SCHOOL OF CIVIL & ENVIRONMENTAL ENGINEERING

FACULTY OF ENGINEERING

GMAT 9606

Microwave Remote Sensing

Course Outline – Session 2, 2016

Version: 11/08/2016

This document, and other material, is available at the Moodle site for this Course

(User your student ID and Z-password to login)

UNSW Course Outline - Microwave Remote Sensing – GMAT9606

Handbook description: UOC 6; HPW 5; S2

Use of passive and active (radar) microwave techniques in remote sensing of earth resources. Topics include: real and synthetic aperture radar systems; passive microwave radiometry; energy-surface interactions; interpretation of microwave image data: applications in agriculture, geology, oceanography and hydrology; issues in signal and image processing; characteristics of airborne and spaceborne microwave sensors.

1. Location of the course

Pre-course workshops -	Thu 17-19 18th & 25th August (CivEng109) (week 4 & week 5)
Lecture -	9-5 Mon 26 Sep (CivEng 109)
	9-5 Tues 27, Wed 28, Thu 29, Fri 30 (CivEng 101)
Demonstration –	Room 201, Civil Engineering Building (UNSW Map Reference H20)
Morning and afternoon tea – in CATS rooms for the lectures	

2. Table of Contents

3. Staff Contact Details

Position	Name	Email	Availability; times and location	Phone
Course Convener	A/Professor Linlin Ge	l.ge@unsw.edu.au	See office door timetable; CE414	9385 4177
Lecturer/ Demonstrator	A/Professor Linlin Ge	l.ge@unsw.edu.au	See office door timetable; CE414	9385 4177
Guest lecturer	Dr Scott Hensley (TBC)	scott.hensley@jpl.nasa.gov		

4. Course details

Credit Points: 6

This course is a 'sister' course with GMAT9600 Principles of Remote Sensing

Summary of the Course

This course will focus on the theory and physics of microwave remote sensing for earth observation. Various radar remote sensing techniques such as SAR and SAR interferometry are discussed throughout the course.

Aims of the Course

1. This course will enable students to explore and gain further understanding of the complementary nature of radar to optical remote sensing through the investigation of synthetic aperture radar and its interaction with ground features with a direct emphasis of their application to real world situations in the field of mining, agriculture, geology, oceanography and hydrology.
2. This course will also cover advanced topics such as SAR interferometry and polarimetry.

Student learning outcomes

At the conclusion of this course the student will be able to:

1. Investigate the ability for radar of different wavelength to penetrate cloud, haze, smoke and vegetation
2. Apply theory to real world situations in the field of mining, agriculture, geology, oceanography and hydrology
3. Undertake SAR intensity and interferometric analysis

Graduate Attributes

The students will be encouraged to develop the following Graduate Attributes by undertaking the selected activities and knowledge content. These attributes will be assessed within the prescribed assessment tasks.

At the conclusion of this course the student will be able to:

1. Investigate a typical application and choose the right microwave band
2. Apply theory to address the application
3. Undertake data analysis and prepare report

5. Rationale for the inclusion of content and teaching approach

Microwave remote sensing is an exciting but challenging field. This course is included to enable students to develop particular skills that will enhance their practice as a remote sensing specialist. It reflects my position that their practice within the field will require advanced levels of radar knowledge to enable ongoing development of innovative applications of all-weather and day-and-night remote sensing.

6. Teaching strategies

A set of comprehensive lecture notes will be provided to students as the main teaching material. However, we will also incorporate the latest research outcomes. Whilst using this material we will aim to engage you in an understanding of the topics and require you to read the text based material in detail. Powerpoint files will be used during the lectures. Two lab based assignments for SAR and SAR interferometry will be included.

7. Assessment

Assessment for the course includes:

• Five quizzes	25% (5% each)	As instructed
• Assignments	10% and 15%	Due three weeks after the conclusion of lectures
• Final Exam	50%	In formal exam period

Students should read the University Calendar or Student Guide for details of University Rules and special considerations.

Students are reminded that the University regards academic misconduct as a very serious matter. Unauthorised material must not be taken into a test or examination. The penalty for any suspected academic misconduct ranges from zero mark for the assignment or exam involved, through failure of the subject, to expulsion from the University. If absent from an examination, class test or practical, students must submit written documentation to the University, via the Student Centre in the Chancellery.

All assignments or practical reports are compulsory parts of the course and must be handed in by the due date. A mark of zero will be given for any submission which violates this rule. OR **The marks for late submissions will be reduced as follows:** -20% (of the maximum mark) for up to 24 hours after the scheduled submission time, then -10% (of the maximum mark) for each additional 24 hour period late. (For example, a student submitting a report/assignment 4 days late has his/her mark reduced by 4 if the maximum mark of the submission is 10.). Any late submission must be made before solutions are issued to the class.

If a student is unable to submit on time due to illness or other legitimate reason, then a brief written explanation must be given to the lecturer for consideration as soon as is feasible. In some cases the lecturer may grant an extension to the submission date provided he has been contacted before the due date.

Further assessment may be granted in this course at the lecturer's discretion. If further assessment is granted then performance in tutorials may be considered as well as an oral exam including use of a

computer.

If students attend less than 80% of their possible classes they may be refused final assessment.

8. Academic honesty and 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 work, or knowingly permitting it to be copied. This includes 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.†

Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

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

Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.

The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at:

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.

9. Course schedule

Day	Lecture (9:00 – 17:00; CE101)	
1	Math Review Introduction to Radar Remote Sensing	
2	Interferometric Signals Coordinate Systems	
3	Interferometric Correlation UAVSAR	
4	InSAR processing Japanese SAR: JERS-1, ALOS and ALOS-2	
5	InSAR and DInSAR case studies Persistent Scatterer Interferometry Review of course	Lab Assignments: Radar Interferometry (ADPS and DInSAR) **Demonstration/ Lab (14:00 – 17:00; CE201)**

Program (see 'Location of the Course' for CATS rooms)

Time slot	Monday	Tuesday	Wednesday	Thursday	Friday
09.00 am – 10.30 am	Lecture (LG)	Lecture (SH)	Lecture (LG)	Lecture (LG)	Lecture (SH)
10.30 am – 11.00 am	**Morning Tea**	**Morning Tea**	**Morning Tea**	**Morning Tea**	**Morning Tea**
11.00 am – 12.30 pm	Lecture (LG)	Lecture (SH)	Lecture (LG)	Lecture (LG)	Lecture (SH)
12.30 pm - 02.00 pm	**Lunch Break**	**Lunch Break**	**Lunch Break**	**Lunch Break**	**Lunch Break**
02.00 pm - 03.00 pm	Lecture (LG)	Lecture (LG)	Lecture (LG)	Lecture (LG)	Lab (LG, AN) (CE 201)
03.00 pm - 03.30 pm	**Afternoon Tea**	**Afternoon Tea**	**Afternoon Tea**	**Afternoon Tea**	
03.30 pm - 05.00 pm	Lecture (LG)	Lecture (LG)	Lecture (LG)	Lecture (LG)	

Initials:

LG – Linlin Ge; **SH** - Scott Hensley (TBC); **AN** – Alex Ng; **CE** - Civil Engineering Building

10. Expected Resources for students

Reference books

"Introduction to microwave remote sensing", Iain H. Woodhouse, Taylor & Francis, 2006.

“Principles of Remote Sensing”, Paul J. Curran. London; New York : Longman, 1985.

“Physical Principles of Remote Sensing”, William.G. Rees. Cambridge, U.K.; New York, NY : Cambridge University Press, 2001.

UNSW Library website: http://info.library.unsw.edu.au/web/services/services.html

11. Course evaluation and development

Student feedback (both formal and informal) on the course will be gathered through CATEI (Course And Teaching Evaluation And Improvement) on the myUNSW portal and throughout the course.

The course has been received extremely well over the past few years and has attracted students from across faculties as well as from other universities. For example, the best features of this course identified by past students included:

- Background and principle description of the Radar and other Remote Sensing techniques.
- Interesting real-life examples and applications.
- Excellent academics, focused on group learning, well catered event.
- Very experienced lecturers from UNSW and NASA.

Past students suggested more practical training, which has been addressed with the addition of two lab assignments.

12. Other information

- Information on relevant Occupational Health and Safety policies and expectations as outlined at : http://www.hr.unsw.edu.au/ohswc/ohs/ohs_policies.html
- Special consideration in the event of illness or misadventure: https://my.unsw.edu.au/student/atoz/consideration.pdf
- Student equity and diversity issues via Student Equity Officers (Disability) in the Student Equity and Diversity Unit (9385 4734).
- Further information for students with disabilities is available at http://www.studentequity.unsw.edu.au/disabil.html