# ENVS6364

# Introduction to Geographic Information Science and Remote Sensing

Session 1, In person-scheduled-weekday, North Ryde 2024

*School of Natural Sciences*

# Contents

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# General Information

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Credit points
10

Prerequisites

Corequisites

Co-badged status
ENVS6364

Unit description
This unit provides students with a comprehensive introduction to the rapidly evolving field of geospatial technologies, including geographic information systems (GIS), global positioning systems (GPS) and remote sensing. Students will develop broad theoretical technical skills in geospatial technologies and managing spatial data, analysing, visualising and synthesising spatial data, and the principles for applying these skills to real-world problems across a range of disciplines, including environmental science and management, physical and human geography, urban planning, biodiversity conservation, archaeology, health, business and marketing. Adding geospatial technology skills to your undergraduate or graduate program can help you identify new areas of research and applications thereby strengthening your career prospects.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

# Learning Outcomes

On successful completion of this unit, you will be able to:

**ULO1:** Perform operations using Geographic Information Systems (GIS) and Remote Sensing software

**ULO2:** Organise, analyse and interpret geographic or spatial information using a range of techniques

**ULO3:** Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence

**ULO4:** Use geographic spatial analysis to effectively communicate through maps and reports

**ULO5:** Utilise standard Geographic Information Science concepts and analytical techniques to develop applications

# General Assessment Information

**Late Assessment Submission Penalty**

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is **11:55 pm**. A 1-hour grace period will be provided to students who experience a technical concern.

For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration.

**Note: Late submissions will be accepted for all assessments in this unit, Standard Late Penalties applies.**

**Special Consideration**

The Special Consideration Policy aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through ask.mq.edu.au.

**Submission of assignments and progress tasks**

Students are required to keep a copy of their submitted assessments.

The assignments will be taken and submitted online and through upload links. In the latter case, assignments must be submitted in Word or PDF format. Maps and tables associated with the assignment must be included in MS Word or PDF documents.

Assignments cannot be emailed or submitted in softcopy format under any circumstances. The Turnitin/online link provided in iLearn must be used to submit assignments by the dates and times indicated.

**Return of marked assignments**

Within two teaching weeks of submitting your assignment, you will receive written feedback via iLearn.

**Requirements to Pass this Unit**

To Pass this unit, you must:

- Attempt all assessments, and
- Achieve a total mark equal to or greater than 50%

Grades for the unit as a whole will be awarded according to the following general criteria (course rubric):

|  | Developing | Functional | Proficient | Advanced |
|---|---|---|---|---|
| **General description of the level of attainment** | Has not yet reached the desired standard. Limited understanding of required concepts and knowledge.<br><br>A **fail** grade (or under some circumstances a conceded pass) would be given | Has reached basic academic standards. Work has limited translation of concepts and procedures to new contexts unless aided.<br><br>A **pass** grade would be awarded | Has completely reached the standards expected. Can work independently in new contexts, adapting procedures to meet the context. Demonstrates awareness of own limitations.<br><br>A **credit** grade would be awarded. | Has gone beyond the expected standards. Exhibits high levels of independence and can use concepts to generate new ways of completing procedures. Can engage in critical reflection.<br><br>A grade of **distinction** or **high distinction** would be awarded. |

# Assessment Tasks

| Name | Weighting | Hurdle | Due |
|---|---|---|---|
| Practical Assignment 1 | 15% | No | 17/03/2024 |
| Practical Assignment 2 | 25% | No | 7/04/2024 |
| Practical Assignment 3 | 30% | No | 26/05/2024 |
| Final Exam | 30% | No | 3-21 June 2024 (TBA) |

# Practical Assignment 1

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 10 hours
Due: **17/03/2024**
Weighting: **15%**

Getting started with GIS. This is a computer-based practical exercise.

On successful completion you will be able to:

- Perform operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence

# Practical Assignment 2

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 20 hours
Due: **7/04/2024**
Weighting: **25%**

Computer-based practical exercise. A report is submitted at the end of the assignment.

On successful completion you will be able to:

- Perform operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Use geographic spatial analysis to effectively communicate through maps and reports
- Utilise standard Geographic Information Science concepts and analytical techniques to develop applications

# Practical Assignment 3

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 22 hours
Due: **26/05/2024**
Weighting: **30%**

Computer-based practical exercise

On successful completion you will be able to:

- Perform operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
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# Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 4 hours
Due: **3-21 June 2024 (TBA)**
Weighting: **30%**

Covers all material from lectures and practical classes

On successful completion you will be able to:

- Perform operations using Geographic Information Systems (GIS) and Remote Sensing software
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[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

# Delivery and Resources

ENVS6364 is an introductory course to Geographic Information Systems (GIS). It introduces students to geospatial technologies, including GIS, GPS, and remote sensing. GIS concepts and principles will be taught, as well as technical skills in data acquisition and management, mapping, spatial sampling, and analysis. Using the latest geospatial software available on the market, our students are trained in industry-standard GIS software.

The topics covered in ENVS6364 are vital to becoming competent in Geographic Information Science. As part of these, you will learn about how the shape of the earth affects mapping, as well as coordinate systems and map projections, how to create and collect GIS data, how to analyze spatial data using various GIS types, how to make maps, how to use remote sensing, and how to work with three-dimensional data. As part of the practical classes, students will be exposed to standard GIS concepts and techniques applied to various disciplines, including environmental science and management, physical and human geography, urban planning, biodiversity conservation, archaeology, health, and business.

**Delivery**

For the practical component of this unit, the course is available either in weekday attendance mode or fully online. We will offer all lectures in weekday attendance mode and will also be streamed online.

**Methods of communication**

We will communicate with you via your university email or through announcements on iLearn. Queries to convenors can either be placed on the iLearn discussion board or sent to mqgislectures@mq.edu.au from your **university email** address.

**Off-shore students**

Off-shore students **must** email the convenor as soon as possible to discuss study options.

**COVID Information**

On-campus teaching continues to be scheduled for Session 1, 2024.

Students are requested to minimise the risk of spreading COVID to themselves and others in accordance with the university and NSW Health guidelines: https://www.mq.edu.au/about/corona virus-faqs and https://www.nsw.gov.au/covid-19/stay-safe. Remember to check this page regularly in case the information and requirements change during semester. If there are any changes to this unit in relation to COVID, these will be communicated via iLearn.

### Lecture program and location

There is one 1 hour online lecture per week. Please check lecture times at the Macquarie University timetables To access your timetable, visit Class Finder (click on the  icon on the homepage of eStudent). Lectures are recorded and posted on iLearn via Echo360. Students are expected to attend lectures in person and virtually/online according to their enrollment. Links for attending lectures online are provided on iLearn. Lecture recordings will also be made available on iLearn.

### Practical program and location

*Weekday attendance:* Students are enrolled on one 3-hour practical class per week. Please check the practical times and rooms on your timetable. Practical class sizes are limited by the number of available computers. You must use the online enrolment system to change the time/ day of your practical class. **Practical classes and lectures begin in Week 1.**

*Fully online attendance:* You must have a home computer with a Windows operating system (Windows 7 or above). Please note that ArcGIS Pro software is NOT supported by Mac or Linux operating systems. Also, we don't provide IT support for installation to Mac or Linux platforms. A copy of the ArcGIS Pro software will be provided to all students. You must install this software on your computer. Internal students may also download and install the software on their personal computers. ArcGIS Pro can also be accessed remotely on the Appstream platform. More information on accessing GIS software on the Appstream platform is provided on the iLearn.

### Resources

### Technology used

This unit will use the online platform of Echo360 and iLearn, ArcGIS Pro, Google Earth, MS Excel software, GPS, and online resources for the practical exercises. Other ESRI software and open-source GIS software may also be used.

You will require access to a computer and broadband internet to complete this unit. The library computers and computer labs are available for casual use outside scheduled practical classes.

Internal students with a home computer with a Windows operating system may obtain a copy of the ArcGIS Pro software from the unit convenor. **The ArcGIS Pro software is NOT supported by Mac or Linux operating systems.** It is not essential for weekday students to have ArcGIS installed on their home computers as the computers in the computer labs are available for casual use outside scheduled practical classes. **However, students registered as fully online must have ArcGIS Pro installed on their home computers.** ArcGIS Pro is also available via *Appstream*. More information regarding this is provided on the iLearn

### Unit web page

This unit's webpage will be available on iLearn. Information about how students can access iLearn can be found at: http://www.mq.edu.au/iLearn/student_info/index.htm

The iLearn page uses Macquarie University's standard interface and has links, access to lectures (as audio files through Echo360, and as downloadable PDF presentations) and practical instructions. Important announcements will be made through iLearn, so check the ENVS6364 page regularly.

Information about how to access lecture recordings through the Echo360 EchoCenter page in iLearn can be found at: http://mq.edu.au/iLearn/student_info/lecture_recordings.htm

### *Recommended texts/materials*

Highly recommend a fast USB Flash Storage Drive (4GB is adequate) for GIS Practicals; if your computer supports USB3 then I would further suggest a USB3 storage drive as the GIS Lab PC's support USB3.

Access to required and recommended resources, plus past central exam papers, is available at the Macquarie Library website (https://www.mq.edu.au/about/campus-services-and-facilities/library/multi-search/multisearch).

**GIS Software.** The University has a site license for ESRI's ArcGIS (www.arcgis.com), which may be installed on a Windows PC with reasonable specs (i.e. 4GB RAM and 2.2 GHz CPU).

Shellito, B. A. (2020). *Discovering GIS and ArcGIS Pro 3rd Edition*. Macmillan Higher Education.

Chang, K. 2008. *Introduction to geographic information systems.* McGraw Hill, New York.

Jensen J. & Jensen R. (2012) Introductory Geographic Information Systems, Pearson Higher Ed.

Longley, P., Goodchild, et al. (2005) Geographical Information Systems and Science.

Burrough PA, McDonnell RA, and Lloyd C. 2015. *Principles of Geographic Information System*s. Oxford University Press, UK.

Huisman O, de By RA (Eds). *Principles of Geographic Information Systems: An Introductory Text Book*: Available online at:https://www.itc.nl/library/papers_2009/general/PrinciplesGIS.pdf

The Khan Academy has many short instructional videos on a range of topics; the statistics (Maths) and SQL (Computing, Programming) provide background learning relevant to GIS.

http://www.khanacademy.org

# Unit Schedule

**The following is a summary of the course content and a tentative schedule. Check iLearn regularly for the weekly content update.**

| Week | Description | Practical |
|------|-------------|-----------|
| **1** | Introduction to Geographic Information Science: what is GIS, and what is it used for? | Practical Assignment 1.1 |

| Week | Description | Practical |
|------|-------------|-----------|
| 2 | Types of GIS data: Vector and Raster data | Practical Assignment 1.2 |
| 3 | Planet Earth is not, in fact, perfectly round: Coordinate systems and map projections | Practical Assignment 1.3 |
| 4 | Spatial Analyses using Vector data | Practical Assignment 2.4 |
| 5 | Spatial Analyses using Raster data | Practical Assignment 2.5 |
| 6 | Capturing physical features on earth surface using GIS | Practical Assignment 2.6 |
| 7 | GIS applications and career in GIS | Practical Assignment 2.7 |
| 8 | Starting a GIS Project: Data Flow Diagrams, ModelBuilder & Spatial analyses with ArcGIS Pro | Practical Assignment 3.8 |
| | **Semester Break** | |
| 9 | Remote Sensing: Surface elevation and Terrain products, raster and TIN, 3D | Practical Assignment 3.9 |
| 10 | Remote Sensing of the Environment | Practical Assignment 3.10 |
| 11 | Application of GIS for environmental solutions | Practical Assignment 3.11 |
| 12 | Application of GIS for environmental solutions | Practical Assignment 3.12 |
| 13 | Unit summary | No practical |

# Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about

throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

## Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

# Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

# Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

## The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

# Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

## Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

## IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

# Changes from Previous Offering

**Course Changes as informed by Previous Student Feedback**

We continually modify the course content, and datasets for practical sessions will differ from year to year.

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Unit information based on version 2024.02 of the Handbook