**ENV202 / ENV502 Introductory Remote Sensing**

|  |  |  |  |
| --- | --- | --- | --- |
| **Credit points:** | 10 | **Mode:** | External / Internal |
| **Assumed knowledge:** | SES101/ENV101 | **Location:** | Casuarina |
| **Pre-requisite(s):** | NA | **Learning method:** | OL, OLR, PB |
| **Year:** | 2015 |  |  |
| **Semester:** | 1 | **Unit coordinator:**  | Dr Karen Joyce |
| **School:** | SENV | **Phone:**  | 08 8946 7627 |
|  |  | **Email:**  | karen.joyce@cdu.edu.au |

**Unit Description**

Remote sensing is the ability to obtain information about something without being in physical contact with it. This is often in the form of a photo or digital image. In environmental and earth sciences, we use satellites and aircraft to take pictures of the earth (such as those used in Google Earth, for example) to map, monitor, and manage our resources. Remote sensing is a powerful tool for understanding environmental features and processes, and is used in a wide variety of applications such as infrastructure mapping, natural disaster assessment, weather forecasting, and national security.

The aim of this unit is to provide an introduction to the theory and practice of using remotely sensed data for environmental mapping, monitoring and management applications. The unit incorporates lecture and practical materials, both of which are integral to gaining a thorough understanding of the art and science of remote sensing. Both internal and external students will have access to state of the art image processing software, as well as a variety of satellite and airborne images. Students will learn about the interactions of light with different environmental features, electromagnetic radiation, multispectral and hyperspectral imagery, Synthetic Aperture RADAR, LiDAR, digital image processing, object oriented information extraction, operational remote sensing, and various applications of the technology. They will also be given the opportunity to speak with industry representatives, who visit the class to give short presentations about their work.

**Learning Outcomes**

On completion of this unit a student should be able to:

1. Explain the interaction of electromagnetic radiation with atmospheric, oceanic, and terrestrial features;
2. Identify a range of commercial airborne and satellite imaging sensor systems;
3. Critically examine the trade offs between spatial, spectral, radiometric and temporal resolution of remotely sensed data;
4. Apply the underlying principals of interpreting image data;
5. Perform basic operations associated with digital image processing; and
6. Evaluate applications of remotely sensed data for monitoring and managing marine and terrestrial resources.

**Teaching and Learning** **Strategies**

This unit will require students to employ a variety of different learning styles and they will be required to be actively engaged in all practical materials. Materials will be presented as weekly lectures and practicals, and will be supplemented by videos and interactive exercises available over the internet, and delivered via Learnline and a companion unit specific website. Students are therefore required to have access to a computer and the internet to complete this unit. Students should aim to complete all materials presented on a weekly basis to ensure that they keep pace with the class.

**Participation**

As a 10 credit point unit, students are expected to complete 10 hours of study per week associated with this unit. For internal students, this will be comprised of a 2 hr lecture and 3 hr practical session, plus five hours independent study to cover readings and assessment work. External students should dedicate similar periods of time to work their way through all materials presented. Internal students are expected to attend all lecture and practical sessions, and external students are encouraged to attend where possible.

Note that all students will be expected to participate in weekly ‘pre-lecture’ theory exercises. These are due by 9am of the week in question, and will be graded as part of the practical exercises.

Non-contact hour communication for all students throughout the semester will be via Learnline discussion boards and email. Alternatively you may make an appointment to speak with the lecturer on the phone or during office hours.

An all day field trip will be held on the 11th April to allow students to gain practical experience in acquiring environmental information appropriate for calibrating and validating remotely sensed image data. This is open to all internal and external students, and is highly recommended but is not compulsory or assessed.

Specific details of individual class times can be obtained by accessing the class timetable at: http://www.cdu.edu.au/timetable

**Overview of Assessment**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Description/Focus** | **Value** | **Relates to learning outcomes** |
| 1. | Practical exercise: Week 1,2,3 | 20 % | *1,3* |
| 2. | Practical exercise: Week 4,6 | 20 % | *1,3,4* |
| 3. | Practical exercise: Week 8,9 | 20 % | *5* |
| 4. | Final project | 40 % | *1-6* |

**Special Requirements**

NA

**Resources**

**Textbook(s)**

Due to the comprehensiveness of online resources, there is no required text for this unit. However if students wish to use a textbook, the following is recommended.

Jensen, John R., 2007, *Remote Sensing of the Environment: An Earth Resource Perspective*, 2nd Ed., Upper Saddle River, NJ: Prentice Hall, 592 pages

Required textbooks can be ordered from the CDU Bookshop through their website at <http://www.cdu.edu.au/bookshop>

**Learnline (Online Learning System)**

Learnline is Charles Darwin University’s on-line learning system. In this unit, Learnline will be used to:

* provide important announcements about the unit
* distribute lecture slides, and other study
* complete online assessments
* access feedback from tasks and grades for assessable work
* provide a communication point where you contribute to discussions as part of your assessment, and to interact with other students in the unit

You will need to connect to the Internet to access it, at <http://online.cdu.edu.au/>

Access to Learnline may not be available until Day 1 of Semester.

If this is your first time using Learnline, click on ‘Learnline Login and Orientation’ BEFORE logging in, to view an orientation video.

It is recommended that all students have access to regular and reliable broadband access to complete unit requirements.

**e-Reserve**

e-Reserve allows electronic copies of journal articles, book chapters and lecturer notes that have been recommended by a lecturer as part of their course reading requirements. You can access e-Reserve at <http://ereserve.cdu.edu.au.ezproxy.cdu.edu.au>.

This site is password protected. Your CDU student login will provide you access. You can then search for items by Lecturer, Unit Code, Title, Author, keyword, Year or Date if you have that information.

**Additional Resources**

Other Suitable books:

* Jensen, John R., 2005, *Introductory Digital Image Processing*, 3rd Ed., Upper Saddle River, NJ: Prentice Hall, 526 pages.
* Lillesand, T. M., Kiefer, R. W., and Chipman, J.W (2008). *Remote Sensing and Image Interpretation*, 6th Ed. (John Wiley and Sons). ISBN 978-0-470-05245-7

The CDU library has full text access to the following relevant on-line journals available through the E-Journal Portal (<http://tn3tv8rl4l.search.serialssolutions.com/> ):

* *International Journal of Remote Sensing*
* *Remote Sensing of Environment*
* *ISPRS Journal of Photogrammetry and Remote Sensing*
* *Natural Hazards*
* *Progress in Physical Geography*

Online resources:

* Remote Sensing Computer Aided Learning program <http://rscal.modis.org.au>
* Remote Sensing Virtual Lab [www.remotesensinglab.com](http://www.remotesensinglab.com)
* Remote Sensing Core Curriculum: <http://www.r-s-c-c.org/>
* NASA Earth Observatory: <http://earthobservatory.nasa.gov/Features/RemoteSensing/>
* The Remote Sensing Tutorial: <http://rst.gsfc.nasa.gov/Front/overview.html>
* USGS data archive (including FREE Landsat imagery) <http://glovis.usgs.gov/>

**Learning Schedule**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Theory** | **Exercise** | **Resources** | **Assessment Due** |
| 1 | What is remote sensing and how is it used? | Library research session | RSCAL Module 1Jensen Chapter 1 |  |
| 2 | How does light interact with the environment? | Introduction to digital image data  | RSCAL Module 1Jensen Chapter 2 |  |
| 3 | How does light give us information about environmental features? | Light Interactions | RSCAL Module 2Jensen Chapter 2RS Virtual Lab |  |
| 4 | What are the characteristics of remote sensing imagery?  | Image characteristics and dimensions | RSCAL Module 4 (topic 2)RS Virtual Lab |  |
| 5 | How is imagery analysed? | GOOD FRIDAY | Jensen Chapter 7 RSCAL Module 3 & 4 | Assessment 1 |
| **MID TERM BREAK 3-12 APRIL** |
| 6 | How are remote sensing data acquired? | Analysing image data |  |  |
| 7 | How can field data be combined with remotely sensed imagery? | NO PRAC | Jensen Chapter 5 |  |
| 8 | How are maps created from imagery? | Digital image processing p1 | RSCAL Module 4 | Assessment 2 |
| 9 | Is it possible to measure environmental change? | Digital image processing p2 |  |  |
| 10 | How accurate is my map? NO LECTURE | NO PRAC | RSCAL Module 4 |  |
| 11 | What are some effective ways to communicate information from remotely sensed products? | Communication methods |  | Assessment 3 |
| 12 | What is the future for remote sensing?Unit summary | NO PRAC |  |  |
| 13 | Revision |  |  |  |
| 14/15 | Exams |  |  | Assessment 4 |

**Assessment Item 1**

|  |  |
| --- | --- |
| **Description/Focus:**  | Practical: Weeks 1,2,3 |
| **Value:**  | 20 **%**  |
| **Due date:**  | Monday, Week 5 |
| **Length:**  | Short answer |
| **Task:**  | Students are required to submit answers to all questions in the practical  |
| **Preparation:** | Students should revise all lecture and practical material |
| **Presentation:**  | Short answer |

**Assessment Item 2**

|  |  |
| --- | --- |
| **Description/Focus:**  | Practical: Weeks 4,6 |
| **Value:**  | 20 **%**  |
| **Due date:**  | Monday, Week 8 |
| **Length:**  | Short answer |
| **Task:**  | Students are required to submit answers to all questions in the practical |
| **Preparation:** | Students should revise all lecture and practical material |
| **Presentation:**  | Short answer |

**Assessment Item 3**

|  |  |
| --- | --- |
| **Description/Focus:**  | Practical: Weeks 8,9 |
| **Value:**  | 20 **%**  |
| **Due date:**  | Monday, Week 11 |
| **Length:**  | Short answer |
| **Task:**  | Students are required to submit answers to all questions in the practical  |
| **Preparation:** | Students should revise all lecture and practical material |
| **Presentation:**  | Short answer  |

**Assessment Item 4 – ENV202 STUDENTS ONLY**

|  |  |
| --- | --- |
| **Description/Focus:**  | Final Project (ENV202 Students) |
| **Value:**  | 40 %  |
| **Due date:**  | Tuesday, Week 14 |
| **Length:**  | 3000 words  |
| **Task:**  | Students are required to select a remote sensing application area of interest and conduct a literature review on the topic based on a minimum of five recently published (last five years) peer reviewed journal articles. They are required to address a specific environmental problem based on their application area of interest, and to detail a mapping, monitoring, and management solution to the problem using remotely sensed data. They are required to specify the type of data most appropriate for the application, and demonstrate knowledge of the processing steps necessary to address the problem. They are however not required to actually acquire the data or perform the processing or analysis. Topic suggestions will be posted on Learnline and discussed in class. Note that this assessment item also includes work completed in the Week 11 practical exercise. |
| **Preparation:** | Students should revise all lecture and practical material, and discuss potential topics with the lecturer. Draft project reports can be reviewed by the lecturer at the students’ request up until one week prior to the due date. |
| **Presentation:**  | Report |
| **Assessment criteria:**  | Provided on Learnline as a separate document under ‘Assessment Items’ |

**Assessment Item 4 – ENV502 STUDENTS ONLY**

|  |  |
| --- | --- |
| **Description/Focus:**  | Final Project (ENV502 Students) |
| **Value:**  | 40 %  |
| **Due date:**  | Tuesday, Week 14 |
| **Length:**  | 5000 words |
| **Task:**  | Students are required to select a remote sensing application area of interest and conduct a literature review on the topic based on a minimum of fifteen (15) recently published (last five years) peer reviewed journal articles. They are required to address a specific environmental problem based on their application area of interest, and to detail a mapping, monitoring, and management solution to the problem using remotely sensed data. They are required to specify the type of data most appropriate for the application, and demonstrate knowledge of the processing steps necessary to address the problem. They are however not required to actually acquire the data or perform the processing or analysis. Topic suggestions will be posted on Learnline and discussed in class. Note that this assessment item also includes work completed in the Week 11 practical exercise.Your final submission should be formatted as a submission to an appropriate journal, and thus should conform to the editorial guidelines of that journal. |
| **Preparation:** | Students should revise all lecture and practical material, and discuss potential topics with the lecturer. Draft project reports can be reviewed by the lecturer at the students’ request up until one week prior to the due date. |
| **Presentation:**  | Journal article format for a relevant journal selected by the student. |
| **Assessment criteria:**  | Provided on Learnline as a separate document under ‘Assessment Items’ |

**ALL ASSESSMENT ITEMS MUST BE SUBMITTED VIA LEARNLINE BY 5PM ON THE DUE DATE.** Failure to submit an assessment item by the due date and time without an authorised extension will attract a penalty of 10% per day. Application for extensions must be submitted in writing to the lecturer at least 48hrs prior to the due date/time and should include a detailed reason for the request. Generally no extensions will be granted for the final assessment item.

Please download the Assignment Cover Sheet for your submission via Learnline, here: http://learnline.cdu.edu.au/support/ess/assignment.html

**CDU Graduate attributes**

CDU graduate attributes refer to those skills, qualities and understandings that should be acquired by students during their time at the University regardless of their discipline of study.
(See <http://www.cdu.edu.au/teachingandlearning/gradattributes.html>).

In this unit, the following graduate attributes are developed:

|  |  |  |
| --- | --- | --- |
| **Attribute** | **Description** | **Learning outcomes** |
| Acquisition | Can identify, retrieve, evaluate and use relevant information and current technologies to advance learning and execute work tasks. | *1-3* |
| Application | Is an efficient and innovative project planner and problem solver, capable of applying logical and critical thinking to problems across a range of disciplinary settings and has self-management skills that contribute to personal satisfaction and growth. | *5,6* |
| Creativity | Can conceive of imaginative and innovative responses to future orientated challenges and research. | *4,6* |
| Knowledge base | Has an understanding of the broad theoretical and technical concepts related to their discipline area, with relevant connections to industry, professional, and regional and indigenous knowledge. | *1-6* |
| Communication | Demonstrates oral, written, and effective listening skills as well as numerical, technical and graphic communication skills in a cross generational environment. | *6* |
| Flexibility | Can function effectively and constructively in an inter-cultural or global environment and in a variety of complex situations. | *6* |