FACULTY OF SCIENCE

SCHOOL OF BEES

GEOS3811

Advanced Techniques in Remote Sensing

S1, 2018

Faculty of Science - Course Outline - 2018

Contents:

Faculty of Science - Course Outline - 2018

1. Information about the course

NB: Some of this information is available on the UNSW Virtual Handbook[1]

Year of Delivery	2018
Course Codes	GEOS3811
Course Name	Advanced Techniques in Remote Sensing
Academic Unit	School of BEES
Level of Course	3rd year
Units of Credit	6UOC
Session(s) Offered	S1
Assumed Knowledge	GEOS2821, GEOS2811 or equivalent course; or acquired related knowledge. Working knowledge of ENVI software is assumed.
Hours per Week	Equivalent of 4 hours a week.
Number of Weeks	1
Dates	Week 1 (26 Feb- 2 Mar) 5-day intensive course and on-line components.

Summary of Course Structure (for details see 'Course Schedule')

Component	Hours	Time	Day	Location
Lectures and labs	30	9 am – 5 pm	26 Feb – 2 Mar	T06 - Lectures G29 - Labs
In-class and Online participation			Ongoing	Moodle Forum
Final Project			End of Wk 12	Online Submission

2. Staff involved

Staff	Name	Contact Details	Consultation Times
Course Convener and Lecturer	Dr Mirela Tulbure	mirela.tulbure@unsw.edu.au	By appointment.
Laboratory Demonstrator	Jack Wearne	jack.wearne@unsw.edu.au	Via Moodle
Guest Lecturer	Dr Mark Broich	mark.broich@unsw.edu.au	

[1] UNSW Virtual Handbook https://www.handbook.unsw.edu.au/undergraduate/courses/2018/GEOS3811.html

3. Course details

Course Description[2]

To develop an understanding of remote sensing principles and applications, including examples relevant to ecology, forestry, geography, and engineering through lectures, hands-on labs, and readings from the primary literature.

Course Aims

To introduce students to state-of-the-art technology and techniques of remote sensing image acquisition and processing, including sourcing imagery through open access databases. The course assumes some prior knowledge of image processing techniques such as that acquired in GEOS2821 or GEOS2811. Through completing the assessment tasks, mastering concepts taught in lectures through hands-on lab classes, students will have the skills for work in businesses or agencies applying remote sensing for environmental mapping and monitoring, natural resource management, ecology, geography and land use planning.

Course Learning Outcomes (CLO)

On satisfying the requirements of this course, students will be able to:

1. Understand the underlying principles of remote sensing, including electromagnetic interactions with the Earth's surface and atmosphere
2. Understand various sensor systems and platforms for collection of remotely sensed data, and their potential and limitations for environmental applications
3. Source free to use remote sensing data from various agencies
4. Demonstrate proficiency and conceptual understanding in using software to perform remote sensing image processing and analysis, through a series of laboratory exercises. This will include ENVI software but also learning to automate tasks through R.
5. Interpret, synthesise and apply that knowledge to produce new applied research in a selected thematic area (e.g. vegetation/land use, soils/geology, fluvial/marine, urban).
6. Communicate their investigation in a variety of written formats that link together the processing methods, results and interpretation, while catering for diverse audiences.

Graduate Attributes Developed in this Course

Science Graduate Attributes	***FOCUS*** *0 = NO FOCUS* *1 = MINIMAL* *2 = MINOR* *3 = MAJOR*	**Activities / Assessment (ATs)**
1. Research, inquiry and analytical thinking abilities	3	All will be achieved through assessment tasks (ATs) / #1 to #3.
2. Capability and motivation for intellectual development	2	In-class discussions and labs/ AT#1, AT#3
3. Ethical, social and professional understanding	2	Inquiry, research project / AT#3

[2] UNSW Virtual Handbook: https://www.handbook.unsw.edu.au/undergraduate/courses/2018/GEOS3811.html

4.	**Communication**	2	On-line components and readings, class participation / AT#2
5.	**Teamwork, collaborative and management skills**	3	Online discussions, Individual research project / AT#2, AT#3
6.	**Information literacy**	3	In class activities, research project / AT#1, AT#2, AT#3

Major Topics (Syllabus Outline)	See course schedule
Relationship to Other Courses within the Program	This course forms part of the BSc major in Spatial Information, as well as contributing and complementing other programs in the geosciences, environmental management, biosciences and related disciplines.

4. Rationale and strategies underpinning the course

Rationale for learning and teaching in this course – How this course is taught

Remote Sensing (defined by Statute II ISPRS[3]) is the art, science, and technology of obtaining reliable information from non-contact imaging and other sensor systems about the Earth and its environment, and other physical objects and of processes through recording, measuring, analysing and representation. Thus, remote sensing is technical in nature, in that one needs to use software to achieve one's aims. However, this course is not about teaching software. It is about the principles and applications of remote sensing, 'the science' of remote sensing (software changes rapidly while principles do not).

There are three elements that you should use for learning in the course. Lecture notes and resource material provide an overview of the subject, and are a key reference source. In the case of the software, there are detailed online manuals that should be referred to. These include both command references and labs. Finally, there are your colleagues in the course. You are all working on similar problems, and you should be learning together. As a 3rd year student, you are expected to do much of the learning both by yourself and with your colleagues.

Teaching Strategies

A flexible strategy combining teacher-centred and learner-centred approaches. Lectures, guided lab sessions, in-class discussions, problem-solving and inquiry are used to introduce learners to a range of concepts related to remote sensing, to develop deep understanding of such concepts, and the ability to transfer that understanding to new learning situations. Through this teaching modality I encourage students to become independent learners. This teaching strategy fosters graduates that are able to apply their knowledge and skills to solving problems.

How the assessment supports and assists the learning

A variety of hands-on lab classes have been devised to address the set learning outcomes, and to foster students that understand their discipline in an interdisciplinary context. The major research project was created to encourage students with independent and collaborative inquiry, to be rigorous in their analysis, critique and reflections. These assessments allow students to apply their knowledge and skills to solving problems, promote effective communication, and of application their discipline in local, national and international contexts.

Access to the lecturer

Email questions via Moodle or by appointment outside lecture times and labs email mirela.tulbure@unsw.edu.au.

[3] International Society of Photogrammetry and Remote Sensing

5. Course schedule

The schedule below might change slightly, but still gives a good indication of what to expect in this course.

Lectures notes and guidelines for lab sessions, the individual research paper and policy brief, will be uploaded on the Moodle platform.

Wk	Day	Lecture topics	Labs and other assessment tasks
0	26 Feb	Introduction: 1. Why RS 2. Brief history of RS 3. Principles of Electromagnetic Radiation and the EM Spectrum 4. Spectral Signatures 5. Elements of Image Interpretation 6. Sourcing images 7. Optical Remote sensing 8. Types of satellite images 9. Satellite remote sensing systems and their "resolutions" 10. Image pre-processing steps	Intro to ENVI [not assessed] Landsat, Sentinel pre-processing steps in ENVI
	27 Feb	1. Image classification, accuracy assessment 2. Image processing 3. High-resolution RS imagery, case study: Mapping emergent wetland vegetation with QuickBird imagery	Landsat, Sentinel image classification, accuracy assessment in ENVI
	28 Feb	Remote Sensing applications: 1. Vegetation indices, time-series analysis, phenology, LiDAR. Examples will focus on deforestation, phenology, and vegetation response to flooding including image time-series Guest Lecturer: Mark Broich	Intro to R and R studio [not assessed] Remote sensing for conservation lab
	1 Mar	Remote Sensing applications: 2. Water including optical data (MT, 2h) 3. SAR data (MB, 1h)	Start Water resources lab
	2 Mar	Remote Sensing Applications: 4. Conservation 5. Geology 6. Fire Course Wrap up	Continue Water resources lab Start guided individual research for final project
2	5 Mar		Finalise Lab Reports
3	12 Mar		Lab 1 (2 parts): ENVI report Due
4	19 Mar		Lab 3: Conservation report Due
5	26 Mar		Lab 4: Water Resources report Due
Break			
6-11	9 Apr – 14 May		Work on Final Project
12	21 May		Final Project due

6. Additional resources and support

Text Books

There is no single required textbook for this course. You will learn about each topic taught in the course from a suite of papers, tutorials, book chapters and other resources throughout the course. A list of suggested textbooks and tutorials is included below:

1. Remote Sensing of the Environment: An Earth Resource Perspective, J. Jensen
2. Remote Sensing and Image Interpretation, Lillesand et al.
3. Remote Sensing and GIS for Ecologists Using Open Source Software, 2017, Pelagic Publishing, Edited by: M. Wegmann et al
4. An excellent summary of key RS principles and examples produced by the Canadian Centre for Remote Sensing.
5. Remote Sensing Time Series Revealing Land Surface Dynamics, Springer, Edited By: C. Kuenzer et al. 2015.

Course Materials

Course materials will be provided on Moodle for online viewing and/or download. This will require a browser such as Firefox, Safari, Internet Explorer or Chrome.

To login to Moodle, go to: https://moodle.telt.unsw.edu.au

Once in Moodle, you will also need your z number and z pass to access some of the readings via the UNSW library website. Lab instructions (Labs), lecture notes (Lectures), and assessment tasks will be available through Moodle, in the corresponding section and day/week.

You will use ENVI, the R scientific programming environment and the RStudio interface to work with data in this technical and hands-on course. R and RStudio are free to use programs already installed on the BEES computers, however you can download for personal use from https://www.r-project.org/ and https://www.rstudio.com/

Required Readings

These will be advised as the course progresses.

Additional Readings

Useful Journals that can be accessed through the UNSW Library (e-Journals)

Remote Sensing of Environment
International Journal of Remote Sensing
Remote Sensing
IEEE Transactions in Geoscience and Remote Sensing
Photogrammetric Engineering and Remote Sensing
Remote Sensing Reviews
Journal of Applied Remote Sensing

You should also become familiar with the use of citation tracking in the Scopus and Web of Science databases. These are available via sirius.library.unsw.edu.au. Citation tracking allows you to see who has been citing articles, and who is cited in articles. It is a very good way of seeing if an idea or method has been critiqued or further developed by subsequent researchers. Google scholar is also a good source to begin your search for relevant papers.

Recommended Internet Sites

http://www.auscover.org.au/
http://visibleearth.nasa.gov/

https://sentinel.esa.int/web/sentinel/missions/sentinel-2
https://www.usgs.gov/products/data-and-tools/real-time-data/remote-land-sensing-and-landsat
http://earthobservatory.nasa.gov
http://neo.sci.gsfc.nasa.gov/Search.html

Computer Laboratories or Study Spaces

Building E26 teaching lab 06 for lectures 9-12pm each day during 26 Feb -02 March 2018 week.

Biosciences (D-26) room G29 for lab sessions, 1-5PM (Monday, Wednesday, Thursday and Friday) and 2-5PM on Tuesday.

7. Required Equipment, Training and Enabling Skills

Required equipment Provided in the computer labs.

Enabling skills - training which may be required to complete this course Working knowledge of ENVI and Microsoft Office. Working knowledge of R and R studio.

8. Assessment Tasks (AT) and Feedback

Task	CLOs assessed	% of total mark	Date		Feedback	
			Release	Due		
AT#1: Lab work & reports (individual)	CL1, CL3, CL5	55	Days 1 - 5	Wk 3/ Wk 4/ Wk 5	Demonstrator	Daily during Labs
AT#2: Class Participation	CL1, CL2, CL5, CL6	15	Ongoing	Ongoing	Demonstrator	Ongoing
AT#3: Final Project and Policy Brief (individual)	CL1, CL2, CL3, CL4, CL5, CL6	30	Day 5	Wk12	MT	

8.1 Assessment Criteria

AT#1:Lab Reports (55% of final course mark)

Due date: end of Week 2

- Instructions for the 3 Labs and marking criteria (rubric) will be uploaded on Moodle.
- Lab reports are to be completed for each lab, and submitted via Moodle
- Answer the lab questions, and include images/screenshots of your results
- **Save the document as a .pdf** and upload to the corresponding **Assessment submission** on Moodle.
- These are meant to be detailed reports that demonstrate your learning and that you have put reasonable effort into attempting and completing the lab exercises - there are (almost) no wrong answers.
- Lab weight distribution: Lab 1 (two parts): 25% / Lab 2: 10% / Lab 3: 20%

AT#2: Class Participation (15% of the final course mark)

Due date: Ongoing

Course participation in both class and well as Moodle Forum

Each student will be expected to have at least one meaningful contribution per week for a full mark on this component). On-line participation may include any of the following:

- share with your colleagues and instructors something that you found in the news where remote sensing has been used and you found interesting: a recent example that I like is about the water crisis in Cape Town, South Africa and how Landsat satellite data has been used to look at reservoir dynamics: https://twitter.com/MirelaGTulbure/status/958262018695356416;
- issues that you may find with the course/lab materials – typos, errors, points of confusion – I am always interested in improving the material and any CONSTRUCTIVE feedback is great feedback
- questions relating to remote sensing or answers to questions from other students (not direct answers to lab assessments)
- A summary of a blog post where remote sensing has been used that you recently read and found useful.

You should not post any content that is in any way offensive or that violates University codes of conduct or explicit solutions to lab assignments (you are welcome to help each other out but don't post the answer).

Submission via Moodle Forum (AT#2)

AT#3: Final Project and Policy Brief (30% of final course mark)

Due date: end week 12

The aim of the final research project is to investigate an environmental remote sensing application, synthesising knowledge acquired through Labs and systematic literature review and applying it to a 'theme' of your choice (e.g. geology, ecology, land use change, surface hydrology, land degradation, etc.). The final project is a research paper to be complemented by a policy brief, as a way of summarising the report findings for decision-makers. Specific instructions will be uploaded on Moodle.

Activities related to this task should be submitted via Moodle under **Assessment Submission**.
The final project is worth 20%, and the policy brief is worth 10%.

9. Administrative Matters

Expectations of Students	You are expected to attend all lectures and laboratories. **All assessable items are compulsory**.
Assignment Submissions	Assignments are to be submitted via Moodle, under **'Assessment Submission**', look for specific folders for submission of the different assessment tasks of this course. Extensions will not be granted unless supported by documentation (e.g. doctor's certificate) or through UNSW Student Central (see https://student.unsw.edu.au/special-consideration).
Occupational Health and Safety	Information on relevant Occupational Health and Safety policies and expectations can be found at https://safety.unsw.edu.au (UNSW) and http://www.bees.unsw.edu.au/health-and-safety (BEES).
Examination Procedures	This course has no final exam.
Equity and Diversity	Those 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.studentequity.unsw.edu.au). Issues to be discussed may include access to materials, signers or note-

takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

Grievance Policy[4]	**School Contact** A. Prof Jes Sammut Grievance Officer School of BEES j.sammut@unsw.edu.au Tel: 9385 8281	**University Contact** Student Conduct and Appeals Officer (SCAO) within the Office of the Pro-Vice-Chancellor (Students) and Registrar. Telephone 02 9385 8515, email studentcomplaints@unsw.edu.au University Counselling and Psychological Services Tel: 9385 5418

10. UNSW 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.

BEES Academic Honesty and Plagiarism

Please note:

In addition to the UNSW Policy on Academic Honesty and Plagiarism, the School of Biological, Earth and Environmental Sciences (BEES), also considers any work submitted that has been produced outside of a given course in a given year to be plagiarism i.e:

- Work produced for a third party e.g. your place of employment, is considered intellectual property of the third party, and as such if such work is submitted in place of a required course work, it is deemed plagiarism.

- All work submitted for assessment must be created specifically for the given assessment task in the given year. Work produced in previous years or for other assessments is not acceptable.