THE UNIVERSITY OF NEW SOUTH WALES

Nanotechnology

NANO 1001

Nanotechnology 1: Introduction to Nanotechnology

Course Outline

Session 2, 2009

Course staff

Dr Valanoor Nagarajan (Coordinator)	Room: 208 Materials Science Phone: 9385 4263 nagarajan@unsw.edu.au	Consultation hours: By appointment
Prof. Justin Gooding	Room: Dalton 132 Phone: 9385 5384 Justin.gooding@unsw.edu.au	By appointment
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To be announced

Timetable and Location

Mondays 9 a.m -12.00 noon
Webster 251

OBJECTIVE

The objective of this course is to introduce students to the field of Nanotechnology. Students will understand the cross disciplinary nature of the field and the relationship of current research in nanotechnology to well-established scientific principles

Course Structure

The course will introduce students to a range of current research topics in Nanotechnology, discussed with reference to recent original research and review publications.
The central theme running through the entire course will be the development of a BARC biosensor. While each lecturer will cover individual topics and concepts pertinent to their respective field, these topics will be tied into the synthesis and functioning of the biosensor.

Each class will consist of a lecture on relevant scientific principles followed by a tutorial-type discussion. The discussion may be either be on a set of questions pertaining to lecture content or discussion of a scientific article closely related to the lecture content.

The major assignment will be based on answering 4-6 key questions based on the Biosensor. Students will work in groups (groups of 4-6) to answer this assignment.

COURSE OUTLINE

The following are keywords for topics to be covered in each week. Detailed notes, papers and other learning materials will be uploaded on Vista. It is advised that you read them before coming to class.

Weeks 1-3 Introduction to Nanomaterials (Nagy)

- Structure of materials-from an atomistic view
- Thermodynamics (i.e. why are interactions different when the system is scaled down to nanoscopic dimensions)
- Surfaces and Interfaces
- Characterization of surfaces using Electron Microscopy
- Introduce Thin film Growth
- Facility tours – EM Unit Labs

Weeks 4-6 The Physics of Nanotechnology (Tba)

- Imaging and Lithography
- Introduction to Quantum Mechanics
- Wave-particle duality
- STM, AFM
- Facility tour- Quantum Center

Weeks 8-10 Nano-Chemistry (Justin Gooding)

- Introduction to Nanotechnology
- Nanoparticles
- Self assembled monolayers
- Patterning of Monolayers
- Integrating biomolecules with surfaces
- Week 3: Tour of AFM/STMs in Microscope Unit

Weeks 11-13 Bio-Nano: The new frontier (Vince Murray)

- Nucleic acids and recognition
- Proteins and recognition
- Methods to engineer biomolecules
- Complex biomolecular machines
- Tour of BABS

Graduate attributes which will be gained through the course	• Research, inquiry and analytical thinking abilities • Capability and motivation for intellectual development • Communication • Information literacy
Expected learning outcomes	*Students should gain:* • Enhanced critical thinking, analytical and problem solving skills • An understanding of scientific principles underpinning nanotechnology • Understanding the vast cross-disciplinary nature of

	Nanotechnology
Teaching strategies	• Core concepts, theories and approaches to numerous problems to be covered in lectures followed by interactive tutorial sessions. • It is expected that students attending classes be prepared for discussion. • Teaching material, including the course outline, assignments, examples of solutions of problems, and course announcements are available on the Course Vista website.

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 solving numerical problems associated with the fundamental scientific principles behind nanotechnology. This will prepare them for advanced higher-level classes in the subsequent years of the program.

- **Effective learning is supported by a climate of inquiry where students feel appropriately challenged.**
  The central theme of the course- the BARC biosensor is a practical device, which poses several challenges. Problems involving devices are challenging; students will perform assignments that will motivate deep analysis of various phenomena that govern the working of an engineering device.

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

- **Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts**
  This is the most fundamental and introductory level course for the program. Students will be able to relate the principles taught in this course to future courses in the program.

Course information

Assessment
Midession Exam: Multiple choice/ short answers: 35%
Final Exam: Multiple choice/ short answers: 35%
Major Assignment: Written group assignment: 30% due end of week 12

In accordance with University Regulations, any changes to the above conditions of assessment must be made, subject to negotiation between academic staff and students, within one week of the first class of the session.

Midsession exam – This exam scheduled in week 7 will cover aspects of the course from wks 1-6 consisting of formal lectures, nominated reading material (from course handouts). It will consist of a combination of short answers and calculations. Examination for the course will be held in Webster 251. The examination will be 1 hour in duration.

Final exam – This major exam will cover all aspects of the course consisting of formal lectures, nominated reading material (from course handouts). It will consist of a combination of short answers and calculations. Examination for the course will be held in the formal examination period following Session 2. The examination will be 1 hour in duration.

Note – All assignments must contain a completed student declaration sheet and will be due on the date specified above. Late submissions will not be accepted without adequate reason in writing. Marked assignments will be returned within two weeks of submission. Requests for special consideration must be submitted using the form available from the Student Desk in the Chancellery and must include medical certificates or other appropriate documents.

Students should note:
(1) Students should attend at least 80% of all classes. **It is a course requirement that all assessment components (assignments and exams) be submitted in order to pass the course.**

(2)Assignments submitted after the deadline will receive a 10% of max. grade penalty for every day late, or part thereof.

(3) 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.

(4) I 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 at the end of the course. Feedback from prior assessments will be discussed in lecture 1.

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

- At the latter stages of the course, students will be asked to provide evaluative feedback through UNSW's Course & Teaching Evaluation and Improvement (CATEI) Process. Feedback from prior assessments will be discussed in lecture 1.
- Students are encouraged to address any problems regarding teaching of this course at the annual staff-student meeting.
- Students' comments on teaching during the session are welcome and will be appreciated.

Administrative Matters

- Students must attend at least 80% of all classes.
- Students unable to attend the final exam on the health grounds should make a rrequest 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