School of Chemical Engineering

UNSW Engineering

FOOD9100

Advanced Processing Technologies

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Francisco Trujillo	francisco.trujillo@unsw.edu.au	Monday 2:00 PM to 3:00 PM (Weeks:1-5,7-10)	Room 420, Hilmer building (Enter via the Science and Engineering Building SEB E8)	+61293855648

Lecturers

Name	Email	Availability	Location	Phone
Yong Wang	yong.wang2@unsw.edu.au			
Ernest Tse	e.tse@unsw.edu.au			
Koentadi Hadinoto	k.hadinoto@unsw.edu.au			

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

This course consists of lectures and discussion groups covering advanced technologies for food processing, safety and preservation. Lecture notes will be supplemented with a list of reading material, including book chapters and journal papers, for class preparation. Lectures will introduce the topics according to the schedule but students are advised to read the supplementary material in advance in order to discuss in class. Basic principles such as Fluid dynamics and Fluid Rheology, Introduction to Plasma, linear and non-linear acoustic, electromagnetism and Kinetics of Microbial and Quality Attributes of Fluid Food will be introduced in the context of novel thermal and non-thermal food processing technologies. Technologies covered include novel-thermal process (such as ohmic, microwave and infrared heating) and non-thermal technologies (including pulsed electric field, radio frequency electric fields, high pressure, ultrasound, irradiation, plasma, ozone, ultraviolet and pulsed light) as they are applied specifically to foods. The course covers basic physical principles, engineering design of technologies, efficacy and mechanisms of microbial inactivation along with nutritional-quality retention and enhancement.

This course is an extension of FOOD3801 (Unit Operations in Food Processing) and FOOD8450 (Advanced Food Engineering), which teach well established food processing technologies focusing on traditional thermal treatments. Thermal processing is a cornerstone of the food industry that provides food safety and extends shelf-life. However, such treatments may lead to losses of desired organoleptic properties and damage to temperature labile nutrients and vitamins. FOOD9100, on the other hand, covers innovative thermal and non-thermal technologies that have been sought by the food industry as alternatives to traditional processes to meet the required food product safety or shelf-life demands while minimizing detrimental effects on its nutritional and quality attributes. The course will apply physical principles, such as electromagnetism, plasma physics and transport phenomena to understand the engineering aspects of new technologies and to be able to implement them into industrial food processes. Each of the proposed technologies will be studied in terms of its engineering, microbiological, nutritional and food quality aspects. Student will be able to use this new knowledge to design process to enhance the quality of food products, to develop new food processing operation and to improve existing traditional food processing technologies.

Course Aims

The objective of this course is learning the principles of non-thermal and novel-thermal food processing technologies. The aims are that student understands the following aspects for each technology covered in the course:

1. Mechanism of actions
2. Physical and engineering aspects
3. Effects on microorganisms
4. Effects on food chemistry and nutritional profiles

This knowledge gives to students the foundation to develop novel-thermal and non-thermal food processing operations, to enhance the quality of food products and to improve existing traditional food processing operations with these novel technologies.

Course Learning Outcomes

1. Understand the physical principles as well as engineering, microbiological and food quality-nutritional aspects related to the advanced processing technologies covered in the course.
2. Design and develop new industrial food processes, based on the technologies learnt in this course, to improve current processing operations or to enhance the quality and nutritional aspect of traditional or new food products.
3. Research the scientific literature in depth in order to advance the knowledge of the course independently and to apply that knowledge to design and develop new food processes or products.

Professional Recognition of Course:

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 instructional method employed in this course is based on students reading and studying the material in advance to find gaps in the knowledge, connecting different parts of the literature, to propose new applications and solutions to improve the quality of foods and the efficiency of food processes with novel-thermal and non-thermal technologies. This strategy develops cognitive skills and critical thinking at a postgraduate level. Students are expected to investigate, generate and synthesize complex ideas and concepts, critically evaluate them and articulate them for discussion in class. Those concepts and new generated insights should be applied to develop new food process and products towards the end of the teaching period working on groups of 3 to 5 members. Lecturers will introduce those technologies and will guide students on their learning process.

With this approach students will not only advance their knowledge on advance food processing technologies but also will develop critical thinking and analytical skills to solve complex problems in an innovative manner. Students will also develop skills to articulate and communicate their ideas to solve specific problems. To succeed in this course students should demonstrate personal independence and team accountability as well as technical skills to apply basic principles to solve current problems on the food processing industry.

Additional Course Information

Students are expected to have studied Chemistry, Physics and Mathematics to Year 1 University standard or equivalent. It is also recommended, although is not necessary, that students had studied traditional food processing technologies as taught on FOOD3801. Traditional processing technologies are widely used by the industry and should be mastered by students before learning advanced technologies, which are either under research or not yet widely used by the industry.

This course is recommended to graduate students of food science, food engineering and chemical or biochemical engineering who are interested in advanced food processing technologies. However, undergraduates and graduates from other disciplines with requisite background will also be considered.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quiz	10%	07/10/2022 06:00 PM	1
2. Video Presentation	15%	11/11/2022 06:00 PM	1, 2, 3
3. Written Project	25%	18/11/2022 06:00 PM	1, 2, 3
4. Final Exam	50%	Exam Period	1

Assessment 1: Quiz

Start date: 07/10/2022 06:00 AM
Due date: 07/10/2022 06:00 PM

This is a 30 minute quiz on the basic concepts learnt on weeks 1 to 4. Students will get marks only for correct answers.

Assessment 2: Video Presentation

Due date: 11/11/2022 06:00 PM

Students working in teams will submit a 7 to 10 minutes video presentation, which is complementary to the written report. The same team will work on the same project to submit the written report and the video presentation. The main difference between the two formats is that that written report must contain an in-depth presentation, analysis and discussion of the problem and its solution, while the video presentation is intended to inform a wider audience of the problem, solutions, major findings and analysis.

The video must be uploaded in Moodle on Friday week 9 11/11/2022 by 06:00 PM. A questions and answers session is scheduled on Tuesday week 10 15/11/2022 from 04:00 PM to 06:00 PM, where the teams will present the videos to the class and lectures will ask questions about the project.

The presentation will be assessed in terms of:

1) Scientific/technical content.

2) Creativity & Feasibility.

3) Quality of the video presentation.

4) Presentation skills.

5) Answering questions.

Assessment 3: Written Project

Due date: 18/11/2022 06:00 PM

Students will work in groups of 3 to 5 members. The team will select an advanced thermal or non-thermal technology to design and develop a new industrial food process or a product, or to improve a traditional food processing technology or to enhance the quality and nutritional aspects of a traditional or a new food product.

The following aspects must be covered:

- microbiology,
- engineering,
- physical principles,
- food quality and nutritional aspects.

Students must research the scientific literature in depth and apply that knowledge to design and develop a new food process or product.

Students must propose new applications and solutions that improve the quality of foods and the efficiency of food processes with novel-thermal and non-thermal technologies. Student should demonstrate critical thinking at a postgraduate level.

It is expected that students will identify gaps in the knowledge and will connect different parts of the literature. Students should investigate, generate, and synthesize complex ideas and concepts, critically evaluate them and articulate them in the written report following sound scientific and logical principles.

The project will be assessed in terms of:

a) Quality of the design of a food-process or product.

b) Understanding and correct application of the technology.

c) In-depth research of the scientific literature.

d) Creativity and feasibility.

Assessment 4: Final Exam

Due date: Exam Period

The final exam will assess the understanding of the processing technologies learnt on the curse. Students will be asked questions that cover physical principles, engineering, microbiological and food quality aspects of those technologies. This will be a 2-hour exam and the feedback will be represented by the mark.

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: 12 September - 16 September	Lecture	Lecture: Introduction to the course and to Novel Thermal and Non-Thermal food processing Time: Monday 12:00 PM to 2:00 PM Lecture Room: Physics Theatre (K-K14-19) Lecturer: Francisco Trujillo
Week 2: 19 September - 23 September	Lecture	Lecture: Fluid dynamics and Fluid Rheology in Novel processing Technologies & High Pressure Processing Time: Monday 12:00 PM to 2:00 PM Lecture Room: Physics Theatre (K-K14-19) Lecturer: Francisco Trujillo
Week 3: 26 September - 30 September	Lecture	Lecture: Pulsed Electric Fields & Radio Frequency Electric Fields Time: Monday 12:00 PM to 2:00 PM Lecture Room: Physics Theatre (K-K14-19) Lecturer: Ernest Tse
Week 4: 3 October - 7 October	Lecture	No Lecture – Public Holiday Discussion on ideas for the final project (make a Team' appointment with Francisco Trujillo)
	Assessment	Quiz
Week 5: 10 October - 14 October	Lecture	Lecture: Introduction to Plasma physics, Plasma food processing Lecture Room: Physics Theatre (K-K14-19)

		Lecturer: Koentadi Hadinoto
Week 7: 24 October - 28 October	Lecture	Lecture: Introduction to linear and non-linear acoustics & Ultrasound Time: Monday 12:00 PM to 2:00 PM Lecture Room: Physics Theatre (K-K14-19) Lecturer: Francisco Trujillo
	Web	Internet resources as an alternative to lab demonstrations (Ultrasound, High pressure, Plasma, Radio Frequency electric fields). Students are encouraged to watch the provided online videos demonstrating some of the novel technologies learnt in this course.
Week 8: 31 October - 4 November	Lecture	Lecture: Novel Thermal Heating (ohmic, microwave and infrared heating) Time: Monday 12:00 PM to 2:00 PM Lecture Room: Physics Theatre (K-K14-19) Lecturer: Yong Wang
Week 9: 7 November - 11 November	Lecture	Lecture: Modelling the Kinetics of Microbial and Quality Attributes of Fluid Food During & Ozone Time: Monday 12:00 PM to 2:00 PM Lecture Room: Physics Theatre (K-K14-19) Lecturer: Ernest Tse
	Assessment	Video Presentation
Week 10: 14 November - 18 November	Lecture	Lecture: ultraviolet and pulsed light Time: Monday 12:00 PM to 2:00 PM Lecture Room: Physics Theatre (K-K14-19) Lecturer: Ernest Tse
	Workshop	Video presentations and Questions and Answers. Time: Tuesday the 15/11/2022 from 4:00 PM to 6:00 PM. Lecture room: To be announced

	Assessment	Written Project

Resources

Prescribed Resources

1. Novel Thermal and Non-thermal Technologies for Fluid Foods. PJ Cullen (Editor), Brijesh K. Tiwari (Editor), Vasilis Valdramidis (Editor). ISBN-10: 0123814707. 2012.
2. Nonthermal Processing Technologies for Food. Howard Q. Zhang (Editor), Gustavo V. Barbosa-Canovas (Editor), V. M. Bala Balasubramaniam (Editor), C. Patrick Dunne (Editor), Daniel F. Farkas (Editor),James T. C. Yuan (Editor). ISBN: 978-0-8138-1668-5. 2011.
3. Emerging Technologies for Food Processing, Second Edition, edited by Da-Wen Sun. Academic Press, 2014.
4. Advances in Thermal and Non-Thermal Food Preservation. Gaurav Tewari (Editor), Vijay Juneja (Editor). ISBN-10: 0813829682. 2007.
5. Non-thermal Food Engineering Operations. Enrique Ortega-Rivas. ISBN-10: 1461420377. 2012.
6. Multiphysics Simulation of Emerging Food Processing Technologies, edited by Pablo Juliano Kai Knoerzer, Peter Roupas and Cornelis Versteeg. Indianapolis, USA.: Wyley & Sons., 2011.

Course Evaluation and Development

Student feedback is extremely valuable and you are expected to provide feedback on the course, directly to the teachers of via MyExperience Survey

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

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Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.