School of Chemical Engineering

UNSW Engineering

FOOD3060

Food Processing Principles

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

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

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

Processing foods at industrial scale requires engineers and food technologists to integrate and apply knowledge from a range of fields. Consider the processing of milk for sale, food safety is assured and consistent consumer experience is achieved through the processes of pasteurisation and homogenisation before packaging. Managing these operations requires you to apply the basic principles of fluid flow and heat transfer, along with an understanding of microbiology. While optimising evaporation and drying in the production of milk powder will require you to apply the principles of material and energy balances and mass transfer.

In this course you will learn the basic physical and engineering principles required to understand the processing of foods at industrial scale. You will be equipped with the basic knowledge to work as a food engineer in food manufacturing companies. The course concentrates on the following topics:

1. Mass and energy balances, including basic principles of thermodynamics, to analyse processing unit operations,
2. Fluid flow, to understand the flowing characteristics of liquid foods,
3. Heat transfer, to understand the cooling and heating of food for preservation,
4. Thermal processing, to understand the effect of temperature on the inactivation of microorganisms for food preservation,
5. Mass transfer, to understand the movement of mass due to gradients of concentration,
6. Particles in foods, as many food ingredients are in the form of particles, and
7. Mixing, which is a fundamental operation for making foods.

Course Aims

This course is a central component of the food science curriculum, allowing students to develop foundational skills and knowledge in food production engineering. This course develops the fundamentals that students acquired in first-year physics and mathematics courses into principles of food processing such as mass and energy balances, fluid flow, and heat and mass transfer. Those principles are then used in subsequent courses to study individual unit operations, which are the building blocks for converting raw materials into finished products.

At the end of this course, students will understand the basic principles governing the transformation of foods during processing, and how to do simple mass and energy balances across a single processing stage or a complete food production plant. Students will also understand the correlations between heat processing and food preservation, as well as the basics of mass transfer and the processing of food particles.

Course Learning Outcomes

1. Calculate material and energy balances for food processes
2. Apply concepts of flow and viscosity as related to the transport of liquid foods
3. Solve problems of steady and unsteady state heat transfer
4. Calculate thermal effects on microorganisms as a function of temperature profiles
5. Apply principles of mass transfer and particle processing to relevant food operations

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

Teaching Strategies

The theoretical content of the course will be presented in lectures and will require students' close attention and participation. However, applying those concepts correctly to solve problems is more important than simply comprehending theoretical concepts. Therefore, this course is primarily focused on problem solving rather than the presentation and consumption of information.

To enable practice, tutorials are integrated into the lectures where students will solve problems during the class and may immediately seek assistance. In this way, students will internalise the concepts and develop problem solving skills. If students do not participate in this process, it is unlikely that they will be able to apply the material at the level required to pass the course.

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. The textbook provides a secondary perspective on the material, with additional worked examples, but without opportunity for feedback. Active participation in lectures is essential.

Given the importance of practising to cement learning, quizzes will provide feedback on student mastery of the basic course material. After quizzes close, they will become available for practice purposes only. The assignment is designed to enable students to practice more complex problems to enhance problem-solving skills and to integrate different topics of the course material.

Additional Course Information

The course is organised into 6 hours of contact per week over a 10-week trimester, except on week 6. Each lecture block may include lectures and tutorials sessions for practicing solving problems. Course materials will be provided through the Moodle course page.

Students are expected to have studied Physics (PHYS1111 or PHYS1121 or PHYS1131) and Mathematics (MATH1031 or MATH1131 or MATH1141) to Year 1 University standard or equivalent. Concepts taught in these courses are assumed knowledge in FOOD3060.

The processing principles taught in this course are used extensively in FOOD3801/FOOD8801 (Unit Operations in Food Processing) and in FOOD3010/FOOD8010 (Food Products and Ingredients Technology), where they are relevant to pasteurization and canning.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quizzes	35%	Weeks 4, 6, 7, 10 and 11	1, 2, 3, 4, 5
2. Assignment	20%	06/08/2023 11:00 PM	1, 2, 3
3. Final Exam	45%	Exam Period	1, 2, 3, 4, 5

Assessment 1: Quizzes

Submission notes: Quizzes go from weeks 2 to 11. See the course schedule for the opening and closing dates of the quizzes.
Due date: Weeks 4, 6, 7, 10 and 11

Students will complete five online quizzes across the term to assess their understanding of lecture content. Each quiz can be attempted multiple times within a time frame of 1 to 2 weeks, with highest mark. The quizzes will provide direct feedback to students after completion on their progress and understanding.

Assessment 2: Assignment

Due date: 06/08/2023 11:00 PM

Students will complete a final assignment to assess their problem-solving skills. It will contain more complex questions than in the quizzes and may require graphical solutions. Written feedback and marks will be provided.

Assessment 3: Final Exam

Due date: Exam Period

Students will complete a final exam that tests their understanding of the fundamental principles taught in the class and its application through problem-solving. The final exam focuses on individual achievement and competence in the subject matter, in line with our accreditation obligations. Feedback will be provided in the form of a final mark. Students will be required to undertake the final exam in person.

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: 29 May - 2 June	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 01 Introduction, 02 Dimensions, units, systems & properties of foods. Wednesday: 10am-12pm, Civil Engineering 701 (K-H20-701). Lecture on 03 Mass balances. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 03 Mass balances.
Week 2: 5 June - 9 June	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 03 Mass balances. Wednesday: 10am-12pm, Civil Engineering 701 (K-H20-701). Lecture on 04 Thermodynamics and energy balances. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 04 Thermodynamics and energy balances.
	Assessment	Quiz 1 opens on Tuesday at 5 pm.
Week 3: 12 June - 16 June	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 04 Thermodynamics and energy balances. Wednesday: 10am-12pm, Civil Engineering 701 (K-H20-701). Lecture on 04 Thermodynamics and energy balances. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 04 Thermodynamics and energy balances.
Week 4: 19 June - 23 June	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 04 Thermodynamics and energy balances, 05 Fluid Flow. Wednesday: 10am-12pm, Civil Engineering 701

		(K-H20-701). Lecture on 05 Fluid Flow. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 05 Fluid Flow.
	Assessment	Quiz 1 closes on Tuesday at 5pm. Quiz 2 opens on Tuesday at 5pm.
Week 5: 26 June - 30 June	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 05 Fluid Flow, 06 Liquid transport system & pumps. Wednesday: 10am-12pm, Civil Engineering 701 (K-H20-701). Lecture on 06 Liquid transport system & pumps, 07 Flow and viscosity measurements. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 08 Non-Newtonian fluids, 09 Heat transfer.
	Assessment	Quiz 3 opens on Friday at 12 pm (noon).
Week 6: 3 July - 7 July	Assessment	Quiz 2 closes on Tuesday at 5pm.
Week 7: 10 July - 14 July	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 09 Heat transfer. Wednesday: 10am-12pm, Civil Engineering 701 (K-H20-701). Lecture on 09 Heat transfer. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 09 Heat transfer.
	Assessment	Quiz 3 closes on Friday at 12 pm (noon).
Week 8: 17 July - 21 July	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 10 Heat exchangers. Wednesday: 10am-12pm, Civil Engineering 701 (K-H20-701). Lecture on 10 Heat exchangers & 11 Unsteady state heat transfer. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 11 Unsteady state heat transfer.
	Assessment	Quiz 4 opens on Wednesday at 12 pm (noon).
Week 9: 24 July - 28 July	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 11 Unsteady state heat transfer.

		Wednesday: 10am-12pm, Civil Engineering 701 (K-H20-701). Lecture on 12 Thermal processing. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 12 Thermal processing.
Week 10: 31 July - 4 August	Lecture	Tuesday: 3 pm-5 pm, Old Main Building 151 (K-K15-151). Lecture on 12 Thermal processing. Wednesday: 10am-12pm, Civil Engineering 701 (K-H20-701). Lecture on 13 Mass Transfer. Friday: 10am-12pm, Goldstein G03 (K-D16-G03). Lecture on 14 Particles in Foods & mixing.
	Assessment	Quiz 4 closes on Wednesday at 12 pm (noon). Quiz 5 opens on Tuesday at 5 pm. The due date of the assignment is on Sunday at 11 pm.
Stuvac: 7 August - 11 August	Assessment	Quiz 5 closes on Sunday at 5 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
- 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
- Fellows, P.J., 2009. *Food processing technology: principles and practice*. Elsevier. https://www.sciencedirect.com/book/9781845692162/food-processing-technology

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.