THE UNIVERSITY OF NEW SOUTH WALES

SCHOOL OF MATERIALS SCIENCE AND ENGINEERING

MATS4333

Fracture Mechanics

Course Outline

Session 2, 2009

Chemical Sci M17 on Wed 4 - 6pm

Course staff

Assoc Prof. Sri Bandyopadhyay (Course Coordinator)	Room: 112 A ; 0414 751 755 s.bandyopadhyay@unsw.edu.au	Consultation hours: Anytime but preferably by appointment

Timetable

Lecture/Tutorial	Day	Time	Location
Lecture& Tutorial	Wednesday	4:00-6:00	Chemical Sci M17

Course outline

1. Revision and clarification of basic concepts Griffith criterion, $K=Y\sigma\sqrt{a}$, $K=K_{IC}$, environmentally assisted crack growth, cyclic fatigue, ductile and brittle fracture, fracture Modes
2. Linear Elastic Analysis Airy stress function, crack tip stresses, finite size effects, crack opening displacement
3. Plastic Analysis Hydrostatic stress, deviatoric stress, yield criteria,
4. Elastic-Plastic Analysis
5. Fracture toughness testing
6. Crack Growth Resistance - R-curves,
7. Fracture mechanics of composites
8. Fracture of interfaces
9. Cyclic Fatigue
10. Stress Corrosion Cracking
11. Fracture of nanomaterials

The 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 analysing fracture theory and examples.

- **Effective learning is supported by a climate of inquiry where students feel appropriately challenged.**
  Fracture is a critical process is design for structural integrity with accurate application requiring a strong understanding of the relevant fracture mechanics theory. The mathematical analysis required is challenging.

- **Learning is more effective when students' prior experience and knowledge are recognised and built on.**
  Assignments will be based upon students identifying and analysing fracture situations themselves.

- **Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts**
  Case studies are presented throughout the course to enable engagement of the materials with real-life histories.

Course information

Units of credit	3
Parallel teaching involved in this course	None
How the course relates to other course offerings and overall program(s) in the discipline	Course applies mechanics concepts to engineering design. Mechanical and structural knowledge associated with materials is called upon.
Course aims	To gain an understanding of fracture mechanics so as to be capable of incorporating fracture criteria into design and failure analysis of engineering structures.
Graduate attributes which will be gained through the course	• Research, inquiry and analytical thinking abilities • Capability and motivation for intellectual development
Teaching strategies	• Theory and concepts will be addressed in lectures. • Extensive use will be made of case studies to exemplify fracture • Problem design and solution will be learnt through assignments • Teaching material, including course outline, notes, problems, assignment, case studies and course announcements are available on the Course Vista website.

ASSIGNMENTS:

2 Assignments covering major aspects of relevant problem solving. Submission is COMPULSORY. Submission deadlines to be notified in class.

TIMETABLE: **Chemical Sci M17 on Wed 4-6pm**

ASSESSMENT: 10% Mid-session Quiz
20% Assignments
70% Final Exam

TEST / QUIZ: Approx. mid/session

REFERENCES:

D. Broek, "Elementary Fracture Mechanics".
J. F. Knott, "Fundamental of Fracture Mechanics".
R. W. Hertzberg, "Deformation and fracture mechanics of engineering materials".
A. G. Atkins & Y.-W. Mai, "Elastic and Plastic Fracture".
T.L. Anderson, “Fracture Mechanics: Fundamentals and Applications”

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, web site, 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 near the end of session
- A feedback facility will be provided on Vista;
- Students are encouraged to raise any matters of concern with the lecturers.
- Students' comments on teaching during the session are welcome and will be appreciated.
- We welcome feedback at all times on presentation of course materials and any other course-related matters, and will be happy to discuss any issues raised in the lectures.
- You will be asked to provide evaluative feedback through the UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process in Week 12.
- Feedback from prior assessments will be discussed in lecture 1.

Administrative Matters

- Students should attend at least 80% of all classes.
- Assignments submitted after the deadline will receive a 10% of max. grade penalty for every day late, or part thereof.
- Students unable to submit assignments on time or attend the final exams on health grounds should make a request for special consideration by submitting the form available from the Student Desk in the Chancellery. Medical certificates or other appropriate documents must be included. Students should also advise the lecturer.

- 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 convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or www.equity.unsw.edu.au/disabil.html). Early notification is essential to enable any necessary adjustments to be made. Information on designing courses and course outlines that take into account the needs of students with disabilities can be found at:

  www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf