI could do, your degree would be worthless, and you wouldn't have a job in 5 years.

Whether the use of AI tools in an assessment is appropriate will depend on the goals of that assessment. As ever, you should discuss this with your lecturers – there will certainly be assessments where the use of AI tools is encouraged, as well as others where it would interfere with your learning and place you at a disadvantage later. Our goal is to help you learn how to ethically and professionally use the tools available to you. To learn more about the use of AI, see this discussion we have written where we analyse the strengths and weaknesses of generative AI tools and discuss when it is professionally and ethically appropriate to use them.

While AI may might provide useful tools to help with some assessments, UNSW's policy is quite clear that taking the output of generative AI and submitting it as your own work will never be appropriate, just as paying someone else to complete an assessment for you is serious misconduct.

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 for information about key dates, access to services, and lots more information
- Engineering Student Life - Current Student Resources for information about everything from getting to campus to our first year guide
- Student Support and Success for our UNSW team dedicated to helping with university life, visas, wellbeing, and academic performance
- Academic Skills to brush up on some study skills, time management skills, get one-on-one support in developing good learning habits, or join workshops on skills development
- Student Wellbeing, Health and Safety for information on the UNSW health services, mental health support, and lots of other useful wellbeing resources
- Equitable Learning Services for assistance with long term conditions that impact on your studies
- IT Service Centre for everything to do with computing, including installing UNSW licensed software, access to computing systems, on-campus WIFI and off-campus VPNs

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. Most 6 UoC courses will involve approximately 10-12 hours per week of work on your part. If you're not sure what to do in these hours of independent study, the resources on the UNSW Academic Skills pages offer some suggestions including: making summaries of lectures, read/summarise sections from the textbook, attempt workshop problems, reattempting workshop problems with some hints from the solutions, looking for additional problems in the textbook.

Full-time enrolment at university means that it is a *full-time* occupation for you and so you would typically need to devote 35 hours per week to your studies to suceed. Full-time enrolment at university is definitely incompatible with full-time employment. Part-time/casual employment can certainly fit into your study schedule but you will have to carefully balance your study obligations with that work and decide how much time for leisure, family, and sleep you want left after fullfilling your commitments to study and work. Everyone only gets 168 hours per week; overloading yourself with both study commitments and work commitments leads to poor outcomes and dissatisfaction with both, overtiredness, mental health issues, and general poor quality of life.

On-campus class attendance

In 2023, most classes at UNSW are running in a face-to-face mode only. Attendance is expected as is

participation in the classes. As an evidence-driven engineer or scientist, you'll be interested to know that education research has shown students learn more effectively when they come to class, and less effectively from lecture catch-up recordings. If you have to miss a class due to illness, for example, we expect you to catch up in your time, and within the coming couple of days.

For most courses that are running in an "in person" mode:

- Lectures are normally recorded to provide an opportunity to review material after the lecture; lecture recordings are not a substitute for attending and engaging with the live class.
- Workshops/tutorials are not normally recorded as the activities that are run within those sessions normally cannot be captured by a recording. These activities may also include assessable activities in some or all weeks of the term.
- Laboratories are not recorded and require in-person attendance. Missing laboratory sessions may require you to do a make-up session later in the term; if you miss too many laboratory sessions, it may be necessary to seek a Permitted Withdrawal from the course and reattempt it next year, or end up with an Unsatisfactory Fail for the course.
- Assessments will often require in-person attendance in a timetabled class or a scheduled examination.

This course outline will have further details in the Course Schedule and Assessment sections.

Class numbers are capped in each class to ensure appropriate facilities are available, to maintain student:staff ratios, and to help maintain adequate ventilation in the spaces. Only students enrolled in each specific 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 classes.

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 have COVID-19 or have been advised to self-isolate by NSW health or government authorities.

Asking Questions

Asking questions is an important part of learning. Learning to ask good questions and building the confidence to do so in front of others is an important professional skill that you need to develop. The best place to ask questions is during the scheduled classes for this course, with the obvious exception being questions that are private in nature such as special consideration or equitable learning plans. Between classes, you might also think of questions — some of those you might save up for the next class (write them down!), and some of them you might ask in a Q&A channel on Teams or a Q&A forum on Moodle. Please understand that staff won't be able to answer questions on Teams/Moodle immediately but will endeavour to do so during their regular working hours (i.e. probably not at midnight!) and when they are next working on this particular course (i.e. it might be a day or two). Please respect that staff are juggling multiple work responsibilities (teaching more than one course, supervising research students, doing experiments, writing grants, …) and also need to have balance between work and the rest of their life.

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

Pilot Hall with experiment rigs // UNSW Chemical Engineering

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.