SCHOOL OF CIVIL & ENVIRONMENTAL ENGINEERING

FACULTY OF ENGINEERING

GMAT 3600

Earth Observation System and Applications

Course Outline – Session 2, 2014

Version: 1/08/2014

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

(User your student ID and Z-password to login)
Earth Observation System (EOS) is a coordinated series of airborne and spaceborne platforms equipped with a variety of sensors for long-term observations of the land surface, biosphere, solid Earth, atmosphere, and oceans. This course will describe the history, challenges and developments in these systems. Topics covered include definition and physics of basic electromagnetic radiation properties, energy-matter relationships, spectral signatures of surfaces and the atmosphere, the reduction of atmospheric effects, optical and microwave sensor concepts, an introduction to data processing, enhancement, image interpretation and presentation of results. Selected from hundreds of satellite missions, Landsat, Satellite Pour l’Observation de la Terre (SPOT), and European Remote Sensing (ERS) will be briefly introduced, as well as future earth observing satellite constellations. The variety of satellite and airborne platforms, and the greater access to imagery, now make it possible to use earth observation systems to address a wide range of applications including climate change. The diverse and ever-growing applications will be reviewed.

1. Location of the course

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>Wed 16:00-18:00</td>
<td>Civil Engineering (CE) Building G8</td>
</tr>
<tr>
<td></td>
<td>Thu 14:00-16:00</td>
<td>Australian School of Business Room 205</td>
</tr>
<tr>
<td>Workshop</td>
<td>Thu 16:00-17:00</td>
<td>Australian School of Business Room 205</td>
</tr>
</tbody>
</table>

2. Table of Contents

1. Location of the course
2. Table of Contents
3. Staff Contact Details
4. Course details
5. Rationale for the inclusion of content and teaching approach
6. Teaching strategies
7. Assessment
8. Academic honesty and plagiarism
9. Course schedule
10. Expected Resources for students
11. Course evaluation and development
12. Other information

3. Staff Contact Details

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Email</th>
<th>Availability; times and location</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Convener</td>
<td>A/Professor Linlin Ge</td>
<td><a href="mailto:l.ge@unsw.edu.au">l.ge@unsw.edu.au</a></td>
<td>Wed 2:00PM - 3:00PM; CE704</td>
<td>9385 4177</td>
</tr>
<tr>
<td>Lecturer/Demonstrator</td>
<td>A/Professor Linlin Ge</td>
<td><a href="mailto:l.ge@unsw.edu.au">l.ge@unsw.edu.au</a></td>
<td>Wed 2:00PM - 3:00PM; CE704</td>
<td>9385 4177</td>
</tr>
</tbody>
</table>
Students should check the Moodle site and their emails regularly in case lectures are re-scheduled through the unforeseen absence of the lecturer.

4. Course details

Credit Points: 6

This course is in parallel teaching with a postgraduate course GMAT9600 Principles of Remote Sensing.

Summary of the Course

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

Aims of the Course

This course will enable students to explore and gain further understanding of remote sensing for earth observation through the investigation of satellite remote sensing data with a direct emphasis of their application to real world situations in the field of mapping and environmental monitoring.

Student learning outcomes

At the conclusion of this course the student will be able to:
1. Investigate remote sensing options for identified applications,
2. Apply theory to the implementation of the chosen option,
3. Appreciate the complementary nature between remote sensing and surveying,
4. Undertake basic data analysis, and
5. Create digital maps.

Graduate Attributes

This course provides an environment that fosters in our students the following attributes as listed:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>the skills involved in scholarly enquiry</td>
<td>Significant</td>
</tr>
<tr>
<td>an in-depth engagement with relevant disciplinary knowledge in its interdisciplinary context</td>
<td>Some</td>
</tr>
<tr>
<td>the capacity for analytical and critical thinking and for creative problem solving</td>
<td>Significant</td>
</tr>
<tr>
<td>the ability to engage in independent and reflective learning</td>
<td>Some</td>
</tr>
<tr>
<td>the skills to locate, evaluate and use relevant information (Information Literacy)</td>
<td>Significant</td>
</tr>
<tr>
<td>the capacity for enterprise, initiative and creativity</td>
<td>Some</td>
</tr>
<tr>
<td>an appreciation of and respect for, diversity</td>
<td>Some</td>
</tr>
<tr>
<td>a capacity to contribute to, and work within, the international community</td>
<td>Minimal</td>
</tr>
<tr>
<td>the skills required for collaborative and multidisciplinary work</td>
<td>Some</td>
</tr>
<tr>
<td>an appreciation of, and a responsiveness to, change</td>
<td>Some</td>
</tr>
<tr>
<td>a respect for ethical practice and social responsibility</td>
<td>Some</td>
</tr>
</tbody>
</table>

5. Rationale for the inclusion of content and teaching approach
Remote sensing is one of the most important spatial information systems which can efficiently gather information essential for decision making. This course is included to enable students to develop particular communications skills that will enhance their practice as a geo-spatial specialist and surveyor. It reflects my position that their practice within the field will require advanced levels of communication to enable ongoing development of cost-effective mapping and planning for a sustainable environment.

On the other hand, GPS and other ground survey techniques play very important roles in georeferencing remote sensing imagery and validating remote sensing results. Therefore, GMAT3600 has close relationship to courses such as

- GMAT1110 Surveying & GIS,
- GMAT3100 Surveying Applications,
- GMAT3200 Geospatial Information Techniques and Applications,
- GMAT4910 Modern Navigation & Positioning Technologies, and
- GMAT4900 Principles of GNSS Positioning.

6. Teaching strategies

A variety of teaching activities will be conducted to maximize teaching and learning outcomes, including:

- lectures are delivered as interactively as possible using PPT slides and animations. 
- quizzes are scheduled almost weekly to enhance learning. 
- workshops are used to supplement lectures with further details and to assist students from non spatial information background. 
- lab exercises are used to give students the opportunity to apply remote sensing theory to real data. 
- assignments are included to reinforce learning. 

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

7. Assessment

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Length</th>
<th>Weight</th>
<th>Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>Various</td>
<td>25%</td>
<td>As instructed</td>
</tr>
<tr>
<td>Lab exercise</td>
<td>2 hours</td>
<td>10%</td>
<td>5 pm Thursday Week 7</td>
</tr>
<tr>
<td>Assignment – remote sensing applications</td>
<td>2 weeks</td>
<td>25%</td>
<td>5 pm Thursday Week 12</td>
</tr>
<tr>
<td>Final Exam</td>
<td>2-3 hours</td>
<td>40%</td>
<td>In the formal exam period</td>
</tr>
</tbody>
</table>
8. Academic honesty and plagiarism

8.1 Rules

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.

8.2 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.

8.3 Grievances

In the first instance all grievances should be discussed with the lecturer involved. If the problem cannot be resolved, students should contact the School's Grievance Officer in writing.
9. **Course schedule**

<table>
<thead>
<tr>
<th>Week (date)</th>
<th>Lecture / tute</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 (28/07)</td>
<td>No lecture – students are away at the Survey Camp</td>
</tr>
</tbody>
</table>
| 02 (04/08) | Introduction to Course  
Introduction to Earth Observation/Remote Sensing |
| 03 (11/08) | Electromagnetic Radiation – Definition & Physics |
| 04 (18/08) | Spectral Reflectance and Atmospheric Attenuation |
| 05 (25/08) | Radar Background and Surface Interaction |
| 06 (01/09) | Interferometric Synthetic Aperture Radar |
| 07 (08/09) | Lab demonstration: DInSAR data analysis |
| 08 (15/09) | Electro-optical Sensors (1) |
| 09 (22/09) | Assignment – remote sensing application |
| 10 (06/10) | Mid-session break |
| 11 (13/10) | Electro-optical Sensors (2) |
| 12 (20/10) | Thermal Infrared Sensing |
| 13 (27/10) | Laser Scanning, Remote Sensing & GIS |
| 13 (27/10) | Revision, course summary |

10. **Expected Resources for students**

The course will be mainly based on PDF files of Powerpoint lecture slides available at the course Moodle site.

The material will be uploaded week by week.

The following are recommended reading materials:

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

11. **Course evaluation and development**

UNSW places a very high priority on ensuring an excellent overall experience for its students. In order to facilitate enhancement of student learning through the continual improvement of courses and teaching, the University has implemented the Course and Teaching Evaluation and Improvement (CATEI) Process (http://teaching.unsw.edu.au/catei).

CATEI allows students to evaluate their learning experiences in an anonymous way. At
the end of each session, you will be asked to complete an on-line survey form, allowing you to express anonymously your reactions and suggestions regarding course content, teaching materials, teachers and assessment. The resulting evaluations are ultimately returned to the course convener who will use the feedback to make ongoing improvements to the course. You are also encouraged to provide comments, suggestions and feedback to the convener of the course at any time during the semester.

The course has been well received by undergraduate and postgraduate students alike. Examples of comments from past years are “The lecturer was amazing”; “The lecturer was wonderful, clear and full of knowledge. The assignments and tutorials were relevant and interesting”; “The content was very interesting”; “the online quizzes enforced a lot of the learning very well”; “Real satellite imagery used during lectures provided a better insight into the topics being discussed.”; “this course gave students new eyes on how people can watch this world which is interesting and the lecturer was professional and patient”.

On the other hand, every year the course is revised and updated taking into account issues and concerns raised by students in the student surveys as part of the CATEI process. Examples of changes that have been made include the introduction of quizzes, assignment and lab exercise with real remote sensing data.

Your input into this quality enhancement process through completing the CATEI surveys is extremely valuable in assisting conveners to plan and revise course content and assessment. This process of evaluation assists us to meet the needs of students and to provide an effective and enriching learning experience. The results of all surveys are carefully considered and, as indicated above, do lead to action to enhance the quality or course content and delivery.

12. Other information

- General Conduct and Behaviour: You are expected to conduct yourself with consideration and respect for the needs of your fellow students and teaching staff. Conduct which unduly disrupts or interferes with a class, such as ringing or talking on mobile phones, is not acceptable and students may be asked to leave the class. Additionally students must conduct themselves and use appropriate and respectful language at all times. More information on student conduct is available at: https://my.unsw.edu.au/student/atoz/BehaviourOfStudents.html

- Information on relevant Occupational Health and Safety policies and expectations as outlined at: http://www.ohs.unsw.edu.au/

- Advice concerning special consideration in the event of illness or misadventure: Applications for special consideration in relation to the final exam are considered by a Faculty panel to which lecturers-in-charge provide their recommendations for each request. If the Faculty panel grants a special consideration request, this will entitle the student to sit a supplementary examination. No other form of consideration will be granted. If you are too ill to perform reasonably on the final exam, do not attend the final and apply for a supplementary instead.
However granting of a supplementary exam in such cases is not automatic. If a student attends the regular final, s/he is unlikely to be granted a supplementary exam.

- 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/