School of Chemical Engineering

UNSW Engineering

CHEN6703

Advanced Particle Systems Engineering

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Rona Chandrawati	rona.chandrawati@unsw.edu.au	9:00-17:00	Hilmer Building (E10), Room 418	N/A
Kang Liang	kang.liang@unsw.edu.au	9:00-17:00	Hilmer Building (E10), Room 320	N/A

Administrators

Name	Email	Availability	Location	Phone
Federico Mazur	federico.mazur@unsw.edu.au	9:00-17:00	Science and Engineering Building (E8), Room 413	N/A

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

The ability to create and control the properties and functions of particles has transformed our world and continues to disrupt industry with new innovations and advances. Particles occur in many processes and products, across a wide range of industries, from food and pharmaceuticals to energy and water to mining and manufacturing. Everything from basic goods like flour and cement, to the most advanced technologies like electric cars, computers and solar panels contain particles or are produced from particulate products. In fact, 80% of all products synthesized or chemically produced go through a particle phase. Therefore, an understanding of this field will be incredibly helpful in preparing for the future of chemical and chemical product engineering.

In this advanced course you will learn about the fascinating nature of particles, colloid and interface science, and its applications, techniques, and processes, with a particular focus on:

- Biotechnology and Pharmaceutical
- Food
- Environmental
- Energy

Building on your existing knowledge of particle and fluid mechanics, you will be introduced to the theory and principles of colloid and interface science, and then explore advanced particle size and surface characterization techniques, as well as nanotechnology and advanced particle synthesis. You will deepen and extend your knowledge of some areas through case studies and group activities.

Course Aims

This course aims to introduce students to the theory and current advances in the synthesis, characterization, separation, and applications of particles. The course explores particle technology across all length scales from granular materials to nano-sized particles and builds on students' existing knowledge of fluid and particle mechanics.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Identify organic and inorganic particles, and their physical and chemical material properties, such as surface charge, morphology, and crystallinity.	PE1.1, PE1.6, PE1.2, PE1.3
2. Describe an array of particle synthesis techniques and principles.	PE1.1, PE1.2, PE1.3, PE1.6
3. Explain the relationship between colloid phenomena, their properties, and applications.	PE1.1, PE1.2, PE1.3, PE1.6

Learning Outcome	EA Stage 1 Competencies
4. Describe advances in the applications of nanoparticles.	PE1.3, PE1.4, PE1.6, PE2.1
5. Work in a group to communicate your knowledge of one or two specific topics in particle technology in an understandable, clear, and precise manner.	PE1.3, PE1.4, PE1.6, PE2.1, PE3.2, PE3.6
6. Investigate and critically evaluate the relative advantages and limitations of advanced particle processes for a wide range of applications.	PE1.3, PE1.4, PE1.6, PE2.1, PE3.2

Teaching Strategies

This advanced course uses a range of teaching strategies including lectures, tutorials built into the lectures, and group work.

The lectures introduce students to the fundamental theory and principles of colloids and particles, and their applications. They also equip students for their own independent learning to achieve the course learning outcomes.

Tutorial case studies will give students an opportunity to practice using their knowledge and skills to solve problems and analyse applications of this technology, as well as critically analysing gaps in the particles industry.

The group work facilitates peer learning so students can deepen their understanding of course content, and further develop their skills in teamwork and communication.

Additional Course Information

CHEN6703 is based on the particle and separation knowledge acquired in CEIC2001. As an advanced course, it will cover lectures, group work, reports and group presentations.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Mini Quiz (online)	5%	Week 3	1, 2
2. Assignment	15%	Week 5	1, 2, 3, 4
3. Quiz	40%	Week 8	1, 2, 3, 6
4. Oral Group Presentation	20%	Week 10	1, 2, 3, 4, 5
5. Report	20%	Stuvac	1, 2, 3, 4, 6

Assessment 1: Mini Quiz (online)

Due date: Week 3

Assessments of first part of the course (Week 1 – 2 topics)

Assessment 2: Assignment

Due date: Week 5

Assessment to monitor and reinforce students' understanding on the following topics: particle synthesis, characterization, formulations, processes, and applications.

Assessment 3: Quiz

Due date: Week 8

The quiz assesses students quantitative and qualitative competence in particle synthesis, characterization, formulations, and their applications.

Assessment 4: Oral Group Presentation

Due date: Week 10

All students will be expected to produce a video presentation on the roles, cutting-edge particle applications, and safety concerns and environmental issues raised from the products or processes involved.

Assessment 5: Report

Due date: Stuvac

Students will write a 2000-word report that provides a perspective on contemporary issues related to particles or particle technology in Australia and the world.

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	Introduction to the course Particle System and Synthesis Techniques: • Organic particles • Inorganic particles
Week 2: 5 June - 9 June	Lecture	Particle Characterization Techniques: • Organic particles • Inorganic particles
	Group Activity	Topics for video presentation and report
Week 3: 12 June - 16 June	Lecture	Particle Processing Techniques
	Group Activity	Case Study
	Assessment	Mini Quiz (online)
Week 4: 19 June - 23 June	Lecture	Advanced Particle Applications: • Biotechnology and Biocatalysis • Environment
Week 5: 26 June - 30 June	Lecture	Particle Catalytic Activity Advanced Particle Applications: Biosensors for Health and Food
	Group Activity	Case Study
Week 6: 3 July - 7 July		Flexibility Week
Week 7: 10 July - 14 July	Lecture	Advanced Particle Applications: Pharmaceutical and Food
Week 8: 17 July - 21 July	Assessment	Quiz
Week 9: 24 July - 28 July	Lecture	Advanced Particle Applications

	Group Activity	Group topics discussions
Week 10: 31 July - 4 August	Lecture	Advanced Particle Applications
	Assessment	Oral Group Presentation
Stuvac: 7 August - 11 August	Assessment	Report

Resources

Prescribed Resources

Resources for Students

Materials will be distributed through Moodle prior to the lecture most weeks. Additional materials and readings can be found on websites and other sources to be referred to by the lecturer in charge.

For group projects and presentation, students should utilize materials in the public domain including technical journals and other resources which can be obtained from the UNSW Library. One starting point for assistance is: library.unsw.edu.au/study/services-for-students/how-to-get-course-resources

Assistance from the library could be gained.

Further resources can be found in other course outlines, for example, hints for thesis writing in the research project outline.

Teaching Strategies

The advanced class covers a range of teaching strategies including lectures, tutorials built into the lectures and significant group work. The lectures provide the basis and knowledge required to gain for this course while the group work will enable the students to deepen their understanding in particular topics and train them in teamwork, report writing and presentations.

The rationale behind the approach to learning and teaching

Lectures are designed to give students background on the development and applications of particles. Students are encouraged to work in a group as well as individually to research on specific topics, write reports and give presentations.

Students are to give presentations on an assigned topic after introductory materials are given by the lecturer.

Self-learning through reference books/technical papers/webpages and other reference materials.

Students will also be assessed by assignment and a quiz on the Advanced Particle lecture materials.

Other Matters:

Calculators are sometimes required in final exams but are no longer supplied by the university. You must provide your own accredited calculator, see university policy
at: https://student.unsw.edu.au/exam-approved-calculators-and-computers

School policy on administrative matters relating to undergraduate students, including matters relating to examination procedures, and what to do in the event of illness or misadventure, may be found on the School's website
at: https://www.engineering.unsw.edu.au/chemical-engineering/student-resources/policies-procedures

Information on UNSW Occupational Health and Safety policies and expectations may be found
at: https://safety.unsw.edu.au/

Students who have a disability that requires some adjustment in their learning and teaching environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of the course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734). Information for students with disabilities is available at: https://student.unsw.edu.au/disability

Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional examination and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

Course Evaluation and Development

Your feedback on the course will be gathered which is then considered carefully with a view to acting on it constructively wherever possible.

The course outline provides you with an opportunity to fulfill an important responsibility in relation to evaluation, that is, convey how feedback has helped shape the course. In other words, the course outline can be used for communicating how the development of the course has been informed by student feedback.

At any time, feedback can be provided to the course coordinator A/Prof Rona Chandrawati and Dr Kang Liang in person or by email.

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.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	
PE2.3 Application of systematic engineering synthesis and design processes	
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	✓