Course Outline

MATS4006

Polymer Science and Engineering 2

Materials Science and Engineering

Science

T3, 2022

1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	Dr. Damia Mawad	damia.mawad@unsw.edu.au	Room 246, School of Materials Science and Engineering (Building E10), by appointment	Email
Lecturer	Dr. Kristopher Kilian	k.kilian@unsw.edu.au	Room 740, School of Materials Science and Engineering (Building E10), by appointment	Email

2. Course information

Units of credit: 6

Pre-requisite(s): MATS3004

Timetabling website: https://timetable.unsw.edu.au/2022/MATS4006.html

	Lecture	Lecture	Laboratory
Day	Tuesday	Wednesday	Wednesday
Location	TBA	SEB G05	E10 Lab 125
Time	1-3 pm	4-6 pm	
Weeks	1-4, 7-9	1-4, 7-9	1-4, 7-9

2.1 Course summary

The course is divided into four sections:

- **Advances in Polymer Synthesis:** synthetic polymers/copolymers, biopolymers and blending routes to produce polymers with enhanced functionalities
- **Polymer Physics and Bulk Properties**: rheology: dilute, concentrated polymer solutions and melt polymers; rubber elasticity theory; gelation phenomena; elastic deformation and viscoelasticity; electric and optical properties; surfaces and interfaces; degradation modes of polymers
- **Functional polymers:** design and application of advanced polymers, including but not limited to polymers in optoelectronics, solar technology, and medicine.
- **Lab component:** 3 laboratories related to degradation of polymers, mass loss, structural, optical and chemical characterisation; 3 laboratories related to network and gelation concepts.

2.2 Course aims

To develop an understanding of the fundamentals in polymer physics covering:

1. advances in polymer synthesis to inform the selection of appropriate methods for producing functional polymers
2. bulk properties that govern the behaviour of polymers and mechanisms of polymer degradation subject to environmental conditions
3. latest breakthroughs in functional polymer research

Course Objectives

- To introduce the students to advances in polymer synthesis, biopolymers and copolymers that ushered the way to polymers with unique and superior functionalities (Lectures 1-3 and 8)
- To gain in depth knowledge of the bulk properties of polymer solutions and solids with emphasis on rheology, viscoelasticity, and network (Lectures 4-9).
- To learn about the failure modes and mechanisms of polymer degradation subject to environmental conditions (Lectures 10-11)
- To introduce up-to-date breakthroughs in functional polymer research (Lectures 12-16)

2.3 Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Assess relevant parameters vital in design consideration of polymers for specific applications

2. Evaluate processing-structure-properties relationships in different classes of polymers

3. Identify bulk properties of polymers and their degradation mechanisms

4. Design and conduct experimental work for the synthesis and characterisation of polymers

2.4 Relationship between course and program learning outcomes and assessments

Course Learning Outcome (CLO)	LO Statement	Program Learning Outcome (PLO)	Related Tasks & Assessment
CLO 1	Asses…	1.1, 1.5, 2.1, 2.3, 3.3	Assignment, Mid-term exam & Final
CLO 2	Evaluate…	1.3, 1.5, 2.2, 2.3	Assignment, Mid-term exam & Final
CLO 3	Identify…	1.1, 1.3, 1.5, 2.3 2.3, 3.6,	Assignment, Lab reports and Final exam
CLO 4	Design and conduct…	1.4, 2.3, 2.4, 3.2, 3.3 & 3.6	Lab reports

3. Strategies and approaches to learning

3.1 Learning and teaching activities

(Based on UNSW Learning Guidelines)

- *Students are actively engaged in the learning process.*

  It is expected that, in addition to attending classes, students will read, write, discuss, and engage in analysing the course content.

- *Effective learning is supported by a climate of inquiry where students feel appropriately challenged.*

  Students are expected to be challenged by the course content and to challenge their own preconceptions, knowledge, and understanding by questioning information, concepts, and approaches during class and study.

- *Learning is more effective when students' prior experience and knowledge are recognised and built on.*

  Coursework, tutorials, assignments, laboratories, examinations, and other forms of learning and assessment are intended to provide students with the opportunity to cross-reference these activities in a meaningful way with their own experience and knowledge.

- *Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts*

  The course content is designed to incorporate both theoretical and practical concepts, where the latter is intended to be applicable to real-world situations and contexts.

Lectures: The core concepts will be taught in lectures; students will have access to the lectures notes before class for annotation during the lecture. Students will be engaged in the learning process through class discussions and problem-solving questions independently and working together with partners and groups.

Labs: Labs are designed so that the students conduct the experiments. Experimental techniques and procedures will be taught through laboratories classes and laboratory reports following the class. Students will actively complete the experiments gaining experience of important materials testing and characterisation techniques. Students will be able to reflect on the experiments and learn to process data through the lab reports after class.

3.2 Expectations of students

- Students must attend at least 80% of all classes with the expectation that students only miss classes due to illness or unforeseen circumstances
- Students must read through lecture notes and lab sheets prior to class
- During class, students are expected to engage actively in class discussions
- Students should work through lecture, tutorial, and textbook questions
- Students should read through the relevant chapters of the prescribed textbook.
- Students should complete all assessment tasks and submit them on time.
- Students are expected to participate in online discussions through the Moodle page

4. Course schedule and structure

This course consists of 52 hours of class contact hours. You are expected to take an additional 102 hours of non-class contact hours to complete assessments, readings and exam preparation, spread over the term.

Week	Topics	Activity
1	Basic concepts Advanced polymerization techniques: an overview	**Laboratory**
2	Copolymerization Network and rubber elasticity	**Laboratory**
3	Refinements in rubber elasticity Hydrogel and viscometer	**Laboratory** Formative Quiz
4	Polymer rheology: dilute and concentrated solution and melt Elastic deformation and viscoelasticity	**Laboratory** Assignment Part 1
5	Elastic deformation and viscoelasticity Revision	Mid-term exam
6	Break	
7	Degradation I Degradation II	**Laboratory**
8	Functional polymers Functional polymers	**Laboratory**
9	Biopolymers Functional polymers: optical and electrical properties	**Laboratory**
10	High performance polymers Revision	Assignment Part 2

5. Assessment

5.1 Assessment tasks

Assessment task	Description	Weight	Due date
Formative quiz:	In-class quiz to assess how the students are understanding the concepts taught within weeks 1-3. This will provide students feedback on how they are progressing in the course before the Census date.	0%	Week 3
Individual assignment:	Design project that runs over the duration of the course - students will be required to choose a polymer and a product made from it. The group assignment should include synthesis of the polymer, fabrication and processing of the product, its degradation and mechanical properties, and input on how to improve the product design. Their designs and characterisation will be based on the content taught in class. Students will hand in a report in week 4 to assess their progress. The final report will be due in week 10.	20% (10% each part)	Part 1: Week 4 Part 2: Week 10
Laboratory:	Laboratories will be related to synthesis of polymers, network and gelation concepts, and polymer degradation.	20%	1 week after lab
Mid-term exam:	2hr duration it will cover the topics taught in weeks 1-4	30%	Week 5
Final exam:	2 hr duration it will cover the topics taught in weeks 6-10	30%	Final exam period

Further information

UNSW grading system: https://student.unsw.edu.au/grades

UNSW assessment policy: https://student.unsw.edu.au/assessment

4.2 Assessment criteria and standards

Satisfactory completion of the course includes the requirement to achieve > 35% in the mid-term exam and > 35% in the final exam, and > 45% weighted average over the two exams. Students who fail to achieve this will be awarded an Unsatisfactory Fail (UF) grade for the course regardless if they receive over 50% in total for the course.

Please refer to the UNSW guide to grades: https://student.unsw.edu.au/grades

5.3 Submission of assessment tasks

- UNSW operates under a Fit to Sit/ Submit rule for all assessments. If a student wishes to submit an application for special consideration for an exam or assessment, the application must be submitted prior to the start of the exam or before an assessment is submitted. If a student sits the exam/ submits an assignment, they are declaring themselves well enough to do so. Information on this process can be found here: https://student.unsw.edu.au/special-consideration. Medical certificates or other appropriate documents must be included. Students should also advise the lecturer of the situation.

- Unless otherwise specified in the task criteria, all assignments must be uploaded via Moodle prior to the due date for submission.
- Late submission is permitted for up to five days after the submission deadline; work submitted after this time will not be accepted.
- Late submissions will attract a penalty of 5% per day.
- Students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course coordinator prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit: https://student.unsw.edu.au/disability. Early notification is essential to enable any necessary adjustments to be made.

5.4. Feedback on assessment

Assignments: Feedback will be given two weeks after submission of the assignment and take the form of the mark for the assignment, overall comments on how the class performed, any common areas that were not answered correctly. Additionally, personal feedback and how each student performed may be given.

Lab reports: Students will receive their mark and individualised feedback on the areas they excelled at and which areas of the reports that were not answered correctly. Feedback will be provided within two weeks after submission.

Midsession exams: Students will receive their marked exams indicating what questions were answered correctly and incorrectly. Overall comments and worked solutions may be provided to the class.

Final exam: Students will receive their final mark.

6. Academic integrity, referencing and plagiarism

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

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.[1] 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 https://student.unsw.edu.au/plagiarism**,** and
- The *ELISE* training site http://subjectguides.library.unsw.edu.au/elise/presenting

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.

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

7. Readings and resources

- L.H. Sperling. Introduction to Physical Polymer Science, 4th Ed. John Wiley & Sons, 2006.
- R.J. Young & P.A. Lovell. Introduction to Polymers, 3rd Ed. CRC Press, 2011.
- I.M. Ward & J. Sweeney. An Introduction to the Mechanical Properties of Solid Polymers, 2nd Ed. John Wiley & Sons, 2008.
- R.C. Progelhof. Polymer Engineering Principles, Hanser Publishers, 1993.

In addition, notes and selected reference material will be issued in lectures.

* Assistance is available from the Library: info.library.unsw.edu.au/web/services/teaching.html

8. Administrative matters

School Office: Room 137, Building E10 School of Materials Science and Engineering
School Website: http://www.materials.unsw.edu.au/
Faculty Office: Robert Webster Building, Room 128
Faculty Website: http://www.science.unsw.edu.au/

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- Student Wellbeing, Health and Safety: https://student.unsw.edu.au/wellbeing
- Disability Support Services: https://student.unsw.edu.au/disability-services
- UNSW IT Service Centre: https://www.it.unsw.edu.au/students/index.html
- Assessment Implementation Procedure: https://www.gs.unsw.edu.au/policy/documents/assessmentimplementationprocedure.pdf
- Special Consideration: https://student.unsw.edu.au/special-consideration