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Course Staff

<table>
<thead>
<tr>
<th>Dr. Damia Mawad</th>
<th>Room 246, School of Materials Science and Engineering (Building E8)</th>
<th>Consultation hours: Fridays, 3-4 pm</th>
</tr>
</thead>
</table>
| Course Coordinator & Lecturer | Phone: 9385 6642
EMAIL: damia.mawad@unsw.edu.au |                                    |

<table>
<thead>
<tr>
<th>Dr. Pramod Koshy</th>
<th>Room 220, School of Materials Science and Engineering (Building E10)</th>
<th>Consultation hours: by appointment</th>
</tr>
</thead>
</table>
| Lecturer         | Phone: 9385 6038
kosh@unsw.edu.au  |                                    |
Course Objective
This course provides a basic understanding of the unique mechanical properties of polymers that account for their wide use as well as mechanisms related to their degradation or decomposition under different environments. Concepts taught include elastic deformation, viscoelasticity and stress-strain characteristics up to failure. These concepts will be related to polymer applications in structural and biomedical engineering. Failure modes of polymers in structural engineering and contributing environmental causes will be discussed. Applied in biomedical engineering, the behaviour of polymers with emphasis on network formation and gelation will be taught, complemented by up to date breakthrough in polymer research.

The course objectives are:
- To provide the student with tools to assess relevant parameters vital in design consideration when a polymer is used in a practical situation.
- To gain basic in depth understanding of the mechanical properties that govern the behaviour of polymers
- To learn about the failure modes and mechanisms of polymer degradation subject to environmental conditions
- To teach the student the mechanism and characteristics of polymer gelation and network formation with emphasis on polymers used in biomedical engineering

Timetable

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>16:00 – 18:00</td>
<td>UNSW Business School 115 (E12-115)</td>
</tr>
<tr>
<td>Wednesday</td>
<td>09:00 – 11:00</td>
<td>Tyree Energy Technology LG05 (H6-LG05)</td>
</tr>
</tbody>
</table>

Your Course at a Glance

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Dr. Pramod Koshy (PK)</th>
<th>Dr. Damia Mawad (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hours</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Week No.</td>
<td>Monday (16:00-18:00)</td>
<td>Wednesday (9:00-11:00) Monday (16:00-1800) Wednesday (9:00-11:00)</td>
</tr>
<tr>
<td>Week 1</td>
<td>UV Degradation of Polymers: Causes and Mechanisms</td>
<td>Thermal Degradation</td>
</tr>
<tr>
<td>Week 2</td>
<td>Thermal Decomposition</td>
<td>Fire resistance of Polymers: Mechanism</td>
</tr>
<tr>
<td>Week 3</td>
<td>Biodegradable plastics</td>
<td>Polymer Nano Composites Fabrication Fracture Toughening</td>
</tr>
<tr>
<td>Week 4</td>
<td>Lab</td>
<td>Mechanical Yield and Crazing</td>
</tr>
<tr>
<td>Week 5</td>
<td>Lab</td>
<td>Elastic Deformation and viscoelasticity</td>
</tr>
</tbody>
</table>
Course Content
The course is divided into two sections:

- **Polymers in structural engineering:**
  - Mechanical properties of polymers including elastic deformation, viscoelasticity, mechanisms of yield and fracture
  - Failure and degradation modes of polymers: causes, mechanisms and prevention
  - Design and application of advanced polymers: toughened/strengthened polymers; fire-resistant plastics; testing methodologies for polymers; polymer nano composites;

- **Polymers in biomedical engineering:**
  - Network formation and gelation: rubber elasticity theory; transition from liquid to solid; theory of gelation; crosslinks formation and types; sol-gel transition; aggregation; swelling; mechanical properties of polymers applied in biomedical engineering.
  - Design and application of advanced polymers: hydrogels; biodegradable polymers; polymers at the bio-interface; implantable polymers; polymer electronics.

Assessment

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Category</th>
<th>Marks*</th>
<th>Due Date</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pramod Koshy</td>
<td>Assignments</td>
<td>10</td>
<td>Week 4, 6</td>
<td>Individual Assignments: Provide a written report (approx. 1-2 pages including figures, tables, references) Topics will be related to subjects taught in class.</td>
</tr>
</tbody>
</table>
Pramod Koshy | Laboratory | 10 | To be decided | Laboratories will be related to degradation of polymers; electronic polymers, thermal behaviour of high-temperature polymers

Pramod Koshy | Final Examination | 30 | Week 6 | Exam will be 2 h in duration
Topic taught by PK

Damia Mawad | Assignment and Presentations | 10 | Assignments: Week 11
Presentations: Weeks 12 | Students will be asked to report on the design of a polymeric biomaterial for a particular biomedical application. This assignment will involve literature search, choice of polymers and their properties, their synthesis and characterization.

Damia Mawad | Laboratory | 10 | At the end of each laboratory session Week 13 | Laboratories will be related to network and gelation concepts taught in class

Damia Mawad | Final Examination | 30 | Examination Period | Exam will be 2 h in duration
Topic taught by DM

**Note:** Students who fail to achieve a score of at least 40% for the overall exam component (i.e., mid-session exam and final exam marks combined), but achieve a final mark >50% for the course, will be awarded a UF (Unsatisfactory Fail) for the course.

Please refer to the UNSW guide to grades: [https://student.unsw.edu.au/grades](https://student.unsw.edu.au/grades)

**Recommended Textbooks**

**References**

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](http://info.library.unsw.edu.au/web/services/teaching.html)

**Learning and Teaching Philosophy Underpinning the Course**
(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.

### Course Information

<table>
<thead>
<tr>
<th>Units of credit</th>
<th>6</th>
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**How the course relates to other course offerings and overall program(s) in the discipline**

The course is an elective course in the Materials Engineering BE program. It introduces the relation between the mechanical properties of polymers and their applications. Students will be taught fundamental concepts related to the viscoelastic behaviour of polymers, their elastic deformation and fracture modes. These concepts will be essential in design consideration when a polymer is used in a practical situation. The course utilizes knowledge and experience from previously studied courses in the BE program including chemistry, mathematics, physical properties of materials, materials characterization, mechanical behavior of materials, fluid flow and heat transfer, thermodynamics and phase equilibria.

**Graduate attributes which will be gained through the course**

- Ability to communicate effectively
- Capacity for creativity and innovation
- Ability to manage information and documentation
- Understanding of professional and ethical responsibilities, and commitment to them
- Ability to function effectively as an individual
- Ability to work effectively in multidisciplinary and multicultural teams
- Capacity for lifelong learning and professional development
- Professional attitudes

**Expected learning outcomes**

In doing this course, you will learn to engage in a hands-on basis to create an outcome that has a practical significance.

You will also learn to:

- Think critically in decision making and problem-solving
- Communicate with correct terminology
- Conduct online research
- Work effectively in a team to solve problems

**Teaching strategies**

Problems involving polymer science & engineering are challenging; students will be given assignments that will motivate deep analysis of various phenomena in materials science and engineering.
• Problem design and solution will be learnt through assignments
• Teaching material, including course outline, notes, problems, assignments, case studies and course announcements are available on the Course Blackboard website.

1 Based on the professional attributes given in Engineers Australia National Generic Competency Standards - Stage 1 Competency Standard for Professional Engineers and UNSW Graduate Attributes.

Academic Honesty and Plagiarism

What is Plagiarism?

All details regarding plagiarism can be found here: [https://student.unsw.edu.au/plagiarism](https://student.unsw.edu.au/plagiarism)

It is important to understand what plagiarism is. The general concept is plagiarism is using the words or ideas of others and passing them off as your own. Examples of plagiarism, including self-plagiarism, are:

- **Copying**
  
  Using the same or very similar words to the original text or idea without acknowledging the source or using quotation marks. This includes copying materials, ideas or concepts from a book, article, report or other written document, presentation, composition, artwork, design, drawing, circuitry, computer program or software, website, internet, other electronic resource, or another person's assignment, without appropriate acknowledgement.

- **Inappropriate paraphrasing**
  
  Changing a few words and phrases while mostly retaining the original structure and/or progression of ideas of the original, and information without acknowledgement.

  This also applies in presentations where someone paraphrases another’s ideas or words without credit and to piecing together quotes and paraphrases into a new whole, without appropriate referencing.

- **Collusion**
  
  Presenting work as independent work when it has been produced in whole or part in collusion with other people. Collusion includes,
  
  - students providing their work to another student before the due date, or for the purpose of them plagiarising at any time
  - paying another person to perform an academic task and passing it off as your own
  - stealing or acquiring another person’s academic work and copying it
  - offering to complete another person’s work or seeking payment for completing academic work.

  This should not be confused with academic collaboration.

- **Inappropriate citation**
  
  Citing sources which have not been read, without acknowledging the 'secondary' source from which knowledge of them has been obtained.

- **Self-plagiarism**
  
  'Self-plagiarism' occurs where an author republishes their own previously written work and presents it as new findings without referencing the earlier work, either in its entirety or partially.
Self-plagiarism is also referred to as 'recycling', 'duplication', or 'multiple submissions of research findings' without disclosure. In the student context, self-plagiarism includes re-using parts of, or all of, a body of work that has already been submitted for assessment without proper citation.

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

Continual Course Improvement

- At the end of the course, students will be asked to provide evaluative feedback through myExperience, the University’s course and teaching evaluation and improvement process
- Students are encouraged to address any problems regarding teaching of this course at the annual staff-student meeting
- Student comments on teaching during the session are welcome and will be appreciated
- At times students may be asked to answer a short questionnaire for feedback on the course

Administrative Matters

- Students should attend at least 80% of all classes.
- Students unable to submit assignments on time or attend the mid-session quizzes or final exams on health grounds should make a request for special consideration. 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.
- Assignments/lab reports submitted after the due date for submission will receive a 10% of maximum grade penalty for every day late, or part thereof.
- 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.

Rules for Exams

Rules governing conduct during exams are given at: https://student.unsw.edu.au/exam-rules