MAT4006

Polymer Science and Engineering 2

Course Outline
Session 2, 2015
Table of Contents

Course staff .................................................................................................................. 2
Lecture Timetable ......................................................................................................... 2
Your Course at a Glance .............................................................................................. 3
Course Objectives .......................................................................................................... 4
Course Content ............................................................................................................. 4
Assessment ...................................................................................................................... 4
References ....................................................................................................................... 4
Learning and teaching philosophy underpinning the course ....................................... 5
Course Information ........................................................................................................ 6
Academic honesty and plagiarism ................................................................................. 6
Continual course improvement ..................................................................................... 7
Administrative Matters ................................................................................................. 8
Rules for Exams ............................................................................................................ 8

Course staff

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Consultation hours: by appointment

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Consultation hours: by appointment

Lecture 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>Tyree Energy Technology LG07</td>
</tr>
<tr>
<td>Thursday</td>
<td>16:00 – 18:00</td>
<td>The Michael Hintze Theatre</td>
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</tbody>
</table>
### Your Course at a Glance

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Monday (1600-1800)</th>
<th>Thursday (1600-1800)</th>
<th>Dr. Damia Mawad (DM)</th>
<th>Dr. Pramod Koshy (PK)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week 1</strong>&lt;br&gt;27 July 30 July</td>
<td>--</td>
<td>--</td>
<td>Degradation of polymers: Effect of different factors including the environment</td>
<td>Biodegradable polymers Mechanisms, structure correlations, examples</td>
</tr>
<tr>
<td><strong>Week 2</strong>&lt;br&gt;3 August 6 August</td>
<td>--</td>
<td>--</td>
<td>Thermal degradation and decomposition</td>
<td>Fire resistance of polymers; mechanisms loss on ignition</td>
</tr>
<tr>
<td><strong>Week 3</strong>&lt;br&gt;10 August 13 August</td>
<td>--</td>
<td>--</td>
<td>Nano composites</td>
<td>Laboratory tutorial</td>
</tr>
<tr>
<td><strong>Week 4</strong>&lt;br&gt;17 August 20 August</td>
<td>--</td>
<td>--</td>
<td>Polymer composite fabrication routes</td>
<td>Laboratory tutorial</td>
</tr>
<tr>
<td><strong>Week 5</strong>&lt;br&gt;24 August 27 August</td>
<td>--</td>
<td>--</td>
<td>Polymers for solar and other advanced applications</td>
<td>Laboratory tutorial</td>
</tr>
<tr>
<td><strong>Week 6</strong>&lt;br&gt;31 August 3 September</td>
<td>Biomedical polymers types, properties</td>
<td>--</td>
<td>--</td>
<td>Laboratory tutorial</td>
</tr>
<tr>
<td><strong>Week 7</strong>&lt;br&gt;7 September 10 September</td>
<td>Biomedical polymers 2</td>
<td>--</td>
<td>--</td>
<td>Mid-session exam</td>
</tr>
<tr>
<td><strong>Week 8</strong>&lt;br&gt;14 September 17 September</td>
<td>Surface functionalization of polymers</td>
<td>Laboratory tutorial</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Week 9</strong>&lt;br&gt;21 September 24 September</td>
<td>Yield, deformation and fracture mechanism</td>
<td>Laboratory tutorial</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

#### MID-SESSION BREAK

| Week 10 | 8 October | **HOLIDAY (Labour Day)** | Factors contributing to strength and toughness of polymeric materials | -- | -- |
| Week 11 | 12 October 15 October | Strategies to reduce stress and increase toughness of polymers | Fatigue: relationship to processing behaviour Time temperature superposition | -- | -- |
| Week 12 | 19 October 22 October | Creep recovery and stress relaxation; crazing | Presentations for assignment | -- | -- |
| Week 13 | 26 October | Revision | -- | -- |

#### FINAL EXAMINATION
Course Objectives

To provide in-depth understanding of the underlying mechanisms of a) the mechanical behaviour of polymeric solids, elastic modulus of polymer chains, and critical effects of temperature on behaviour of thermoplastics and thermosets under load; and b) viscoelasticity of polymers, developments in polymer matrix composites and polymer matrix nanocomposites for light weight structural and engineering applications.

Course Content

- Mechanical properties of polymers: mechanisms of yield, deformation and fracture; factors contributing to strength and toughness; strategies to reduce stress and increase toughness; creep, recovery and stress relaxation; time-temperature superposition; fatigue; effect of polymer processing on mechanical behaviour.
- Degradation mechanisms of polymers: crazing; environmental effects; degradation prevention.
- Design and application of advanced polymers: toughened/strengthened polymers; fire-resistant plastics; testing methodologies for polymers; biomedical polymers; polymer matrix composites.
- Application of polymers in clean energy, electronics, sensors, and smart applications.
- Nanocomposites: with combination of high mechanical, electrical, and thermal properties

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>To be decided</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>
<tr>
<td>Pramod Koshy</td>
<td>Laboratory</td>
<td>10</td>
<td>Week 8</td>
<td>Laboratories will be related to degradation of polymers; electronic polymers, thermal behavior of high-temperature polymers</td>
</tr>
<tr>
<td>Pramod Koshy</td>
<td>Final Examination</td>
<td>30</td>
<td>Week 7</td>
<td>Exam will be 2 hours in duration Topics taught by PK</td>
</tr>
<tr>
<td>Damia Mawad</td>
<td>Assignment and Presentations</td>
<td>15</td>
<td>Assignments: Week 11 Presentations: Weeks 12 &amp;13</td>
<td>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.</td>
</tr>
<tr>
<td>Damia Mawad</td>
<td>Laboratory</td>
<td>5</td>
<td>At the end of each laboratory session Weeks 8 &amp; 9</td>
<td>Laboratories will be related to biological polymers and functionalization of polymers</td>
</tr>
<tr>
<td>Damia Mawad</td>
<td>Final Examination</td>
<td>30</td>
<td>Examination Period</td>
<td>Exam will be 2 hours in duration Topics taught by DM</td>
</tr>
</tbody>
</table>
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

Learning and teaching philosophy underpinning the course
Based on UNSW Learning Guidelines

The course is designed for students to actively engage in the learning process and analyse and synthesise the content in a real world environment.

- **Students are engaged actively 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>
</tr>
</thead>
<tbody>
<tr>
<td>How the course relates to other course offerings and overall program(s) in the discipline</td>
<td>Students are actively engaged in the learning process. It is expected that, in addition to attending classes, students read, write, discuss, and are engaged in solving problems in polymer micro and macro aspects and in the analysis of materials behaviour; Students will be given assignments that will motivate deep analysis of various phenomena in materials science and engineering.</td>
</tr>
</tbody>
</table>

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.

* 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?

Plagiarism is the presentation of the thoughts or work of another as one’s own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, website, Internet, other electronic resource, or another person’s assignment without appropriate acknowledgement;
- paraphrasing another person’s work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
• piecing together sections of the work of others into a new whole;
• presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
• claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

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.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle

† Adapted with kind permission from the University of Melbourne.

Continual course improvement

• Students will be asked to provide evaluative feedback through the UNSW's Course and Teaching Evaluation and Improvement (CATEI) process at the end of the course

• 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://my.unsw.edu.au/student/atoz/SpecialConsideration.html). Medical certificates or other appropriate documents must be included. Students should also advise the lecturer of the situation.

- Assignments/lab reports submitted after the deadline 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 (www.studentequity.unsw.edu.au). Early notification is essential to enable any necessary adjustments to be made.

Rules for Exams

Rules governing conduct during exams are given at: https://my.unsw.edu.au/student/academiclife/assessment/examinations/examinationrules.html - Rulesfortheconductofexaminations

Note that the use of mobile phones or music players in an exam room will constitute Academic Misconduct.