USC

Course Outline

Code: ENS254
Title: Earth Observation: Remote Sensing and Surveying

School of: Science & Engineering
Teaching Session: Semester 2
Year: 2019
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Please go to the USC website for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1 Description

In this course, you will learn theoretical, applied & practical aspects of modern & conventional geospatial techniques necessary for observing and analysing earth resources. You will acquire a combination of high-tech & low-tech geospatial skills that will include satellite image analysis, digital map creation, and surveying. In addition to performing GIS and image analysis, you will use instruments such as compass, theodolite, GNSS (GPS). Finally, you will integrate data-sets collected using various techniques in GIS to compare their suitability for different situations.

1.2 Course topics

Remote Sensing and Image Interpretation:
· Electro-magnetic spectrum and sensor types
· Analogue and digital image interpretation
· Image analysis (classification and change detection)
· Image analysis (enhancements)
· Remote sensing applications to a variety of areas

Ground truthing for satellite image using surveying methods:
· Surveying Techniques
· Using theodolite, compass and range finders
· Data collection and analysis

Global navigation satellite systems (GNSS):
· GNSS fundamentals
· Global positioning system (GPS) and GLONASS
· Differential GNSS
· GNSS accuracy
· Data collection and analysis:

Integration of satellite images and other geographic data collected through surveying and GNSS in a GIS
· Visualisation through a cartographic map
· Data Analysis and Synthesis

2. What level is this course?

200 level Developing - Applying broad and/or deep knowledge and skills to new contexts. May require pre-requisites and introductory level knowledge/skills. Normally undertaken in the 2nd or 3rd year of an undergraduate program

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

Specific Learning Outcomes On successful completion of this course you should be able to:	**Assessment Tasks** You will be assessed on the learning outcome in task/s:	**Graduate Qualities or Professional Standards mapping** Completing these tasks successfully will contribute to you becoming:
Describe, explain and assess geospatial techniques and concepts.	Task 1	Knowledgeable.
Select and apply geospatial tools and skills to address a real-world issue	Task 2, Task 3	Empowered.
Evaluate and justify the use of different primary earth observation datasets for different applications.	Task 2, Task 3	Empowered.
Demonstrate critical spatial thinking	Task 1, Task 2, Task 3	Creative and critical thinkers.

5. Am I eligible to enrol in this course?

Refer to the USC Glossary of terms for definitions of "pre-requisites, co-requisites and anti-requisites".

5.1 Enrolment restrictions

Nil

5.2 Pre-requisites

Nil

5.3 Co-requisites

Nil

5.4 Anti-requisites

Nil

5.5 Specific assumed prior knowledge and skills (where applicable)

Basic knowledge of computer operation.

6. How am I going to be assessed?

6.1 Grading scale

Standard – High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL)

6.2 Details of early feedback on progress

The task 1 for this course starts in week 3. This include a series of quizzes and activities where students get feedback on their performances.

6.3 Assessment tasks

Task No.	Assessment Tasks	Individual or Group	Weighting %	What is the duration / length?	When should I submit?	Where should I submit it?
1	Remote sensing image analysis and interpretation	Individual	40	Image visual interpretation (6 marks) Comparing satellite sensors (4 marks) 1500 words report on image analysis (30 marks)	Week4, Week5, and Week 7	Blackboard SafeAssign
2	Surveying and mapping activity sheets and report	Individual	40	Completing the fieldwork activity sheets (6 marks) Completing the fieldwork spreadsheet (4 marks) 1500 words report of surveying and mapping (30 marks)	Week 10 Week11 Week 13	Blackboard SafeAssign
3	Exam	Individual	20	Objective type and short answer questions	Week 12	During week 12 lecture
			100%			

Assessment Task 1: Report on remote sensing image analysis and interpretation

Goal:	The purpose of this task is for you to develop your skills and knowledge to interpret, analyse, and evaluate the provided digital satellite imagery from different sensors for specific landscape features with different image analysis tools.
Product:	Image interpretation report. Table on satellite sensors comparision Report with analysis products such as maps and tables.
Format:	This task will have three parts. The first part will be about interpreting remote sensing images. The second part will be about comparing different satellite sensors. While the third part will be an individual report as a MS Word file with 1500 words. The report will require remote sensing image analysis of earth using different image analysis techniques. You will identify a study area and subsequently collect remote sensing data of the area. You will analyse the remote sensing digital data using image enhancement, image classification and/or change detection techniques.
Criteria:	The assignment will be assessed based on: • Ability to visually interpret satellite images • Ability to understand satellite sensors • Analysis and application of remote sensing techniques • Selection of image analysis tools • Processing the image to achieve the set goals • Presentation of results • Critical spatial thinking

Assessment Task 2: Data sheets, spreadsheet, and report on surveying and mapping of field information and its relationship with remote sensing data sets

Goal:	This task will consolidate your learning across the course. You will compare the information collected through remote sensing techniques with the information collected through surveying techniques for ground truthing. The ground truthing will be undertaken using basic surveying techniques and using the global navigation satellite systems (GNSS) receivers. For this, you will plan and undertake field-based data-capture operation using a variety of techniques. These techniques will involve use of basic surveying with instruments such as a compass, theodolite, range finders and tape measure. The captured data-sets will be tabulated for traverse calculation and mapped digitally in a GIS.
Product:	Reports in the provided templates
Format:	Completed data sheets and spreadsheets on surveying and mapping for the first two parts, For the final part, an individual report as a MS Word file with 1500 words. The report will require mapping of the field data collected using conventional surveying techniques and using GNSS such as GPS. You will collect and or analyse data across the lecture series that will relate to this task. That process will ensure that you stay up to date and enable you to receive feedback on your learning in this large project. You will present methods of data collection and its subsequent mapping in geographical information systems.
Criteria:	You will be assessed on: • Ability to conduct surveying for field data collection • Ability to map (manually as well as digitally) the data collected through surveying • Documenting the use of tools, technique and methodology Critical spatial thinking

Assessment Task 3: Quizzes and activities (20%)

Goal:	This assessment task will facilitate your learning of geospatial technologies while considering the theoretical foundations. You will demonstrate your understanding of the critical concepts behind different geospatial techniques and their subsequent applications for observing and analysing earth resources.
Product:	Exam during week 12 lecture
Format:	A combination of multiple-choice and short-answer questions
Criteria:	You will be evaluated on your: • Ability to understand the concept behind earth observation data collection and analysis • Ability to understand concepts behind surveying and mapping methods and tools.

7. What are the course activities?

7.1 Directed study hours

The directed study hours listed here are a portion of the workload for this course. A 12 unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

Location: Specific Campus(es) or online:	**Directed study hours for location:**
USC Sunshine Coast	Lectures: 2 hours per week Fieldwork or computer laboratory tutorial: 2 hours per week

7.2 Course content

Week # / Module #	What key concepts/content will I learn?
1	Course theme, structure, and history of remote sensing and surveying
2	An introduction to remote sensing Satellite image interpretation and composition
3	Satellite image acquisition Satellite image resolution Satellite image characteristics
4	Image enhancement Remote sensing satellites Spatial modelling for image analysis
5	Image classification
6	Understanding spheroid and datum Understanding coordinate system
7	Cartography for remote sensing and surveying data products
8	Surveying Surveying techniques
9	Traverse surveying Traverse calculation
10	Introduction to global navigational satellite systems (GNSS) with an emphasis on global positioning system (GPS) Principles behind satellite-based navigation GNSSS other than GPS
11	Errors associated with GNSS GPS augmentation
12	Exam Surveys with GNSS GNSS applications
13	Spatial data integration Knowledge-based image classification Review

Course content is subject to variation.

8. What resources do I need to undertake this course?

Please note that course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Blackboard site. Please log in as soon as possible.

8.1 Prescribed text(s)

Please note that you need to have regular access to the resource(s) listed below as they are required:

Author	Year	Title	Publisher
CRCSI	2018	Earth Observation: Data, Processing and Applications Series	CRC Spatial Information, Australia

Required and recommended readings

CRCSI. (2017). *Earth observation: data, processing and applications. Volument 2: Processing* B. Harrison, D. Jupp, M. Lewis, T. Sparks, S. Phinn, N. Mueller, & G. Bryme (Eds.), *Earth Observation Series* Retrieved from http://www.crcsi.com.au/assets/Consultancy-Reports-and-Case-Studies/Earth-Observation-reports-updated-April-2018/Vol2-Introduction-low-res-0.5MB.pdf

CRCSI. (2018a). *Earth Observation: Data, Processing and Applications. Volume 1: Data* B. Harrison, D. Jupp, M. Lewis, B. Forster, N. Mueller, C. Smith, S. Phinn, I. Coppa, D. Hudson, C. Smith, I. Grant, J. Anstee, A. G. Dekker, C. Ong, & I. Lau (Eds.), *Earth Observation Series* Retrieved from http://www.crcsi.com.au/assets/Consultancy-Reports-and-Case-Studies/Earth-Observation-reports-updated-April-2018/Vol1-Introduction-low-res-0.8MB.pdf

CRCSI. (2018b). *Earth Observation: Data, Processing and Applications. Volume 1A: Data—Basics and Acquisition* B. Harrison, D. Jupp, M. Lewis, B. Forster, N. Mueller, C. Smith, S. Phinn, D. Hudson, I. Grant, & I. Coppa (Eds.), *Earth Observation Series* Retrieved from http://www.crcsi.com.au/assets/Consultancy-Reports-and-Case-Studies/Earth-Observation-reports-updated-April-2018/Vol1A-low-res-27MB.pdf

CRCSI. (2018c). *Earth Observation: Data, Processing and Applications. Volume 1B: Data—Image Interpretation* B. Harrison, D. Jupp, M. Lewis, B. Forster, B. A. Harrison, D. L. B. Jupp, M. M. Lewis, B. C. Forster, I. Coppa, N. Mueller, D. Hudson, S. Phinn, C. Smith, J. Anstee, I. Grant, A. G. Dekker, C. Ong, & I. Lau (Eds.), *Earth Observation Series* Retrieved from http://www.crcsi.com.au/assets/Consultancy-Reports-and-Case-Studies/Earth-Observation-reports-updated-April-2018/Vol1B-low-res-24MB.pdf

CRCSI. (2018d). *Earth Observation: Data, Processing and Applications. Volume 1X: Data—Appendices* B. Harrison, D. Jupp, M. Lewis, B. Forster, N. Mueller, C. Smith, S. Phinn, D. Hudson, I. Grant, & I. Coppa (Eds.), *Earth Observation Series* Retrieved from http://www.crcsi.com.au/assets/Consultancy-Reports-and-Case-Studies/Earth-Observation-reports-updated-April-2018/Vol1X-low-res-2.5MB.pdf

CRCSI. (2018e). *Earth Observation: Data, Processing and Applications. Volume 2A: Processing—Basic Image Operations* Earth Observation Series, B. Harrison, D. Jupp, M. Lewis, T. M. L. Sparks, S. Phinn, N. Mueller, & G. Byrne (Eds.), *Earth Observation* Retrieved from http://www.crcsi.com.au/assets/Consultancy-Reports-and-Case-Studies/Earth-Observation-reports-updated-April-2018/Vol2A-low-res-20MB.pdfLillesand, T., Kiefer, R.W. and Chipman, J. (2014) Remote sensing and image interpretation Wiley and Sons

Ghilani C. D. & Wolf, P. R. (2008) *Elementary surveying: an introduction to geomatics* (Upper Saddle River: Prentice hall).

Campbell J. (2008) *Introduction to remote sensing* (New York: The Guilford Press).

Jensen J. (2007) *Remote Sensing of the Environment: An Earth Resource Perspective* (Upper Saddle River, NJ: Prentice-Hall).

Kavanagh B. F. (2010) *Surveying: with construction applications* (Upper Saddle River: Prentice Hall).

Liu J. G. & Mason, P. J. (2009) *Essential image processing and GIS for remote sensing* (Oxford: Wiley-Blackwell).

Mesev V. (2007) *Integration of GIS and remote sensing* (West Sussex: Wiley).

Schowengerdt R. A. (2007) *Remote sensing: models and methods for image processing* (London: Academic Press).

Slocum T. A., McMaster, R. B., Kessler, F. C. & Howard, H. H. (2009) *Thematic cartography and geovisualization* (Upper Saddle River: Pearson/Prentice Hall).

Weng Q. (2010) *Remote Sensing and GIS Integration: Theories, Methods, and Applications* (New York: McGraw-Hill).

Mather P. M. & Koch, M. (2011) *Computer processing of remotely-sensed images* (Oxford: Wiley Blackwell).

Other free resources

Fundamentals of Remote Sensing, Canada Centre for Remote Sensing, Available at: http://ccrs.nrcan.gc.ca/resource/tutor/fundam/pdf/fundamentals_e.pdf .

Short, Nicholas M., Remote Sensing Tutorial Available at: http://rst.gsfc.nasa.gov/Front/tofc.html.

TUTORIALS

Prescribed tutorial

Available with Reprographics at print cost and the electronic copy will be available on the BlackBoard.

Srivastava, S. K. (2019). Tutorial Manual for ENS 254 Earth Observation: Remote Sensing and Surveying. Maroochydore, University of the Sunshine Coast.

Other resources

ESRI (2019) ArcGIS Desktop 10.6 Help, Available at http://desktop.arcgis.com/en/arcmap/latest/get-started/main/get-started-with-arcmap.htm

8.2 Specific requirements

The later part of this course will require field visits. See instructional manual for clothing requirements. The prescribed tutorial manual must be purchased from the reprographic services.

9. Risk management

Health and safety risks for this course have been assessed as low.

It is your responsibility as a student to review course material, search online, discuss with lecturers and peers, and understand the health and safety risks associated with your specific course of study. It is also your responsibility to familiarise yourself with the University's general health and safety principles by reviewing the online Health Safety and Wellbeing training module for students, and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1 Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

10.2 Assessment: Additional requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

a) The final mark is in the percentage range 47% to 49.4%
b) The course is graded using the Standard Grading scale
c) You have not failed an assessment task in the course due to academic misconduct

10.3 Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate:

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task.
- 10% (of the assessment task's identified value) for the third day
- 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.
- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.

To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

10.4 Study help

In the first instance, you should contact your tutor, then the Course Coordinator. Additional assistance is provided to all students through Academic Skills Advisers. To book an appointment or find a drop-in session go to Student Hub.

Contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au

10.5 Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website:
http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.6 General Enquiries

In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC South Bank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **USC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **USC Fraser Coast -** Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **USC Caboolture -** Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au