

UNIVERSITY OF
WOLLONGONG



Subject Outline

EESC204
Introductory Spatial
Science

Faculty of Science,
Medicine and Health

School of Earth and
Environmental
Sciences

Spring

2013

Subject Outline

Subject code:	EESC204
Subject name:	Introductory Spatial Science
Credit points:	6
Pre/co-requisites:	None
Mode of delivery:	On Campus
Delivery location:	Wollongong

Version history

2 nd edition	Dr Sarah Hamylton , Faculty of Science , UOW- updated to new Faculty template	2013
1 st edition	Dr Sarah Hamylton , Faculty of Science , UOW	2012

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<http://www.uow.edu.au/about/disclaimer/index.html>

The University of Wollongong attempts to ensure that the information contained here is correct at the time of production, however, sections may be amended without notice by the University in response to changing circumstances or for any other reason.

Contacts

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Lecturers/Tutors/ Demonstators	Office	Phone	Email	Consultation times
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Subject Information

Outline

The primary aim of this subject is to provide you with a comprehensive introduction to the theory and practice of dealing with geospatial technologies, collectively termed 'spatial science'. Spatial science draws upon concepts, tools and skills from several other related disciplines (primarily geography, cartography and computer science) and technologies (for example, GIS, remote sensing, global positioning systems).

In essence, spatial science is concerned with all aspects of dealing with spatially referenced data (that is, data for which the location of a feature or phenomenon is important and is known). This includes identifying the location and examining the nature of features (geodetics, global positioning, remote sensing), and representing those features on maps (cartography) that are stored in a computer information system (GIS). It also encompasses exploring where the features are located in relation to each other and other features (spatial analysis), and what this means for issues in the real world. Geographic Information Systems (GIS) provides an enabling framework for carrying out spatial science. Because of this, spatial science is sometimes termed Geographic Information Science (GISc).

This subject is relevant to a wide range of disciplines, including medicine and health, engineering, disaster management, environmental management, education and biology. Material used throughout the course will draw on examples from these disciplines.

Learning Outcomes

The principal aim of this subject is to provide you with a comprehensive introduction to the theory and practice of dealing with geospatial technologies, collectively termed 'spatial science'. Because spatial science covers a broad range of complex conceptual and technical knowledge, it is not possible for you to become an expert after taking only one subject. Instead, this class will provide an awareness of how spatial science can be applied within your area of interest (ie geosciences, human geography, biology, environmental science), it will equip you with the knowledge and skills needed for basic use of spatial technologies (particularly GIS, but also remote sensing and GPS) and it will provide a sound basis for further study (ie, EESC304: GIS and EESC305: Remote Sensing). By the end of this subject, you should:

1. Understand the nature of spatial data, how it is mapped, and how it is represented in the computer.
2. Understand the basic principles that underlie key spatial technologies, (GIS, remote sensing, GPS).
3. Understand the basic spatial questions that can be asked using spatial technologies, the most common tools used to ask them, and how they work.
4. Develop skill as an independent problem solver (know how to figure out what you don't know in spatial software).
5. Gain practical experience using spatial technologies to solve a real world problem.

Faculty Graduate Qualities

Valuable qualities gained by UOW graduates are essential for gaining employment and making an important contribution to society and their chosen field – further information is available at <http://www.uow.edu.au/about/teaching/qualities/>

Engagement in this subject will contribute to each student's development of the following UOW Science Graduate Qualities:

Informed

- Comprehensive knowledge of an area of Science and well-developed skills in using relevant technologies
- Awareness of the international context in which advances in Science are made and applied

Independent learners

- Critical thinking skills
- Scientific approach to the acquisition, analysis, and interpretation of data

Independence in seeking to extend knowledge through ongoing research, enquiry and reflection

- Problem solvers
- Application of creative, logical and critical thinking to scientific problems

Effective communicators

- Well-developed written, oral & aural communication
- Effective collaboration and teamwork across a range of settings and cultures

Responsible

- Ethical decision making
- Respect for diverse opinions, professions, and cultures
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- Respect for diverse opinions, professions, and cultures

Study Time

Students should note that UOW policy equates 1 credit point with 2 hours of study per week that includes lectures and tutorials. For example, in a 6 credit point subject, a total of 12 hours of study per week is expected.

Lecture/Tutorial/Laboratory Times

Refer to <http://www.uow.edu.au/student/timetables/index.html> for an up-to-date timetable.

Lectures: Tuesday 12:30-1:30 in 20-4 and Thursday 17.30-18.30pm in 32.G01. There are two times available for practicals: Tuesday 9:30-12.30 pm or Thursday 13:30-16:30 pm, both will run in the Hyperion Computer Lab in Building 17-110B. One practical will be held in the field and you will be advised accordingly (see provisional table below).

There are two, one-hour long lectures each week. The information covered in the lectures each week is designed to provide the conceptual basis for the technical skills you will learn in the practicals the following week. Thus, it is important to attend the lectures so that you understand what you are doing in the practicals. The slides from each lecture will be provided on-line via the eLearning site. However, where possible (nearly every week), lectures will include interactive elements to enhance your understanding (and hopefully make it more interesting and fun) that can only be experienced by being present. A list of suggested readings to support the lectures (mainly from the recommended textbook) is provided in the Master Schedule (later in this guide). All of the readings are available via the library, either in electronic form or via the textbook in closed reserve.

Recommended Readings

The following book is recommended for this subject. It is available from the University bookshop. Lecture outlines are available on the web – and further focused reading is necessary to answer specific topics.

- Longley et al (2011). Geographic Information Systems and Science. 4th Edition. John Wiley and Sons, Ltd, West Sussex, England, 517 pp.

Students will be expected to read materials as directed in the lectures. Recommended readings are not intended as an exhaustive list and students should use the Library catalogue and databases to locate additional resources.

e-Learning

This subject has materials and activities available via Moodle. To access Moodle you must have a UOW user account name and password, and be enrolled in the subject. Moodle is accessed via SOLS (student online services). Log on to SOLS and then click on the eLearning link in the menu column.

For information regarding the eLearning spaces please use the following links:

Moodle - http://uowblogs.com/moodlelab/files/2013/05/Moodle_StudentGuide-1petpo7.pdf

Lecture Schedule or Topic List

Provisional outline (note this may change due to re-scheduling and guest speakers)

Unit	Week	Dates	Lecture Topics	Prac Topics	What is due?	Readings		
						Getting started...	For further information, see...	
1. Nature of spatial data	1	29 Jul-2 Aug	Intro to the subject	-	-	-	-	
			What is GIS?			Textbook Ch 1	-	
	2	5-9 Aug	Using spatial science.	Ex 1.1: Intro to ArcGIS. Making a map.	Ex 1.1 Thought Questions	Textbook Ch 2	Burrough, PA "Geographical information systems: society, science and systems"	
			Designing effective maps.			Textbook Ch 12	Robinson et al Ch 18	
	3	12-16 Aug	Key mapping concepts.	Ex 1.2: Coordinates, projections, map scale and resolution.	Ex 1.2 Thought Questions	Textbook Ch 5	DeMers "The Map as model for geographic data", Robinson et al Ch 3, 4, 5	
			GIS Data Models			Textbook Ch 3	Chou "Spatial Data"	
	4	19-23 Aug	Topology	Ex 1.3: Data structures and their implications.	Ex 1.3 Thought Questions	Textbook Ch 8	Davis Ch 3-4	
			Databases & Attributes.			Textbook Ch 10, Ch 12	Chrisman "Levels of Measurement" and "Manipulating attributes"	
	2. Acquiring spatial data	5	26-30 Aug	Data acquisition.	Ex 1.4: GPS field exercise.	Ex 1.4 Thought Questions	Textbook Ch 9	Davis p 126-155.
				GPS			Enge, P (2004) article	Cullen "Mapping the details of the Reef"
6		2-6 Sept	Remote sensing I.	Ex 1.5: Georeferencing / digitizing.	Ex 1.5 Thought Questions	Robinson Ch 8	-	
			Remote sensing II.			Robinson Ch 12		
3. Basic spatial analysis	7	9-13 Sept	Overview of spatial analysis	Prac Test completed during your prac.	Prac Test	Textbook Ch 14	Longley, P. "Geographic query and analysis: from data to information"	
			Database query			Textbook Ch 14	Chrisman Ch 5.	
	8	16-20 Sept	Guest lecture	Ex 1.6: Database query: Raster	-	Textbook Ch 14	Chrisman Ch 6	
			Guest lecture			Textbook Ch 14	Chrisman Ch 7	
9	23-27 Sept	Models and GIS.	Ex 1.7 Database query: Vector	-	Textbook Ch 16	Delaney "Modelling"		
STUDY RECESS								
4. Spatial science in practice	10	7-11 Oct	Public Holiday	Select project and plan your analysis.	-	-	-	
			Project launch			Project information in eLearning site.	-	
	11	14-18 Oct	Problem solving in GIS.	Do the analysis.	-	-	-	
	12	21-25 Oct	- Error and uncertainty in spatial data.	Write up the final report.	Project Report	Textbook Ch 6	-	
5. Review	13	28 Oct-1 Nov	Exam Review.			-	-	
	14	STUDY RECESS (4 ^h - 8 th Nov)						

Assessment

Minimum attendance requirements

Lectures

Lectures are an opportunity to learn about important concepts in Introductory Spatial Science and are an essential component of this subject. The range of geospatial topics, and the applications to specific marine and coastal areas of investigation are broad, and the material is not covered in any single book. Several lectures will be delivered by professionals in these fields and you are encouraged to ask questions and enjoy the diversity of topics that will be covered. Reading to assist you will be provided in lectures and in relation to assignment topics on Elearning. Note that you can only really become familiar with the scientific forefront in this discipline by reading the peer-reviewed literature (e.g. journal articles).

Practicals

Practicals are an essential component of this subject, and it is important that you attend them. They involve use of digital data in the University Central Computing lab (Hyperion Lab, B17), and you will be asked to sign a Data Access Agreement indicating that you will abide by the guidelines for use of this data. You should also observe the rules for use of the computer laboratory.

Minimum performance requirements

Note: To achieve an overall pass grade in EESC204 (i.e. greater or equal to 50 per cent) a student is required to achieve a satisfactory performance in each component of the subject. 'Satisfactory performance' is defined as achieving at least 45% in the final theory exam and a satisfactory standard (although not necessarily a pass) in each of the other components of the subject. The final examination will be held during the university exam period, over two weeks of November. You must be able to sit this final exam to complete this subject. The School will not entertain specious requests for supplementary examinations.

Students who do not meet the minimum performance requirements as set out in the Subject Outline may be given a Fail grade or TF (Technical Fail) grade on their Academic Transcript. See the General Course Rules at <http://www.uow.edu.au/handbook/generalcourserules/index.html>

Students need to complete each component at the level specified.

Students who do not meet the minimum performance requirements as set out in the Subject Outline may be given a Fail grade or TF (Technical Fail) grade on their Academic Transcript. See the General Course Rules at <http://www.uow.edu.au/handbook/generalcourserules/index.html>

Assessment Task Summary

Your understanding and skill in spatial science will be tested in a range of ways during the semester, including ‘thought questions’ leading to a Practical test, a Practical assignment, a project where you use GIS to solve a real-world problem and a final exam (see the chart below).

Assessment	Due	Worth (%)	How to submit it	Feedback
Practical Thought Questions	During Practicals weekly, in weeks 2 - 6.	20	Moodle site (during your Practical only)	Provided for each question on-line. Additional comments on request.
Practical Test	During Practical once in Week 7.	20	Moodle site (during your Practical only)	Provided for each question after tests are marked. Additional comments on request.
Practical Project Report	By Friday 14.30 pm in week 12.	20	SMAH Central (by Friday at 14:30 pm)	Written comments provided upon request.
Exam	Exam period once.	40	During exam period.	Meeting to discuss to be arranged upon request.

Note that all assessment items must be submitted on time unless academic consideration is granted via the University system. Forgetting to do it or waiting until the last moment and then having a problem with a computer are not acceptable excuses for a late submission. All but the final exam will be submitted via the eLearning site, which provides confirmation that the submission worked properly. Assignments will be retained for one year after the completion of the subject, as per Faculty policy. Feedback of various types will be provided for each assessment item.

Practical Thought Questions

As you complete exercises 1.1-1.5, you will answer three or more ‘thought questions’ via a quiz in the eLearning site. The purpose of this is to show you how well you understand what has been covered in each Practical (supporting subject goals 3-4). This will help you prepare for the Practical test (in week 7). Your mark will be available on-line the following week, when the results will be discussed at the start of your next Practical.

Practical Test

During your Practical session in week 7, you will complete a test in the eLearning site based on the concepts and skills you've learned in the Practicals up to that point. The purpose of the test is to assess how well you understand how basic tools work in ArcGIS, and the extent to which you can use them to solve simple problems (supporting goals 3-4). You may use ArcGIS, some sample spatial data, and your lecture notes to complete the test. Feedback and your mark will become available on-line the following week. Once you view the feedback, make sure to ask us if you have any questions.

Practical project report

In the last three weeks of the semester, you will complete a simple project using ArcGIS to address a spatial analysis problem. The purpose of the project is to give you experience carrying out a real world project independently (supporting goals 3-5). You will design and complete a GIS analysis. Additional information about the projects and project report will be provided via the eLearning site later in the semester. You will complete a project report documenting and analyzing your results. Upload the report to the eLearning site by 5 pm on the Friday 19th October. Your mark will be published on-line.

Final exam

The purpose of the exam is to test how well you can integrate and apply these concepts in a problem-solving context. More information about the exam will be provided during lectures in week 13.

To further help you study, a series of interactive review modules are provided in the eLearning site (in section 'exam review' – to be released later in session). Use these to test your skills with various key concepts covered in the subject. And please fill out the accompanying survey to let me know what you think of the review materials.

Note: To achieve an overall pass grade in EESC204 (i.e. greater or equal to 50 per cent) a student is required to achieve a satisfactory performance in each component of the subject. 'Satisfactory performance' is defined as achieving at least 45% in the final theory exam and a satisfactory standard (although not necessarily a pass) in each of the other components of the subject. The final examination will be held during the university exam period, over two weeks of November. You must be able to sit this final exam to complete this subject. The School will not entertain specious requests for supplementary examinations.

Practicals

Practicals are an essential component of this subject, and it is important that you attend them as that is where you will gain much practical experience for this subject. It will be important that you complete practical assessments and keep your completed practical work sheets, as you will need the information to complete the practical test. The questions in the test will examine the extent to which you have understood the material completed in practicals, and the specific answers to some of the questions. There is also a set of Revision exercises available on Elearning which support some of the practicals and are further

designed to support the learning objectives. The material in these Revision exercises will also be assessed in the practical test.

Performance grades

HD	High Distinction	85–100%
D	Distinction	75–84%
C	Credit	65–74%
P	Pass	50–64%
PS	Pass Supplementary	50%
<hr/>		
F	Fail (unsatisfactory completion)	0–49%
TF	Technical Fail	No mark recorded

Scaling

Marks awarded for any assessment task (including examinations) may be subject to scaling at the end of the session by the Unit Assessment Committee and/or the Faculty Assessment Committee (FAC). Marks will only be scaled to ensure fairness/parity of marking across groups of students. Scaling will not affect any individual student's rank order within their cohort. For more information refer to Assessment Guidelines – Scaling <http://www.uow.edu.au/about/policy/UOW058609.html>

Submission and Return of Assessment Items

Students are advised to keep an electronic or hard copy of all submitted assessment tasks except in circumstances where this is not possible e.g. where the task is submitted at the end of activity in which it was completed.

Submitting an assignment at SMAH Central

Assignments submitted at SMAH Central MUST have a SATS (Student Assignment Tracking System) coversheet attached to the front of the assignment. Instructions for generating a coversheet can be found on the SMAH Central web page.

For an assignment to be successfully submitted at SMAH Central please note the following:

- The coversheet must be signed and dated
- The assignment must have the correct coversheet i.e. the correct subject code and tutorial group (if applicable)
- A legible barcode with all numbers and digits below e.g. UOW20121007656
- Assignments must be submitted by 2.30pm on the due date

If an assignment is submitted to SMAH Central without any of the above we will contact you and advise that you need to return to SMAH Central with the correct coversheet. Your

assignment won't be recorded as being submitted until the correct coversheet is attached. This might mean that the assignment is recorded as being submitted late.

Late Submission

All assessment tasks are to be submitted on the due dates as specified in this Subject Outline. Assessment tasks submitted late will be penalised by the deduction of 10% of the maximum possible mark for the assessment task per calendar day or part thereof. Deduction of marks will not result in a negative mark.

Note that assessment tasks submitted to SMAH Central must be submitted by 2:30 pm on the due date to guarantee being recorded in SATS as being submitted on time.

Academic Consideration including Extensions of Time

Applications from students for academic consideration should be made only on the grounds of serious or extenuating circumstances. Applications for academic consideration are governed by the University's Student Academic Consideration Policy at <http://www.uow.edu.au/about/policy/UOW058721.html>

Do not assume that an application for special consideration will be automatically granted.

Supplementary Assessments

Supplementary assessment may be offered to students who receive a mark of 48% or 49%, and are otherwise identified as meriting an offer of a supplementary assessment. The form of supplementary assessment will be determined at the time the offer of a supplementary assessment is made. For more information refer to the Supplementary Assessment Guidelines <http://www.uow.edu.au/content/groups/public/@web/@gov/documents/doc/uow112335.pdf>.

Note that if you are offered a supplementary examination as the supplementary assessment that you will need to sit the examination in the supplementary examination period.

Referencing

The Harvard referencing system is used in Introductory Spatial Science (EESC204)– this is also known as the author-date system due to the order of the information presented. Failure to document *adequately* and *fully* is to ignore scholarly rules – and run the risk of plagiarism. Please consult the UOW library website for further information: <http://public01.library.uow.edu.au/refcite/style-guides/html/>

Plagiarism

Students are responsible for submitting original work for assessment, without plagiarising or cheating, abiding by the University's policy on plagiarism as set out in the University Handbook under the University's Policy Directory. Plagiarism has led to expulsion from the University.

The University's Academic Integrity and Plagiarism Policy, Faculty Handbooks and subject guides clearly set out the University's expectation that students submit only their own original

work for assessment and avoid plagiarising the work of others or cheating. Re-using any of your own work (either in part or in full) which you have submitted previously for assessment is not permitted without appropriate acknowledgement. Plagiarism can be detected and has led to students being expelled from the University.

The use by students of any website that provides access to essays or other assessment items (sometimes promoted as 'resources') is extremely unwise. Students who provide an assessment item (or provide access to an assessment item) to others, either directly or indirectly (for example by uploading an assessment item to a website) are considered by the university to be intentionally or recklessly helping other students to cheat. This is considered academic misconduct and students place themselves at risk of being expelled from the University.

<http://www.uow.edu.au/about/policy/UOW058648.html>

Other policies

Code of Practice – Students: <http://www.uow.edu.au/about/policy/UOW058664.html>

Course Progress Policy: <http://www.uow.edu.au/about/policy/UOW058679.html>

Graduate Qualities Policy: <http://www.uow.edu.au/about/policy/UOW058682.html>

Academic Grievance Policy: <http://www.uow.edu.au/about/policy/alphalisting/UOW058653>

Science Faculty Academic Grievance Policy &

Procedures: <http://www.uow.edu.au/science/UOW000977.html>

Non-Discriminatory Language Practice and

Presentation: <http://www.uow.edu.au/about/policy/UOW058706.html>

Occupational Health and Safety: <http://www.uow.edu.au/about/policy/UOW016894.html>

Student Conduct Rules and accompanying

Procedures: <http://www.uow.edu.au/about/policy/rules/UOW060095.html>

Students can access information on student support services and facilities.

Student Services: <http://www.uow.edu.au/student/services/index.html>

Student Facilities: <http://www.uow.edu.au/student/facilities/index.html>

General Advice

Students should refer to the Faculty of Science, Medicine and Health website for information on policies, learning and support services and other general advice.

Use of Electronic Devices in Timetabled Activities

Ensure that mobile phones are turned off or turned to silent before timetabled activities. Electronic devices including mobile phones and portable MP3 players should not be accessed during timetabled activities unless otherwise advised.

Digital data access and use

Several of the practicals involve use of digital data in the University Central computing lab, and you will be asked to sign a Data Access Agreement indicating that you will abide by the guidelines for use of this data. You should also observe the rules for use of the computer laboratory.

Use of Electronic Devices in Timetabled Activities

Ensure that mobile phones are turned off or turned to silent before timetabled activities. Electronic devices including mobile phones and portable MP3 players should not be accessed during timetabled activities unless otherwise advised.