School of Civil and Environmental

Term 3, 2020

GMAT 9606 MICROWAVE REMOTE SENSING

COURSE DETAILS

Units of Credit	6	
Contact hours	3 hours per week, equivalent	
Class	9:00-17:00 Monday 19 Oct – Friday 23 Oct	Online
Course Coordinator and Lecturer	Professor Linlin Ge email: l.ge@unsw.edu.au office: CE414 phone: 9385 4177	
Lecturer	Dr Scott Hensley email: scott.hensley@jpl.nasa.gov office: phone	

INFORMATION ABOUT 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.

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.

HANDBOOK DESCRIPTION

See link to virtual handbook:

https://www.handbook.unsw.edu.au/undergraduate/courses/2020/gmat9606/

OBJECTIVES

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.

The course will address the following programme attributes:

- An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context
- Capacity for analytical and critical thinking and for creative problem solving
- Ability to engage independent and reflective learning
- Information literacy
- Skills for collaborative and multi-disciplinary work
- A respect for ethical practice and social responsibility
- Skills for effective communication

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.

Students are strongly encouraged to attend all lectures and prepare for class discussions on selected topics.

Below are some suggested approaches to learning in the course.

Private Study	• Preview lecture material and textbook • Review lecture material and textbook • Do set problems and assignments • Join Moodle discussions of problems • Reflect on class problems and assignments • Download materials from Moodle • Keep up with notices and find out marks via Moodle
Lectures	• Find out what you must learn • See methods that are not in the textbook • Follow worked examples • Hear announcements on course changes
Workshops	• Be guided by Demonstrators • Practice solving set problems • Ask questions
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving
Laboratory Work	• Hands-on work, to set studies in context

EXPECTED LEARNING OUTCOMES

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

	Learning Outcome	EA Stage 1 Competencies
1.	Investigate remote sensing options for identified applications,	*PE1.1, PE1.2, PE1.3, PE1.4, PE3.4*
2.	Apply theory to the implementation of the chosen option,	*PE1.5, PE2.1, PE2.3, PE3.3, PE3.5*
3.	Appreciate the complementary nature between remote sensing, GIS and surveying,	*PE1.3, PE1.4, PE1.5*
4.	Undertake basic data analysis, and	*PE1.2, PE2.2*
5.	Create digital maps.	*PE2.2, PE3.2, PE3.4*

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

COURSE PROGRAM

Term 3 2020

Day	Lecture (9:00 – 17:00; online)	Remark
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	Lab Assignments: Radar Interferometry (ADPS and DInSAR) Demonstration/ Lab (14:00 – 17:00; CE201)
5	InSAR and DInSAR case studies Persistent Scatterer Interferometry Review of course	

ASSESSMENT

Details of each assessment component, the marks assigned to it, the criteria by which marks will be assigned, and the dates of submission are set out below.

Assessment task	Length	Weight	Due date
Five Quizzes	Various	25% (5% each)	As instructed
Assignment 1	2 hours	10%	5pm Monday 9 Nov
Assignment 2	2 hours	15%	5pm Monday 9 Nov
Final Exam	2 hours	50%	In the formal exam period

Assessment Criteria: *The course learning outcomes include a significant level of technical learning, calculations, and engineering understanding of problems. These outcomes can be effectively and ideally assessed in an exam environment that can reflect the students' understanding of concepts, and the students' abilities to make decisions and solve problems within limited time. The final exam will be held under close book conditions. You need to score at least 40% in the final exam to be able to pass the course.*

Students who perform poorly in the quizzes and lab assignments are recommended to discuss progress with the lecturer during the term. Note: The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

Supplementary Examinations for Term 3 2020 will be held on Monday 11th January – Friday 15th January 2021 (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

PENALTIES

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 workshops 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.

RELEVANT RESOURCES

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

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

https://student.unsw.edu.au/dates

PLAGIARISM

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person’s work or ideas as if they were your own. When it is necessary or desirable to use other people’s material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

https://student.unsw.edu.au/plagiarism

ACADEMIC ADVICE

(Formerly known as Common School Information)

For information about:

- Notes on assessments and plagiarism,
- School policy on Supplementary exams,
- Special Considerations: student.unsw.edu.au/special-consideration
- Solutions to Problems,
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC.

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving
	PE2.2 Fluent application of engineering techniques, tools and resources
	PE2.3 Application of systematic engineering synthesis and design processes
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (professional and lay domains)
	PE3.3 Creative, innovative and pro-active demeanour
	PE3.4 Professional use and management of information
	PE3.5 Orderly management of self, and professional conduct
	PE3.6 Effective team membership and team leadership