Fundamentals of Materials Processing

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Course Staff

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<td></td>
<td>Consultation hours: by appointment</td>
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<tr>
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<td>Consultation hours: by appointment</td>
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Course Objective

This course covers selected topics in materials processing including elements of both extractive metallurgy and secondary processing methods. Students will understand the basic elements of operations of processing used in primary metal refinement and assorted secondary processing and shaping methods such as casting, rolling, welding and powder metallurgy.

Your Course at a Glance

| MATS6001 Fundamentals of Materials Processing 2017 - Timetable & Core Subjects |
|-----------------------------|-----------------------------|
| **Week** | **Monday 09:00-11:00** | **Thursday 14:00-16:00** | **Topic (Lecturer)** | **Topic (Lecturer)** |
| 1 | Intro to Inorganic Materials (RJ) | Semiconductor Properties (RJ) |
| 2 | Semiconductor Materials Processing and Single Crystal Growth (RJ) | Thin Film Technology – Vacuum Evaporation (RJ) |
| 3 | PLD and CVD methods | (Quiz 1) |
| 4 | Nanomaterials Processing (RJ) | Nanoparticles, Nanowires, CNT and Graphene (RJ) |
| 5 | Chemical Processing of Materials (RJ) | Sustainable Materials Processing (RJ) |
| 6 | Iron & Steel Making (Guest Lecture) | Mid-Semester exam |
| 7 | Intro to Metals Processing (KJL) | Primary Metals Processing (KJL) |

Mid-Semester Break

| 8 | Casting Processes (I) (KJL) | Casting Processes (II) (KJL) |
| 9 | Metal Rolling & Extrusion (KJL) | Forging Processes (KJL) |
| 10 | (Quiz 2) | Powder Consolidation (KJL) |
| 11 | Joining Processes (II) (KJL) | Joining Processes (I) (KJL) |
| 12 | Additive & Subtractive Manufacturing (KJL) | Course Study Review (KJL) |

Final Examination (KJL)

Timetable

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<th>Lectures</th>
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<tr>
<td><strong>Day</strong></td>
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<tr>
<td>Monday</td>
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<tr>
<td>Thursday</td>
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Course Content

This first section of this course includes an introduction to processing of inorganic materials, semiconductor processing, single crystal growth of Si, GaAs, carbon based material, thin film processing (physical and chemical vapour deposition), sputtering and pulse laser deposition method, advanced nanostructures such as nanoparticles, nanowires, nanotubes, wet chemical methods, electro-less and electrochemical methods.
Course material covered in the second section includes primary & secondary metals processing such as smelting and ore reduction, fixed and continuous casting processes including sand-box casting, investment casting, die-casting, slab and twin-roll strip-casting; metal billet and sheet rolling; tube and bar extrusion; forging techniques; Powder consolidation techniques including hot isostatic pressing and spark plasma sintering; Soldering, Brazing and Welding, Subtractive manufacturing including multi-axis milling, machining, grinding and spark erosion; Additive manufacturing including typical 3D printing techniques such as extrusion melting, selective laser melting/sintering, e-beam melting and droplet ejection. In addition, this course will cover sustainable materials processing- waste plastic, electronics waste processing and sustainable iron and Steel making.

Assessment

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<tr>
<th>Assessment Task</th>
<th>Assessment Due/Held</th>
<th>Grade Allocation</th>
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<tr>
<td>Quiz 1</td>
<td>Week 3 March 16\textsuperscript{th} 14:00-16:00</td>
<td>10%</td>
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<td>Students will be assessed on course material (Weeks 1-3)</td>
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<tr>
<td>Midsession Examination*</td>
<td>Week 6 April 6\textsuperscript{th} 14:00-16:00</td>
<td>40%</td>
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<td>The examination will be 2 hours in duration and held during class time. Students will be assessed on course material (Weeks 1-6). You will be assessed in understanding and ability to apply theory and technology learnt throughout the course in a Q &amp; A context.</td>
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<tr>
<td>Quiz 2</td>
<td>Week 10 May 8\textsuperscript{th} 09:00-11:00</td>
<td>10%</td>
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<td>Students will be assessed on course material (Weeks 7-9)</td>
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<tr>
<td>Final Examination*</td>
<td>TBA</td>
<td>40%</td>
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<tr>
<td>The examination will be 2 hours in duration and held during the examination period. Students will be assessed on metals processing course material (Weeks 7-12). You will be assessed in understanding and ability to apply theory and technology learnt throughout the course in a Q &amp; A context.</td>
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Note: Students are required to pass both the mid-term and final examinations to pass this course.

References

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 read, write, discuss, and are engaged in solving problems on the primary and secondary processing of materials, and their effects on the functional and mechanical properties of these materials.
  Effective learning is supported by a climate of inquiry where students feel appropriately challenged.

• **Learning is more effective when students’ prior experience and knowledge are recognised and built on.**
  This course is built on prior knowledge of materials science & engineering and chemistry.

• **Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts**
  Students will be asked to analyse the role of materials processing in understanding various functional, microstructural & mechanical phenomena in materials science and how these properties influence the science and engineering of existing and new materials.

### Course Information

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<th>Units of credit</th>
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<td><strong>How the course relates to other course offerings and overall program(s) in the discipline</strong></td>
<td>This is a Master’s level course and a background in materials science, process metallurgy or physical metallurgy would be advantageous.</td>
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| **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:  
• Identify the distinguishing features of different types of primary and secondary processing techniques and their commercial applications.  
• Solve problems and identify appropriate processing techniques suitable for specific real-world applications in a systematic, analytical manner.  
You will also learn to:  
• Communicate with correct terminology  
• Conduct online research |
| **Teaching strategies** | • Core concepts, theories and approaches will be covered in lectures.  
• These concepts will be synthesised in a practical context in topic assignments and presentations.  
• Class discussion will be extensively used to encourage students involvement in teaching and learning |
Teaching material, including course outline, notes, assignments, case studies and course announcements are available on the Course Moodle 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

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](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](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](https://student.unsw.edu.au/exam-rules)