



## UNSW Course Outline

# GMAT2120 Surveying and Geospatial Technology - 2024

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## General Course Information

**Course Code :** GMAT2120

**Year :** 2024

**Term :** Term 3

**Teaching Period :** T3

**Is a multi-term course? :** No

**Faculty :** Faculty of Engineering

**Academic Unit :** School of Civil and Environmental Engineering

**Delivery Mode :** In Person

**Delivery Format :** Standard

**Delivery Location :** Kensington

**Campus :** Sydney

**Study Level :** Undergraduate

**Units of Credit :** 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

This course will cover some contemporary terrestrial surveying instruments and their use. The course will commence with precise digital levelling (bar-code level) instruments, covering design, accuracy, error sources, precise levelling techniques, errors and calibration. The theory will be

supported with a practical exercise. Electronic total stations will be introduced, including circle reading, level sensors, centring systems, constrained centring, precise horizontal and zenith angle measurement, observation procedures and elimination of errors. This theory will be exercised with a larger field project and some minor exercises. Robotic total stations and ATR (automatic tracking) technology will be described. Finally, principles and applications of the Electronic Distance Meter (EDM), phase and pulse measurement techniques, wave propagation in atmosphere, measurement of atmospheric parameters, coefficient of refraction, velocity corrections, geometric reductions, reductions of distances to the ellipsoid, and analysis of errors will be dealt within a field practical exercise. An EDM height traversing practical will round out this course. At the conclusion of this course students will have gained an understanding of the impact specific field techniques and instrumentation on the attainable precision when conducting terrestrial surveys.

## **Course Aims**

The aim of the course is to study modern terrestrial surveying instrumentation in depth, particularly precise digital levels, electronic total stations (including robotic) and electronic distance meters (EDM). Students will perform field practical exercises with all these instruments to exercise the theory they have learnt and to produce professional reports of this work.

## **Relationship to Other Courses**

This course is a part of a three-year stream of 'pure' surveying measurement courses. It builds on GMAT1110. You should have already passed or been exempt from that course. If you have attempted but failed GMAT1110 then you should contact the course coordinator. This course also builds on GMAT2500 and GMAT2700. This course runs concurrently with GMAT2550 and some exercises have been structured to run concurrently. GMAT3100 and GMAT3150 in third year will further extend this course.

# Course Learning Outcomes

Course Learning Outcomes
CLO1 : Perform a precise digital levelling survey using a modern bar-code instrument, leap frog EDM height traverse using a modern total station to achieve first/second order quality, high precision horizontal and vertical directions using a modern total station and medium length EDM distance measurement.
CLO2 : Demonstrate efficient field work practices including skill with various surveying instruments, forward planning and logistics for complex survey tasks, production of clear field notes and redundant field checks to ensure accuracy.
CLO3 : Perform reductions of observations from various field exercises and all associated statistical analysis.
CLO4 : Test various instruments and techniques to determine the size of errors and indicate the accuracy of the resulting measurements.

Course Learning Outcomes	Assessment Item
CLO1 : Perform a precise digital levelling survey using a modern bar-code instrument, leap frog EDM height traverse using a modern total station to achieve first/second order quality, high precision horizontal and vertical directions using a modern total station and medium length EDM distance measurement.	<ul style="list-style-type: none"><li>• Final Exam</li><li>• Field Practicals</li><li>• Levelling Quiz</li></ul>
CLO2 : Demonstrate efficient field work practices including skill with various surveying instruments, forward planning and logistics for complex survey tasks, production of clear field notes and redundant field checks to ensure accuracy.	<ul style="list-style-type: none"><li>• Final Exam</li><li>• Field Practicals</li><li>• Levelling Quiz</li></ul>
CLO3 : Perform reductions of observations from various field exercises and all associated statistical analysis.	<ul style="list-style-type: none"><li>• Final Exam</li><li>• Field Practicals</li><li>• Levelling Quiz</li></ul>
CLO4 : Test various instruments and techniques to determine the size of errors and indicate the accuracy of the resulting measurements.	<ul style="list-style-type: none"><li>• Final Exam</li><li>• Field Practicals</li><li>• Levelling Quiz</li></ul>

## Learning and Teaching Technologies

Moodle - Learning Management System | Blackboard Collaborate

## Learning and Teaching in this course

The original material for this course was prepared by the previous lecturer, A/Prof Jean Rüeger and his expertise is gratefully acknowledged. The current material and the teaching methods have been modernised. Whilst using this material a focus on the understanding of the topics is

sought and requirement to read the text-based material in detail.

I have considered feedback from last year's students in this course and in response will continue to supply electronic teaching materials on Moodle. Due to the smaller class size, I will be able to offer the lectures face-to-face in a room and lectures live online (Hybrid) using Blackboard Collaborate (BBCU). I will endeavour to mark reports promptly for effective student feedback. I have also made some improvements to the requirements of the pracs so that they can be more easily completed in one practical session. Attendance and attention at lectures will be expected but will not be sufficient to learn the topics to the level required. There will be a lot of reading required. You will also need to do the calculations, practical assignments and workshop problems. There is a significant practical component to this course. It is important that you prepare thoroughly for the practicals by reading the instructions, visiting the site, and familiarising yourself with the equipment prior to the practical classes. Previous students have found field practicals to be the most rewarding and enjoyable part of the course and for this reason they are compulsory for all students. **A doctor's certificate or other supporting documentation will be needed in the event that a student misses a field practical.**

## Assessments

### Assessment Structure

Assessment Item	Weight	Relevant Dates
Final Exam Assessment Format: Individual	45%	Start Date: UNSW Final Exam Period Due Date: UNSW Final Exam Period
Field Practical Assessment Format: Individual	50%	Start Date: Will discuss in class Due Date: Will discuss in class
Levelling Quiz Assessment Format: Individual	5%	Start Date: See moodle Due Date: See moodle

## Assessment Details

### Final Exam

#### Assessment Overview

The final exam is comprised of a 40-minute field practical exam worth 10% at the end of term, and a 2-hour final exam during the final exam period worth 35%.

#### Course Learning Outcomes

- CL01 : Perform a precise digital levelling survey using a modern bar-code instrument, leap frog EDM height traverse using a modern total station to achieve first/second order quality, high precision horizontal and vertical directions using a modern total station and medium

length EDM distance measurement.

- CLO2 : Demonstrate efficient field work practices including skill with various surveying instruments, forward planning and logistics for complex survey tasks, production of clear field notes and redundant field checks to ensure accuracy.
- CLO3 : Perform reductions of observations from various field exercises and all associated statistical analysis.
- CLO4 : Test various instruments and techniques to determine the size of errors and indicate the accuracy of the resulting measurements.

### **Detailed Assessment Description**

The final exam component consists of two tasks. A Practical Exam on Friday of week 10 worth 10% + a Final Exam in the exam period worth 35%. Details of the practical exam will be given by the lecturer during term.

The Final Exam covers all material. It will be a paper style exam in a room. The questions will be a mixture of theoretical and applied questions relying heavily on the practical and workshop exercises which are underpinned by the lecture slides. Coming to all lectures and workshops (pracs are compulsory) will give the student a significant advantage in the Final Exam.

### **Assessment Length**

Practical Exam = 40 mins, Final Exam = 2hr

### **Submission notes**

Hand written for both Practical and Final

### **Assignment submission Turnitin type**

Not Applicable

### **Generative AI Permission Level**

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

## **Field Practicals**

### **Assessment Overview**

6 x various field practicals of differing complexity requiring calculations and reports. Marks will be returned within 2 weeks. A report with generic feedback will be sent to all students, followed by a class discussion in the lecture period which will clarify any issues that arose.

### Course Learning Outcomes

- CLO1 : Perform a precise digital levelling survey using a modern bar-code instrument, leap frog EDM height traverse using a modern total station to achieve first/second order quality, high precision horizontal and vertical directions using a modern total station and medium length EDM distance measurement.
- CLO2 : Demonstrate efficient field work practices including skill with various surveying instruments, forward planning and logistics for complex survey tasks, production of clear field notes and redundant field checks to ensure accuracy.
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- CLO4 : Test various instruments and techniques to determine the size of errors and indicate the accuracy of the resulting measurements.

### Detailed Assessment Description

P1 Laser levelling prac	5%		Due on the day
P2 report (Levelling prac)	10%		Due 2 weeks after fieldwork (Thurs)
P3 report (Angle resec + Ht)	10%	(7 + 3)	Due 2 weeks after fieldwork (Thurs) (Ht – 25/10)
P4 report (Mini Prac)	5%		Due 11/10 (Friday of week 5)
P5 report (Leap Frog)	10%		Due 2 weeks after fieldwork (Thurs)
P6 report (EDM)	10%		Due 2 weeks after fieldwork (Thurs)

### Assessment Length

Varies depending on prac exercise. Will be discussed in class.

### Submission notes

Will be supplied in class.

### Assessment information

Each student will be a member of a group of 3 (or occasionally 2) students. Groups will be established during the first lecture and may change at the lecturer's discretion as the term progresses. Students are free to select their partners; however, students are advised to select their partners very carefully. Students that do not attend the first lecture, or cannot find a partner, will be put in a group by the lecturer. Get the mobile phone number, e-mail address, etc. of your group members immediately after the formation of the group. The joint (or individual) submissions for the practicals require considerable interaction between the students. Make sure

that all field data are copied immediately after the fieldwork, so that all the students in the group have access to the data. Further information about the practicals will be distributed during the lectures and are available on the class web site. Rules for practicals are given below.

Some practicals require individual reports by the students, even if the fieldwork was shared (See instructions). Submissions are to be handed to the lecturer supervising the practical (or slip under their office door with appropriate title page) or emailed (see submission instructions) before the due date.

Reports must follow the instructions given in the handout "Submission of Reports". (A sample report is given on the course web site). Submissions must include a declaration on the authorship of the work. Each submission is to have a title page (title of assignment, date of submission, course code, course name, student number, name of student) and a summary of results page. Word processed submissions are required. Spreadsheets may be used for computations as long as they are designed by the student. This should also be emailed/ submitted with an appropriate file name ie John\_Smith\_GMAT2120\_Prac 2.xls to aid organisation for the lecturer.

Each practical has instructions about computations and reporting. It is strongly recommended that student reports are written in the same sequence and with the same headings.

#### **Assignment submission Turnitin type**

Not Applicable

#### **Generative AI Permission Level**

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

## **Levelling Quiz**

#### **Assessment Overview**

This 90 minute quiz on Moodle is designed to reinforce the statistics and calculations involved in precise levelling. Marks will be returned immediately after the quiz closes.

#### **Course Learning Outcomes**

- CL01 : Perform a precise digital levelling survey using a modern bar-code instrument, leap

frog EDM height traverse using a modern total station to achieve first/second order quality, high precision horizontal and vertical directions using a modern total station and medium length EDM distance measurement.

- CLO2 : Demonstrate efficient field work practices including skill with various surveying instruments, forward planning and logistics for complex survey tasks, production of clear field notes and redundant field checks to ensure accuracy.
- CLO3 : Perform reductions of observations from various field exercises and all associated statistical analysis.
- CLO4 : Test various instruments and techniques to determine the size of errors and indicate the accuracy of the resulting measurements.

#### **Detailed Assessment Description**

The levelling assignment replaces a former mid-session test. It is a moodle quiz designed to test your understanding of precise levelling after lectures, workshops and a prac exercise.

#### **Assessment Length**

90 mins

#### **Submission notes**

Moodle quiz

#### **Assessment information**

The moodle levelling quiz is designed to reinforce the statistics and calculations involved in precise levelling. Students who perform poorly should seek extra help from the lecturer and work harder.

#### **Assignment submission Turnitin type**

Not Applicable

#### **Generative AI Permission Level**

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

## **General Assessment Information**

#### **Grading Basis**

Standard



# Course Schedule

## Attendance Requirements

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

## General Schedule Information

See moodle. ECOS is not capable of displaying the course schedule.

# Course Resources

## Prescribed Resources

Lecture Material (check the course website):

<http://moodle.telt.unsw.edu.au>

The Powerpoint lecture slides and other documents are available for download as PDF files at the course website.

Lectures can also be viewed as BBCU recordings.

Text and Reference Books

**Text book:**

Uren, J & Price, WF. "Surveying for Engineers", 5th edition, 2010

(available in bookshop – compulsory to purchase for B Eng(Surveying) and Dual award (3776) students only. Optional for other students)

## Recommended Resources

**Reference book:**

- Uren, J & Price, WF. "Surveying for Engineers", 5th edition, 2010
- Schofield, W. "Engineering Surveying", 4th edition, 1993
- Bannister, A., Raymond, S. Baker, R. (1992) Surveying, 6th Edition, Pitman, London.
- Kavanagh, B.F. (2003) Surveying: Principles and Applications, 6th Ed, Prentice Hall, ISBN 0-13-

## Course Evaluation and Development

All prac exercises will be de-briefed in class after marking. Many opportunities for 1-on-1 feedback during prac exercises.

## Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Craig Roberts		CE412	0293854464		No	Yes

## Other Useful Information

### Academic Information

#### I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

#### II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and policies. In particular, students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)
- [Equitable Learning Services](#)

### III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

### IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: <https://www.unsw.edu.au/engineering/student-life/student-resources/program-design>.

*Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.*

### Academic Honesty and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: [student.unsw.edu.au/plagiarism](https://student.unsw.edu.au/plagiarism). The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient

time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

[www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf](http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)

## Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

## Faculty-specific 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)

## School Contact Information

For assistance with enrolment, class registration, progression checks and other administrative matters, please see [the Nucleus: Student Hub](#). They are located inside the Library – first right as you enter the main library entrance. You can also contact them via <http://unsw.to/webforms> or reserve a place in the face-to-face queue using the UniVerse app.

For course administration matters, please contact the Course Coordinator.

Questions about the this course should normally be asked during the scheduled class so that everyone can benefit from the answer and discussion.