INFORMATION ABOUT THE COURSE

The purpose of this new course is to introduce civil and environmental engineering (CVEN) students to the principles of remote sensing and a wide range of its applications such as monitoring water pollution, ground subsidence due to groundwater extraction, thermal deformation of buildings, slope stability, and movement of levees.

The student will learn the principles of a wide variety of remote sensing techniques that are used for monitoring changes on the surface of Earth. Its aims are to introduce CVEN students, particularly those with an interest in structures, environmental or geotechnical topics, to the concepts and methodologies used by experts in remote sensing. It is not intended to produce remote sensing specialists, but rather to allow BE CE graduates to work with geospatial specialists in this field. It will cover monitoring of settlement of land (e.g. landslide, sinkhole and mine subsidence), coastal erosion and oil spill on the sea. It will also cover how natural disasters such as earthquakes, flood and bushfire can be monitored with remote sensing so that structures are better designed to resist these events and their environmental impact can be minimised.

The course is offered in the summer break to provide opportunities for CVEN students to complete a year 4 elective outside the usual session 1 and session 2 offerings.

This course has a strong focus on applications of satellite remote sensing techniques relevant to civil and environmental engineering. Hence, it can be taken as an extension to courses such as ‘GMAT3500 Remote Sensing and Photogrammetry’, ‘GMAT3600 Earth Observation and Applications’ and ‘GMAT9600 Principles of Remote Sensing’, which focus on principles and techniques of satellite, airborne and ground-based remote sensing.

CVEN4800 students wishing to learn more about radar remote sensing may enrol, with special permission from the program coordinator or Head of School, in the UNSW-NASA joint one-week course ‘GMAT9606 Microwave Remote Sensing’ in the mid-semester break of semester 2, typically in end of September. A NASA Public Lecture on remote sensing of the Earth and planets is usually offered in connection with GMAT9606.

Students from other Engineering schools or faculties may also enrol in this course with special permission from their
program coordinators or Heads of School. In order to give such students a taste of satellite remote sensing, a two-day workshop on ‘Satellite Remote Sensing and Applications’ is usually held for students from across UNSW in the mid-semester break of semester 1, typically in mid April.

HANDBOOK DESCRIPTION
See link to virtual handbook:


OBJECTIVES
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.

The course will address the following programme attributes:

- An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context: the course will cover topics of geospatial knowledge in the inter-disciplinary context of civil and environmental engineering.
- Capacity for analytical and critical thinking and for creative problem solving: this will be achieved by addressing each remote sensing application with problem statement, conventional techniques, why remote sensing is needed and what the future holds.
- Ability to engage independent and reflective learning: this will be facilitated through additional readings and news forum.
- A respect for ethical practice and social responsibility: the environmental aspect of the course will be very useful to address this attribute.
- Skills for effective communication: the course will improve students’ communication skills through preparing reports on lab assignments.

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 reheat 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.

The lecturer will attend all laboratory and workshop classes. There will 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.

Some of the approaches to learning are listed in the table below.

| Private Study                          | • Review lecture material  
|                                        | • 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 (quizzes, examinations, assignments, laboratory reports etc.) | • Demonstrate your knowledge and skills
|                                        | • Demonstrate higher understanding and problem solving
| Laboratory Work                        | • Hands-on work, to set studies in context

**EXPECTED LEARNING OUTCOMES**

By the end of this course students will be familiar with the challenges and techniques of satellite remote sensing, and be competent in processing satellite imagery including choice of sensors, satellite tasking, pre-processing, classification, and visualisation. Students will understand the strengths and weaknesses, and characteristics of several different remote sensing techniques, and be able to decide which technique to use for different civil, environmental and geospatial applications.

These learning outcomes require student-centred and self-directed learning. For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

**ASSESSMENT**

Assessment for the course includes:
- Five quizzes 25% (5% each) Due dates see later
- Three lab assignments 8%, 7% and 10%, respectively Due dates see later
- 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 quiz, 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 quizzes or assignments 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.**

### QUIZZES – a tool to facilitate timely revision of lectures

<table>
<thead>
<tr>
<th>Quiz</th>
<th>Topic</th>
<th>Issued on:</th>
<th>Due on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Quiz 1: Principles of satellite remote sensing and techniques</td>
<td>13 Jan 2015</td>
<td>19 Jan 2015</td>
</tr>
<tr>
<td>2</td>
<td>Quiz 2: Remote sensing applications in civil engineering</td>
<td>13 Jan 2015</td>
<td>19 Jan 2015</td>
</tr>
<tr>
<td>3</td>
<td>Quiz 3: Remote sensing applications in geotechnical engineering</td>
<td>19 Jan 2015</td>
<td>26 Jan 2015</td>
</tr>
<tr>
<td>4</td>
<td>Quiz 4: Remote sensing applications in environmental engineering</td>
<td>21 Jan 2015</td>
<td>26 Jan 2015</td>
</tr>
<tr>
<td>5</td>
<td>Quiz 5: Remote sensing applications in transport</td>
<td>23 Jan 2015</td>
<td>26 Jan 2015</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Topic</th>
<th>Issued on:</th>
<th>Due on:</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Lab assignment 1: Satellite remote sensing of urban expansion (8%)</td>
<td>15 Jan 2015</td>
<td>9 Feb 2015</td>
</tr>
<tr>
<td>2</td>
<td>Lab assignment 2: Satellite remote sensing of mine subsidence (7%)</td>
<td>19 Jan 2015</td>
<td>10 Feb 2015</td>
</tr>
<tr>
<td>3</td>
<td>Lab assignment 3: Satellite remote sensing of flood (10%)</td>
<td>21 Jan 2015</td>
<td>12 Feb 2015</td>
</tr>
</tbody>
</table>

### COURSE PROGRAM (there might be small changes due to the availability of guest lecturers)

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
</table>
| 1   | 12/01/2015 | Course introduction  
Electromagnetic radiation  
Principles of satellite remote sensing |
| 2   | 13/01/2015 | Techniques of satellite remote sensing  
• Multispectral remote sensing  
• Hyperspectral remote sensing  
• Thermal remote sensing  
• LiDAR remote sensing  
• Radar remote sensing |
<p>| 3   | 14/01/2015 | Remote sensing applications in civil engineering – Part 1 |
| 4   | 15/01/2015 | Remote sensing applications in civil engineering – Part 2 |
| 5   | 16/01/2015 | Remote sensing applications in geotechnical engineering – Part 1 |
|     | Break              | Break |</p>
<table>
<thead>
<tr>
<th></th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>19/01/2015</td>
<td>Remote sensing applications in geotechnical engineering – Part 2</td>
</tr>
<tr>
<td>7</td>
<td>20/01/2015</td>
<td>Remote sensing applications in environmental engineering – Part 1</td>
</tr>
<tr>
<td>8</td>
<td>21/01/2015</td>
<td>Remote sensing applications in environmental engineering – Part 2</td>
</tr>
<tr>
<td>9</td>
<td>22/01/2015</td>
<td>Remote sensing applications in transport – Part 1</td>
</tr>
<tr>
<td>10</td>
<td>23/01/2015</td>
<td>Remote sensing applications in transport – Part 2</td>
</tr>
</tbody>
</table>

### RELEVANT RESOURCES

- Lecture notes and suggested additional readings are provided on Moodle.  
  - [http://moodle.telt.unsw.edu.au/](http://moodle.telt.unsw.edu.au/)
- Recommended Internet sites:
  - The Centre for Remote Imaging, Sensing and Processing (CRISP) at the National University of Singapore, [http://www.crisp.nus.edu.sg/~research/#current](http://www.crisp.nus.edu.sg/~research/#current)

### DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

[https://my.unsw.edu.au/student/resources/KeyDates.html](https://my.unsw.edu.au/student/resources/KeyDates.html)

### 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](https://student.unsw.edu.au/plagiarism)

### ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism,
- School policy on Supplementary exams,
- Special Considerations,
- 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:

[http://www.engineering.unsw.edu.au/civil-engineering/resources/academic-advice](http://www.engineering.unsw.edu.au/civil-engineering/resources/academic-advice)