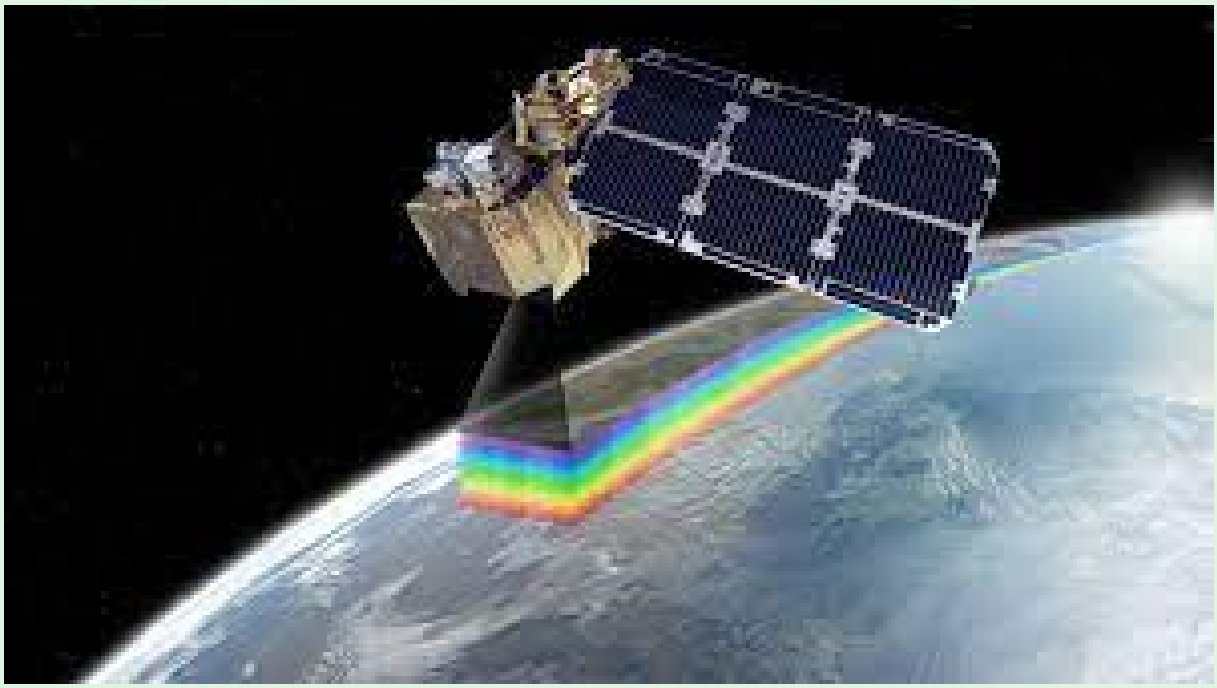
CVEN4800

Satellite Remote Sensing and Applications

Term 1, 2023



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
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School Contact Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Course Details

Units of Credit 6

Summary of the Course

This course introduces the concepts, principles and techniques used for satellite remote sensing to civil and environmental engineering students. Topics include:

Electromagnetic radiation
Principles of satellite remote sensing
Multispectral remote sensing
Hyperspectral remote sensing
Thermal remote sensing
LiDAR remote sensing
Radar remote sensing

Remote sensing applications in civil engineering

- structural deformation
- urban expansion

Remote sensing applications in geotechnical engineering

- ground settlement
- slope stability
- mine subsidence
- earthquakes

Remote sensing applications in environmental engineering

- coastal erosion
- bathymetry
- water pollution
- vegetation monitoring
- groundwater extraction
- oil spill
- flood
- bushfire

Remote sensing applications in transport

- road traffic conditions
- ship detection
- underground tunnelling

Course Aims

To introduce several topics and methods which are specialist skills of a geospatial engineer.

To broaden and deepen the knowledge of remote sensing, including the use of a broad range of satellite sensors and analysis techniques relevant to civil and environmental engineering.

The educational process and underlying knowledge in this course may be applied to other types of geospatial and civil engineering tasks.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Be familiar with the challenges and techniques of satellite remote sensing.	PE1.3
2. Be competent in processing satellite imagery including choice of sensors, satellite tasking, pre-processing, classification, and visualisation.	PE2.2
3. Understand the strengths and weaknesses, and characteristics of several different remote sensing techniques.	PE3.3
4. Be able to decide which technique to use for different civil, environmental and geospatial applications	PE3.1, PE3.2

Teaching Strategies

This course consists of a mixture of lectures, workshops, hands-on computer sessions and online quizzes. It will place emphasis on problem solving skills and application to real case studies.

In designing this course, my objective has been to train intelligent users of data collected from remote sensing satellites. The core philosophy has been that, regardless of the applications, intelligent use of these data requires a basic understanding of the underlying physics as well as an acquaintance with the design of the major sensing systems since both of these impact the information content, processing and interpretation of the remote sensing data. Thus, the course is designed to introduce students to basic radiative transfer modeling, and to provide a survey of the types of sensing systems in use today, the types of data that they produce, and the tools and techniques available for interpretation and analysis, with reference to specific applications as appropriate to civil, environmental and geospatial engineering.

The course will not be run in distance mode however the lectures will be videotaped. The resultant files are not intended to be a substitute for class attendance but may be useful for students who can’t avoid missing a class, and for those who attend the class but want to rehear part of it to aid their understanding.

Commercial software packages, such as ENVI and ESRI ArcGIS, will be used by students to analyse and visualise real remote sensing data. Students will have the opportunity to present their results in front of the whole class.

The lecturer will attend all laboratory and workshop classes. There might be some guest lectures on specific topics by the leading remote sensing scientists from the Stanford University, NASA Jet Propulsion Laboratory (JPL), the German Aerospace Centre (DLR)/ Technical University of Munich (TUM), and Japan Aerospace Exploration Agency (JAXA).

There is no pre-requisite for this course. Hence the teaching of this course will be at a level recognises the limited prior knowledge in satellite remote sensing. This course may assist students' final year thesis, depending on the topic chosen.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Final Exam	50%	In formal exam period	1, 3, 4
2. Lab assignment	25%	Not Applicable	2, 4
3. Five quizzes	25%	Not Applicable	1, 2, 3, 4

Assessment 1: Final Exam

Start date: In formal exam period
Assessment length: 2 hours
Due date: In formal exam period

Assess the overall understanding of the course

Assessment 2: Lab assignment

4 LAB ASSIGNMENTS

Additional details

LAB ASSIGNMENTS – step-by-step instructions will be provided

1. Lab assignment 1: Google Earth worshop (4%) Issued: Week 6; due on: Friday 5pm, Week 7
2. Lab assignment 2: Land use classification (7%) Issued: Week 6; due on: Friday 5pm, Week 8
3. Lab assignment 3: NDVI and greenness map generation (7%), Issued: Week 6; due on: Fri 5pm, Week 9
4. Lab assignment 4: Hydrologic analysis based on DEM (7%), Issued: Week 6; due on: Fri 5pm, Week 10

Assessment 3: Five quizzes

QUIZZES – a tool to facilitate timely revision of lectures

Additional details

QUIZZES – a tool to facilitate timely revision of lectures

1. Quiz 1: Principles of satellite remote sensing and techniques Issued on: Mon 5pm, Week 3; due on: Mon 9am, Week 4
2. Quiz 2: Remote sensing applications in civil engineering Issued on: Mon 5pm, Week 6; due on: Mon 9am, Week 7
3. Quiz 3: Remote sensing applications in geotechnical engineering Issued on: Mon 5pm, Week 7; due on: Mon 9am, Week 8
4. Quiz 4: Remote sensing applications in environmental engineering Issued on: Mon 5pm, Week

8; due on: Mon 9am, Week 9

5. Quiz 5: Remote sensing applications in transport Issued on: Mon 5pm, Week 9; due on: Mon 9am, Week 10

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
O-Week: 6 February - 10 February	Seminar	NASA Guest lecture (TBC)
Week 1: 13 February - 17 February	Lecture	Course introduction Electromagnetic radiation Principles of satellite remote sensing
Week 2: 20 February - 24 February	Lecture	Techniques of satellite remote sensing • Multispectral remote sensing • Hyperspectral remote sensing • Thermal remote sensing • LiDAR remote sensing • Radar remote sensing
Week 3: 27 February - 3 March	Lecture	Remote sensing applications in civil engineering – Part 1
Week 4: 6 March - 10 March	Lecture	Remote sensing applications in civil engineering – Part 2
Week 5: 13 March - 17 March	Lecture	Remote sensing applications in geotechnical engineering – Part 1
Week 6: 20 March - 24 March	Laboratory	Labs instructions available
Week 7: 27 March - 31 March	Lecture	Remote sensing applications in geotechnical engineering – Part 2
Week 8: 3 April - 7 April	Lecture	Remote sensing applications in environmental engineering – Part 1
Week 9: 10 April - 14 April	Lecture	Remote sensing applications in environmental engineering – Part 2
Week 10: 17 April - 21 April	Lecture	Remote sensing applications in transport ; Course review

Resources

Prescribed Resources

- Lecture notes and suggested additional readings are provided on Moodle.
    - https://moodle.telt.unsw.edu.au/

- Recommended Internet sites:
    - NASA e-book ‘Earth As Art’, http://www.nasa.gov/connect/ebooks/earth_art_detail.html#.VEM4ch2UdqY
    - Canadian Centre for Remote Sensing (CCRS), http://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/satellite-imagery-products/9271
    - The Centre for Remote Imaging, Sensing and Processing (CRISP) at the National University of Singapore, http://www.crisp.nus.edu.sg/~research/#current

Submission of Assessment Tasks

Please refer to the Moodle page of the course for further guidance on assessment submission.

UNSW has a standard late submission penalty of:

- 5% per day, for all assessments where a penalty applies, capped at five days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

Academic Honesty and 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 Information

Final Examinations:

Final Exams in T1 2023 will be held on campus between the 28th of April and the11th of May, and Supplementary Exams between the 22nd of May and the 26th of May. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

ACADEMIC ADVICE

- Key Staff to Contact for Academic Advice (log in with your zID and password): https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw
- Key UNSW Dates - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.
- CVEN Student Intranet (log in with your zID and password): https://intranet.civeng.unsw.edu.au/student-intranet
- Student Life at CVEN, including Student Societies: https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life
- Special Consideration: https://student.unsw.edu.au/special-consideration
- General and Program-Specific Questions: The Nucleus: Student Hub
- Book an Academic Advising session: https://unswengacademicadvising.as.me/schedule.php

Disclaimer

This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

The European Space Agency

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering 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	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	✓
PE3.2 Effective oral and written communication in 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	