GMAT3220

Geospatial Information Systems

Term One // 2021

School of Civil and Environmental Engineering // UNSW Engineering

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Samsung Lim	s.lim@unsw.edu.au	Wednesday and Thursday	CE411	x54505

School Contact Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Course Details

Credit Points 6

Summary of the Course

The main objective of this course is to provide fundamental Geospatial Information System (GIS) knowledge and skills. GIS is a multidisciplinary field built out of knowledge from geography, cartography, computer science and mathematics. The basics of cartography, spatial analysis and computer programming will be covered in the classroom to help students build up the foundation of GIS. Study of spatial representation, georeferencing, data accuracy, data models, data structures and data processing are necessary for students to investigate further the advanced areas of GIS in their future career. More advanced topics will be discussed in GMAT4220 where generic algorithms, fundamental theories and techniques, and practical applications of GIS will be studied.

Course Aims

This course aims to provide the practical training in order for the student to work effectively and critically with GIS. Concepts and definitions of spatial information systems, coordinate systems, mapping and spatial issues, data structures including vector, raster and surface modeling. Inputting both spatial and attribute data to the GIS. Transformation of data between coordinate systems, re-projection of map coordinates. GPS-based image registration. Geo-databases. Editing data and creating topologically clean data. Tagging spatial data with attributes, linking spatial data to attribute databases. Use of basic analysis functions: spatial selection, attribute selection, making reports of spatial and attribute data, interfacing to the system using a high level language. Use of the World Wide Web to disseminate information.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Develop simple data models for use in many GIS applications.	PE1.1, PE2.1, PE2.3
2. Understand the concepts and definitions of spatial systems, coordinate systems, mapping and spatial issues with maps, data structures including vector, raster and surface modelling	PE1.2, PE1.6, PE2.3
3. Be capable to build geo-databases and analyse spatial data	PE1.4, PE2.2, PE3.3
4. Design a Web-based GIS	PE1.5, PE2.4, PE3.3

Teaching Strategies

It is estimated that about 80% of all information has a "spatial component". Geographic Information Systems (GIS) is a way of managing, analysing, visualising and delivering spatial information to engineers, other professionals, clients and the community. The use of GIS is now ubiquitous in many infrastructure provision and service delivery fields, such as planning, construction, mining, environment, transport, disaster response, security, health, etc. Students will learn the foundations of geoinformation management, gaining proficiency in the use of the basic GIS software tool, setting up a functioning GIS,

and executing some basic spatial query operations are important outcomes.

This course is based on a 2-hour lecture plus 3-hour lab per week. Lectures are designed to teach generic algorithms and fundamental theories. Lab exercises are to learn basic GIS techniques and gain experience with practical applications.

Additional Course Information

Approaches to learning in the course are given in the following:

Private Study	• Review lecture material and textbook • 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	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving
Laboratory Work	• Hands-on work, to set studies in context

Assessment

Late submission will get 10% deduction of the assignment mark for each day late – up to a maximum of seven days. After seven days, the assignment will receive zero.

Students who perform poorly in the on-site lab assessments and homework assignments are recommended to discuss progress with the lecturer during the semester. Homework assignments will be briefed to you in the middle of lectures without prior notice, hence attendance in lectures is essential.

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Homework	16%	1pm Wednesday, Weekly	1, 2, 3, 4
On-site lab work	20%	11pm Friday Weekly	1, 2, 3, 4
Major Assignment	20%	23/04/2021 11:00 PM	1, 2, 3, 4
Final Exam	44%	07/05/2021 12:00 PM	1, 2, 3, 4

Assessment Details

Assessment 1: Homework

Start date: 1pm Wednesday, Weekly

Details:

This is homework assignment consisting of a few questions about the lecture.

Additional details:

Assessment of homework (4 points per week for 8 weeks) will be based on the following criteria:

- *No answers 0 point*
- *Partial or incorrect answers 1-3 points*
- *Complete and correct answers 4 points*

Submission notes: A word document with your answers to the homework questions should be submitted via Moodle.

Turnitin setting: This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment 2: On-site lab work

Start date: 10am Thursday Weekly

Details:

This is on-site lab work on a weekly basis. Detailed step-by-step instructions will be provided. Tutorial on each lab exercise will be provided.

Additional details:

Assessment of on-site lab work (5 points per week for 8 weeks) will be based on the following criteria:

- *No output* *0 point*
- *Partial output* *1-2 points*
- *Full output but with incorrect results* *3-4 points*
- *Complete and correct results* *5 points*

Submission notes: A lab report including your answers to the lab questions and screen shots of data processing should be submitted via Moodle.

Turnitin setting: This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment 3: Major Assignment

Start date: 29/03/2021 09:00 AM

Details:

The main objective of this assignment is to analyze a GIS data input problem and produce a display of the results using ArcGIS.

Assignment: Black Bart[1] is a criminal who was arrested in Katoomba. His crimes include harassing surveyors and stealing from tourists. At the time of his arrest his Garmin GPS receiver was seized. You are asked to present evidence on a computer display of where Black Bart has traveled according to the waypoints stored in the GPS receiver.

[1] Black Bart here is a fictious name, but there was a real one in history: https://en.wikipedia.org/wiki/Black_Bart_(outlaw)

Additional details:

Assessment of major assignment report (40 points) will be based on the following criteria:

- Written presentation max. 10 points
- Review of other work max. 10 points
- Quality of project work max. 10 points
- Results, Interpretation & conclusions max. 10 points

Submission notes: An electronic copy of individual report in Microsoft Word format, and a zip file of data, maps and reference documents, etc. that you produced or obtained during the course of the assignment, but do not include the data given to you from the lecturer, should be submitted via Moodle.

Turnitin setting: This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment 4: Final Exam

Start date: 07/05/2021 09:45 AM

Length: 2 hours

Details:

Centrally managed final exam.

Additional details:

A mark of at least 25 points out of the total 88 points in the final exam is required before the class work is included in the final mark.

Turnitin setting: This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 15 February - 19 February	Lecture	Introduction to the course & Introduction to GIS
	Tut-Lab	Introduction to ArcGIS: ArcMap, ArcCatalog, ArcToolbox
Week 2: 22 February - 26 February	Lecture	Map Projections
	Tut-Lab	Map Projections
Week 3: 1 March - 5 March		
Week 4: 8 March - 12 March	Lecture	Vector and Raster
	Tut-Lab	Vector and Raster
Week 5: 15 March - 19 March	Lecture	Data Acquisition
	Tut-Lab	Image Registration
Week 6: 22 March - 26 March		
Week 7: 29 March - 2 April	Lecture	Spatial Interpolation
	Tut-Lab	Digitise, Edit & Clean
Week 8: 5 April - 9 April	Lecture	Data and Database
	Tut-Lab	Tables, Relationships and Queries
Week 9: 12 April - 16 April	Lecture	Surface Modelling
	Tut-Lab	Surface Modelling
Week 10: 19 April - 23 April	Lecture	Spatial Analysis
	Tut-Lab	Spatial Analysis

Resources

Prescribed Resources

Kang-tsung Chang, Introduction to Geographic Information Systems, 9th Ed., the McGraw-Hill Companies

Recommended Resources

Maribeth Price, Mastering ArcGIS, 6th Ed., the McGraw-Hill Companies

Course Evaluation and Development

There are two forums, namely GIS Forum and ArcGIS Forum, available on Moodle so that students can post their questions. The lecturer will respond to the questions on an ad-hoc basis.

Laboratory Workshop Information

A student copy of ArcGIS will be distributed to students. They need to download and install the s/w on their PC or laptop by themselves.

Submission of Assessment Tasks

Please refer to the Moodle page of the course for further guidance on assessment submission.

Academic Honesty and 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

Academic Information

Key UNSW Dates - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.

Final Examinations:

Final exams in Term 1 will be held online between 30th April - 13th May inclusive. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

Supplementary Examinations:

Supplementary Examinations for Term 1 2021 will be held on 24th - 28th May inclusive should you be required to sit one. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism;
- Special Considerations: student.unsw.edu.au/special-consideration;
- General and Program-specific questions: The Nucleus: Student Hub
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC/SURVSOC/CEPCA

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

Image Credit

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CRICOS

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Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	✓
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	