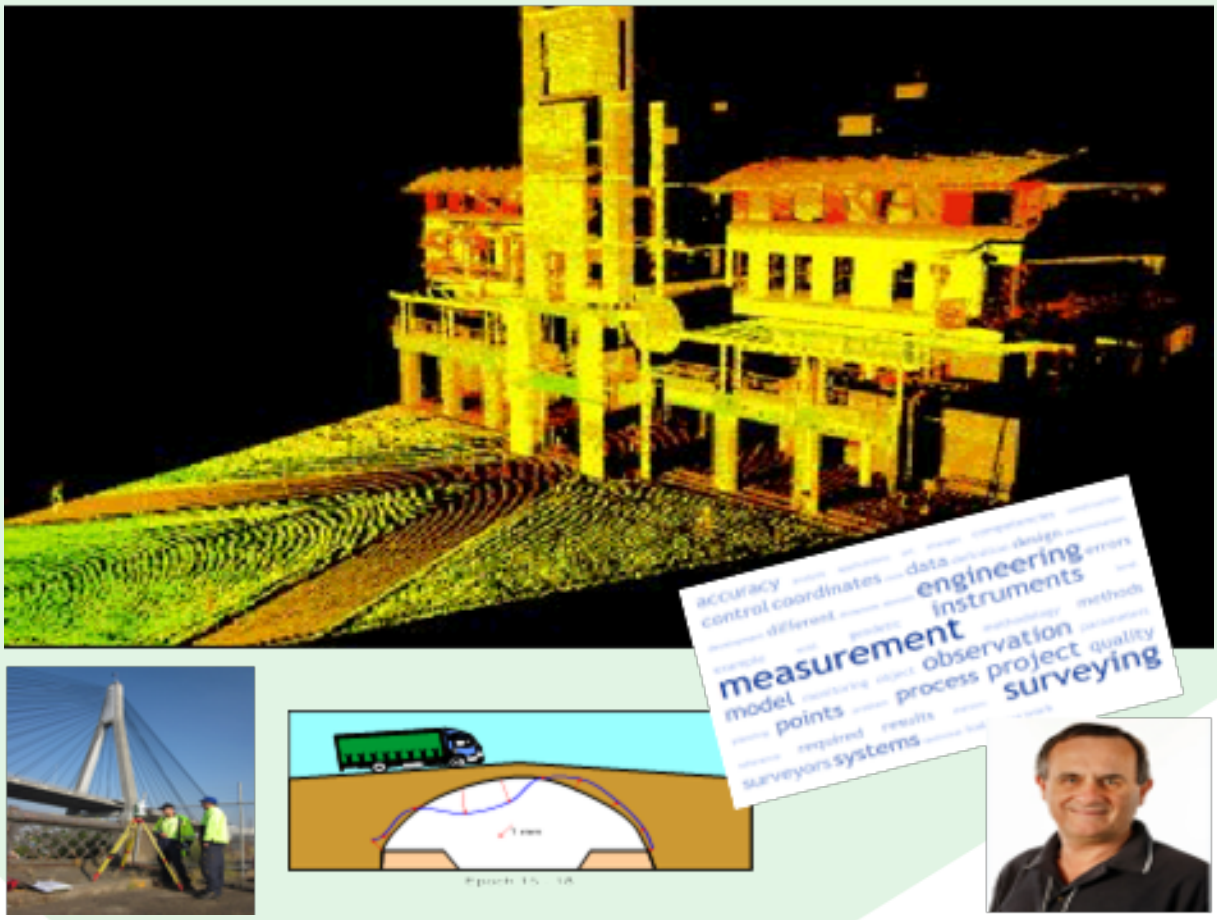
GMAT3100

Surveying Applications and Design

Term 1, 2022



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Bruce Harvey	B.Harvey@unsw.edu.au	Available in my office or by email whenever I am not in class or meeting.	CE207	02 9385 4178

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

Units of Credit 6

Summary of the Course

This course introduces the student to a wide variety of surveying applications undertaken as part of engineering projects. Selected topics of specialist survey applications will be dealt with using lectures, guest speakers and technology demonstrations. Topics will be selected from the following: mining surveying (including azimuth transfer, north-seeking gyro theodolites, plumbing of shafts and high structures), industrial surveying, tunnel surveying, hydrographic surveying, alignments, monitoring of deformations and settlement of terrain, structures and machines, design of precise engineering networks, project surveying methodology and advanced least squares analysis.

Course Aims

To broaden and deepen the knowledge of surveying instrumentation, to discuss equipment used in related areas of measurement, and to introduce students to specialised surveying techniques relevant to engineering and certain surveying sub-disciplines. A broad range of surveying instrumentation will be covered in this course.

The aim of this subject is to cover several topics and methods that are specialist skills of a consultant surveyor - not commonplace skills. But it does **not** aim to give the student a vast knowledge of all them. It is not expected that every graduate will need to know all of the particular topics covered, or necessarily work in these sub-dscipline areas on graduation. However, some graduates will need to know some of the topic areas in great detail, and may spend a considerable part of their career in one of the fields introduced in this course. Moreover, even if students do not work in the specific topic areas dealt with in the course, the educational process and underlying knowledge may valuably be applied to other surveys.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Design survey methods, including choice of instruments, analysis and error prevention, for: industrial (e.g. indoor) surveys, high rise construction, mining, tunnelling and deformation monitoring of buildings, bridges and dams.	PE1.1, PE1.2, PE1.3, PE1.5
2. Use surveying instruments in a variety of applications and analyse aspects of deformation surveys, including datum and free net problems.	PE1.3, PE2.1, PE2.2, PE3.4
3. Interpret problems from client instructions and design solutions to surveying problems with the level of creativity and innovation appropriate to the complexity of the challenge.	PE2.1, PE2.3, PE2.4, PE3.1, PE3.2, PE3.4
4. Design and execute Surveying and Geospatial measurements and data analysis for surveying projects using least squares adjustment software.	PE1.2

Learning Outcome	EA Stage 1 Competencies
5. Demonstrate the characteristics of effective teamwork and professional conduct and apply organisational and interpersonal strategies	PE3.1, PE3.5, PE3.6
6. Review professional journal and conference publications and present findings.	PE1.3, PE3.2

Teaching Strategies

This course is currently co-taught by UNSW academic Bruce Harvey and industry experts. Emphasis is placed on problem solving skills and application to real case studies from consulting surveying. The lectures give an overview of problems and methods, but not all the details. The lecturers ask questions during the lecture periods that stimulate thought into the topics. The aim is to involve students in the class, to deepen their understanding of the topics, and to give them confidence in their ability to design and undertake high precision, or unusual consulting surveys.

Additional Course Information

This course introduces the student to a wide variety of surveying applications undertaken as part of engineering projects. Selected topics of specialist survey applications will be dealt with using lectures, guest speakers and technology demonstrations. Topics will be selected from the following: mining surveying (including azimuth transfer, north-seeking gyro theodolites, plumbing of shafts and high structures), industrial surveying, tunnel surveying, hydrographic surveying, alignments, monitoring of deformations and settlement of terrain, structures and machines, design of precise engineering networks, project surveying methodology and advanced least squares analysis. This course builds on previous surveying courses in years 1 and 2, specifically GMAT1110, GMAT2120 and GMAT2550.

Attendance and attention at classes is strongly recommended, but it will not be sufficient to learn the topics to the level required. There will be a lot of reading required in this course. Previous students who did not do enough reading or did not attempt the supplied lab questions have been surprised to get very low marks. *At UNSW, the normal workload expectations of a student are about 150 hours for a 6 UoC course, including class contact hours, preparation and time spent on all assessable work.*

As a reward for reading all the details in this course outline, the first person to open the cupboard opposite my office door may receive a small prize.

If you want some help with goal and time management, motivation, work and study management, or well-being then I suggest you visit http://www.thefridge.org.au/ .It might give you some new or useful ideas.

Assessment

Past exam papers will be provided on the class Moodle site.

Any changes to the above assessment details will be notified in class and on the class Moodle site. After each test each student will be given individual and detailed feedback on their test or exam paper soon after it has been marked by contacting the course convenor. Further details of assessment and exam rooms will be given in classes, if in doubt contact the lecturer.

There might be some calculation based questions in the exams but most of the questions will seek to find whether you have learned some of the main facts and information, whether you understand the important aspects of the type of surveying covered in the question, and whether you can describe how you would apply the knowledge.

Some of the questions in the tests will require you to propose a solution for a non-routine survey problem that a new client might bring to a consultant surveyor. The highest marks will go to those who can propose a good method, justify it well, and communicate their proposed solution to a client clearly and reliably. Pass marks will go to those who can present a reasonable problem solution and a reasonable justification for their proposal. Note that some questions in the assessment tasks in this course have more than one correct answer and different surveyors might propose a variety of valid solutions. In such cases your answers should include justifications for your methods, you do not need to try to find or guess what the examiners own personal opinion or solution might be.

Further details will be given, and discussed in class, about the type of questions that might be in the exams and which parts (topics and expected outcomes) of the course are related to the exam. The exams are set by the course convenor and reviewed by another staff member of the school.

Late submissions will be penalised at the rate of 5% per day after the due time and date have expired.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Mid-term test	25%	15/03/2022 09:00 AM	1, 2
2. Assignments	20%	Not Applicable	1, 2
3. Problem Based Learning - Moodle Quizzes	10%	Not Applicable	1, 2
4. Final Exam	45%	Not Applicable	1, 2

Assessment 1: Mid-term test

Assessment length: 1 hour 30 mins
Due date: 15/03/2022 09:00 AM

Conventional test, but students can use computers. Individual feedback is given by the lecturer. Small class.

This is not a Turnitin assignment

Assessment 2: Assignments

1) This assignment requires study of an international survey conference paper (eg FIG or IAG) or journal or survey project reports in a technical publication. Students select one of the papers that relates to the topics in GMAT3100. No two students use the same material. Each student gives a 5 minute ppt or similar presentation to the class. The presentation should be a clear and concise summary of the base material and reveal an understanding of the topic. Students are informally given feedback by the peers. 2) High Precision Survey and Design. 14% Requires group fieldwork and analysis. A separate document describes the assignment in detail. The assignment changes each year. Standard process - reports marked with comments.

This is not a Turnitin assignment

Assessment 3: Problem Based Learning - Moodle Quizzes

Weekly quizzes managed through Moodle. Feedback built into the quizzes, and consultation with teacher. Audit system requires students to show their workings to the course coordinator during session. Students who perform poorly in the quizzes and workshops are recommended to discuss progress with the lecturer during the semester.

This is not a Turnitin assignment

Assessment 4: Final Exam

Start date: Determined by Exams Branch in exam period
Assessment length: 2 hours

Final exam in a computer lab. Students may use software to solve some questions, and type answers. Students are invited to visit the lecturer after the examination period for individual feedback. Small class.

This is not a Turnitin assignment

Attendance Requirements

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

Course Schedule

It is proposed that in 2022 all lectures in GMAT3100 will be taught in BBCU sessions (access via Moodle) with some students in the class room and some online. Hopefully many students will be in the class rooms. Lectures will be recorded in BBCU.

The proposed schedule of classes will be supplied as a one page table in a separate file on the class Moodle. If there are changes to the proposed table, they will be updated on the class Moodle site and discussed in class.

Week	**Monday Topic 2-4 pm**	**Tuesday Topic 9-11 am**	**Tuesday Lab/Field 11am - 1pm**
1 (14 Feb)	Course overview, intro & organisation. Revision. Project Surveying Methodology.	Terrestrial Laser scanning	Field: Use Laser Scanner and safety aspects. Lab: Moodle questions
2	Point Clouds. Reflectorless EDM and 'Distos', Case study. Laser trackers.	Motorised TS instruments and automatic target recognition.	Field: rEDM, Use ATR motorised total stations. Lab: Moodle questions
3	No class – GMAT3150 survey camp	No class	No class
4	Underground Mine Surveying. Underground Traversing & Tunnels.	Gyro theodolites. Student seminar presentations (assignment 1)	Seminar presentations contd Lab: Underground surveying calcs
5	Shaft Heights. Open cut mines. Subsidence Lab: Moodle based questions.	**Mid-term test** in CE201	Mini prac – Shaft height and position transfer
6	No class – Flexibility week	Optional: Mini pracs	
7	Setting out large and high-rise structures. Tiltmeters. Direct & alignment surveys for industrial & construction surveys.	3D intersection systems. High Precision survey techniques. Rotating axes & dish surveys.	Lab: 3D Lines calculations
8	Refraction parameters. Network datums, free network adjustments	Guest lectures: Case studies of survey projects: SG and AL	Guest lecture: Case studies of survey projects MN
9	Problem solving case studies: Haymarket tanks survey; Colo and SH Bridge. Advanced data analysis. Bayesian & Robust L1.	Deformation Monitoring & Analysis. Case Study – deformation monitoring.	Lab: Advanced data analysis. Free network & deformation solutions.
10	Easter Public Holiday – no class	Hydrographic surveying, Olympics surveys. Course revision	Complete Moodle based questions. Discuss past exam papers

Resources

Prescribed Resources

- There is no textbook.
- FIXIT software is provided on Moodle.
- The PowerPoint lecture slides are available for download as pdf files the course Moodle website. Monitor the site during session because it will be updated regularly. Additional materials are also provided on Moodle.
- This course has a lot of reading material available on the class web site and elsewhere. You are advised to find some of the material that interests you the most and study it, for the other material skim through it at a level that you know what is there and where to find it if you need it later. The objectives of this course are to introduce you to several different types of specialist consulting surveying, not to make you an expert in all the topics. So the assessment tasks will NOT seek to find if you have read and memorised it all. The assessment tasks will seek to find if you have read some of the material and studied (by reflection) some of the topics in some depth.

Recommended Resources

Reference Books

The relative importance of class notes and reference books, and purchase details will be discussed in class.

CASPARY W (2000) *Concepts of Network and Deformation Analysis*, Monograph No. 11, 3rd impression, School of Geomatic Engineering, UNSW

HARVEY BR (2016) *Practical Least Squares and Statistics for Surveyors*, Monograph No. 13, 3rd ed., UNSW.

OGAJA CA (2011) *Geomatics Engineering: a practical guide to project design*. CRC Press ISBN 978-1-4398-1743-8

RÜEGER JM (2003) Electronic *Surveying Instruments* Monograph 18, School of Surveying and Spatial Information Systems, UNSW A free copy will be supplied to all students in this course in 2015.

RÜEGER JM (1996) *Project Surveying*, Lecture Notes, Papers, Tutorials and other Material, School of Geomatic Engineering, UNSW, Jan 2001, 332 + x pages Out of print but new versions of parts of it are on class web site.

RÜEGER JM (1996) *Electronic Distance Measurement - An Introduction*, 4th ed., Springer-Verlag, Berlin-Heidelberg-New York,
http://www.springer.com/earth+sciences+and+geography/geophysics/book/978-3-540-61159-2

UREN J and PRICE WF *Surveying for Engineers, 6th Edition or later*

VOSSELMAN G and MAAS H-G (2010) *Airborne and Terrestrial Laser Scanning* Whittles ISBN 978-1904445-87-6

Course Evaluation and Development

Previous students' feedback in the end of term myExperience surveys rated this course very highly. One of the suggestions for improvements was to change the type of some of the Quiz questions. In 2022, COVID conditions and restrictions will determine how much we are able to do active in class learning. Some of our classes will include PBL (problem based learning) and it is suggested that students spend more of their own time doing additional problem solving. The lecturer is available outside class time to help with questions.

In our lectures in 2022 the quantity of words in PowerPoint slides will be reduced and the amount of student activity, thinking, talking, and interaction will be increased to try to make class attendance more worthwhile. In this course in recent years we have placed more emphasis on problem solving skills and application to real case studies from consulting surveying.

Laboratory Workshop Information

We will use specialised surveying equipment from our survey store.

This course involves a small amount of field work. If there is light rain field work is on, if rain is heavy then the practical might be postponed. Do not assume a class will be cancelled, attend on time and ask the supervisor. Practical classes take place in a variety of weather. Do not forget umbrellas, waterproof jackets, hats, sun cream, sturdy footwear (thongs or sandals are not acceptable), warm clothes, etc.

The practical exercises form an important part of the course. A good deal of time and care has gone into the organisation of these classes to ensure that you get the maximum benefit from the time that you spend and the equipment which is available. Most practicals will be done in groups of students. It is important that each student within a group gets experience in each aspect of each practical.

The location of fieldwork will depend on the state of construction on campus. Supervisors will advise you of the site and H&S matters. If you have any questions or doubts about an H&S matter discuss it with you supervisor. Students are required to read the supplied instructions well before the exercise is commenced. *Any equipment lost or damaged may have to be paid for by the group.*

Submission of Assessment Tasks

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

UNSW has a standard late submission penalty of:

- 5% per day, for all assessments where a penalty applies, capped at five days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

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

Final Examinations:

Final exams in T1 2022 will be held online between 29th April - 12th May inclusive, and supplementary exams between 23rd - 27th May inclusive. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

ACADEMIC ADVICE

- Key Staff to Contact for Academic Advice (log in with your zID and password): https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw
- Key UNSW Dates - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.
- CVEN Student Intranet (log in with your zID and password): https://intranet.civeng.unsw.edu.au/student-intranet
- Student Life at CVEN, including Student Societies: https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life
- Special Consideration: https://student.unsw.edu.au/special-consideration
- General and Program-Specific Questions: The Nucleus: Student Hub
- 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

Images for front page provided by Bruce Harvey

CRICOS

CRICOS Provider Code: 00098G

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	✓