# CHEN6703

## Advanced Particle Systems Engineering

Term Two // 2021

School of Chemical Engineering // UNSW Engineering

# 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 | |
| Kang Liang | kang.liang@unsw.edu.au | 9:00-17:00 | Hilmer Building (E10), Room 320 | |

### Administrators

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

## School Contact Information

For assistance with enrolment, class registration, progression checks and other administrative matters, please see the Nucleus: Student Hub. They are located inside the Library – first right as you enter the main library entrance. You can also contact them via http://unsw.to/webforms or reserve a place in the face-to-face queue using the UniVerse app.

If circumstances outside your control impact on submitting assessments, Special Consideration may be granted, usually in the form of an extension or a supplementary assessment. Applications for Special Consideration must be submitted online.

For course administration matters, please contact the Course Coordinator.

# Course Details

## Credit Points 6

## Summary of the Course

CHEN6703 is an advanced course where you will learn about the fascinating nature of particles, colloid and interface science, its applications and processes involved. Particles occur in a large number of processes and products. 80% of all products synthesized or chemically produced go through a particle phase. Thus, particles are important in the majority of industries including food, biotech, pharmaceuticals, energy, water, and manufacturing as all metals and minerals are processed as particles. Everyday products and future products such as electric cars, computers and mobile phones contain particles or are produced from particulate products.

The course will cover a range of topics, processes, and techniques related to particle technology which occur in the following industries:

- Biotechnology and Pharmaceutical
- Food
- Environmental
- Energy

Theory and basics of colloid and interface science will be introduced. Advanced particle size and surface characterization techniques will be discussed together with nanotechnology and advanced particle synthesis. Some of the above topics will be detailed and deepened by case studies and group projects.

## Course Aims

The course introduces an understanding of interactions between particles in solutions, self-assembly to form “soft” particles, the current development and various synthesis, characterization, separation, and applications of particles. From granular materials, the course goes further to smaller particles and droplets down to nano-sized particles.

## Course Learning Outcomes

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

| Learning Outcome | EA Stage 1 Competencies |
|---|---|
| 1. After completing this course, students should be familiar with basic principles of colloid and interface science, physical and chemical material properties such as surface charge, hydrophobicity and others. | PE1.1, PE1.2, PE1.6 |
| 2. Students should have general knowledge on advanced particle synthesis techniques and principles. | PE1.1, PE1.2, PE1.5, PE1.4 |
| 3. Students should know about the advanced, new applications of micro- and nanoparticles and their safety issues. | PE3.1, PE3.3, PE2.1, PE2.2 |
| 4. Through group work, students should be able to transform | PE3.6, PE3.3, PE3.2, PE2.2, |

| Learning Outcome | EA Stage 1 Competencies |
| --- | --- |
| gained knowledge and understanding for one or two specific topics (depth) and present it in report and presentation style in an understandable, clear and precise manner. | PE3.4, PE1.3 |

## Teaching Strategies

The course is suitable for students who would like to learn more about the recent development and applications of particles. The knowledge and experiences gained will benefit in a broad range of jobs including working in food and biotechnology, pharmaceutical, nanotechnology, energy, environment, and all industries which process particles.

As most daily used goods and special equipment is based on a wide range of raw materials, which mostly are processed as particles, this course will provide a wide range of applications.

## 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, group reports and group presentations.

# Assessment

**Mark scaling for Professional Electives**

To ensure that students taking more difficult elective courses are not disadvantaged, the final marks in each Professional Elective will be adjusted by a scaling factor. The scaling procedure will be such that the average final mark of each elective class is proportional to the average WAM to date of the students in that class, i.e. the average mark to average WAM ratio is the same for all professional elective classes in a given session. Note that a student's individual WAM will have no effect on his/her mark, apart from its small influence on the class's average WAM.

## Assessment Tasks

| Assessment task | Weight | Due Date | Student Learning Outcomes Assessed |
|---|---|---|---|
| Mini-Quiz | 5% | Week 3 | 1, 2, 3 |
| Assignment | 15% | Week 5 | 1, 2, 3 |
| Mid-Term Quiz | 40% | Week 8 | 1, 2, 3 |
| Group Video | 20% | Week 10 | 1, 2, 3, 4 |
| Group Report | 20% | Week 10 | 1, 2, 3, 4 |

## Assessment Details

**Assessment 1: Mini-Quiz**

**Details:**

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

**Assessment 2: Assignment**

**Details:**

Formative assessment to allow students to monitor and reinforce their understanding of the topics

**Assessment 3: Mid-Term Quiz**

**Details:**

Summative assessment on Week 1 – 7 topics with quantitative and qualitative components

**Assessment 4: Group Video**

**Details:**

A discussion/perspective on contemporary issues related to particles in Australia industry.

Group work is a core part of this course as it simulates professional engineering work that is commonly done in teams.

Topics will be released in week 2 for selection.

Outstanding report may be selected for submission to Engineering Magazines (such as IChemE and RACI magazines).

Details of this assessment will be posted on Moodle.

**Assessment 5: Group Report**

**Details:**

A discussion/perspective on contemporary issues related to particles in Australia industry.

Group work is a core part of this course as it simulates professional engineering work that is commonly done in teams.

Topics will be released in week 2 for selection.

Outstanding report may be selected for submission to Engineering Magazines (such as IChemE and RACI magazines).

Details of this assessment will be posted on Moodle.

### Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

## Course Schedule

View class timetable

### Timetable

| Date | Type | Content |
|---|---|---|
| O Week: 25 May - 28 May | | |
| Week 1: 31 May - 4 June | Lecture | Introduction to the course<br><br>Particle System and Synthesis |
| Week 2: 7 June - 11 June | Lecture | Particle Characterization Techniques:<br><br>• Organic particles<br>• Inorganic particles |
| | Group Activity | Topics for video presentation and report |
| Week 3: 14 June - 18 June | Lecture | Particle Formulations Nanozymes |
| | Assessment | Assessment 1: Mini-Quiz |
| Week 4: 21 June - 25 June | Lecture | Advanced Particle Applications:<br><br>• Biosensors<br>• Pharmaceutical and Food |
| Week 5: 28 June - 2 July | Lecture | Advanced Particle Applications:<br><br>• Biotechnology and Biocatalysis<br>• Environment<br>• Energy |
| | Assessment | Assessment 2: Assignment |
| Week 6: 5 July - 9 July | | Flexibility Week |
| Week 7: 12 July - 16 July | Lecture | Particle dynamics, size and shape |
| Week 8: 19 July - 23 July | Assessment | Assessment 3: Mid-Term Quiz |
| Week 9: 26 July - 30 July | Lecture | Advanced Particle Applications:<br><br>• Energy and Catalysis |
| | Group Activity | Group topics discussions |
| Week 10: 2 August - 6 August | Lecture | Advanced Particle Applications:<br><br>• Nanoparticle engineering for sensing and drug delivery |
| | Assessment | Assessment 4-5: Group Video and 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.

## Recommended Resources

### IEAust / UNSW graduate attributes mapping

On completion of this course, you should be able to have achieved an understanding of advanced particle technology. You should be able to define the mechanism for self-assembly, important interactions of particles in solution, advanced particle handling, synthesis, applications, and issues relating to nanoparticles. You also should be able to use basic theoretical equations to calculate important parameters involved in particle interactions. You will have the opportunity to demonstrate those outcomes in the assignment and the quiz, during which your critical mind will be used on your new knowledge in a group report.

| **Be able to critically evaluate the relative advantages and limitations of advanced particle processes for a wide range of applications** | |
|---|---|
| 2. an in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context | The students will work in groups to assess the issues related to particles technology in specific applications during the group project |
| PE1.2 In-depth technical competence in at least one engineering discipline | |

| **Be able to actively search for relevant information so to better understand and implement the important concepts discussed in class** | |
|---|---|
| 4. the ability to engage in independent and reflective learning | The student will prepare discussion paper relating to important issues in particle technology |
| PE3.6 Capacity for lifelong learning and professional development | |

| **Students should understand important aspects of colloids and interfacial phenomena, new advances in the applications of nanoparticles, and membrane interactions with particles.** | |
|---|---|
| 2. an in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context | Students will be exposed to elements of colloid and surface chemistry relevant to particle interactions |
| PE3.6 Capacity for lifelong learning and professional development | Students will be exposed to new nanoparticle technology applications |
| 3. the capacity for analytical and critical thinking and for creative problem-solving | Students will be exposed to processes involving the application of particle science and technology |
| PE2.1 Ability to undertake problem identification, formulation, and solution | |

## 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 generally not required; when you submit work through Moodle for assessment you are agreeing to uphold the Student Code.

Some assessments will require you to complete the work online and it may be difficult for the course coordinator to intervene in the system after the due date. You should ensure that you are familiar with assessment systems well before the due date. If you do this, you will have time to get assistance before the assessment closes.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

### Late penalties

Unless otherwise specified, submissions received after the due date and time will be penalised at a rate of 10% per day or part thereof (including weekends). For some activities including Moodle quizzes and Team Evaluation surveys, extensions and late submissions are not possible.

### Special consideration

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

UNSW has a Fit to Sit / Submit rule, which means that if you attempt an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

**Please note** that students will **not** be required to provide **any** documentary evidence to support absences from any classes missed **because of COVID-19 public health measures such as isolation**. UNSW will **not** be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration **will** be required for assessment and participation absences – but no documentary evidence **for COVID 19 illness or isolation** will be required.

## Academic Honesty and Plagiarism

**Academic integrity** is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage (International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013). At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and plagiarism can be located at:

- The Current Students site
- The ELISE training site

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

**Referencing** is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism. Further information about referencing styles can be located at https://student.unsw.edu.au/referencing.

For assessments in the School of Chemical Engineering, we recommend the use of referencing software such as Mendeley or EndNote for managing references and citations. Unless required otherwise specified (i.e. in the assignment instructions) students in the School of Chemical Engineering should use either the APA 7th edition, or the American Chemical Society (ACS) referencing style as canonical author-date and numbered styles respectively.

# Academic Information

To help you plan your degree, assistance is available from academic advisors in The Nucleus and also in the School of Chemical Engineering.

## Additional support for students

- Current Student Gateway
- Engineering Current Student Resources
- Student Support and Success
- Academic Skills
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- IT Service Centre

## Course workload

Course workload is calculated using the Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete, for both regular and intensive terms. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

## On-campus class attendance

Physical distancing recommendations must be followed for all face-to-face classes. To ensure this, only students enrolled in those classes will be allowed in the room. Class rosters will be attached to corresponding rooms and circulated among lab demonstrators and tutors. No over-enrolment is allowed in face-to-face class. Students enrolled in online classes can swap their enrolment from online to a **limited** number of on-campus classes by Sunday, Week 1.

In certain classroom and laboratory situations where physical distancing cannot be maintained or the staff running the session believe that it will not be maintained, face masks will be designated by the course coordinator as **mandatory PPE** for students and staff. Students are required to bring and use their own face mask. Mask can be purchased from IGA Supermarket (Map B8, Lower Campus), campus pharmacy (Map F14, Middle Campus), the post office (Map F22, Upper Campus) and a vending machine in the foyer of the Biological Sciences Building (Map E26, Upper Campus).

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. Do not come to campus if you have any of the following symptoms: fever (37.5 °C or higher), cough, sore throat, shortness of breath (difficulty breathing), runny nose, loss of taste, or loss of smell. If you need to have a COVID-19 test, you must not come to campus and remain in self-isolation until you receive the results of your test.

**You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-**

**isolate.** We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed. Further information is available on any course Moodle or Teams site.
For more information, please refer to the FAQs: https://www.covid-19.unsw.edu.au/safe-return-campus-faqs

## Image Credit

Dr Peter Wich

## CRICOS

CRICOS Provider Code: 00098G

## Acknowledgement of Country

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

## 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 | ✓ |