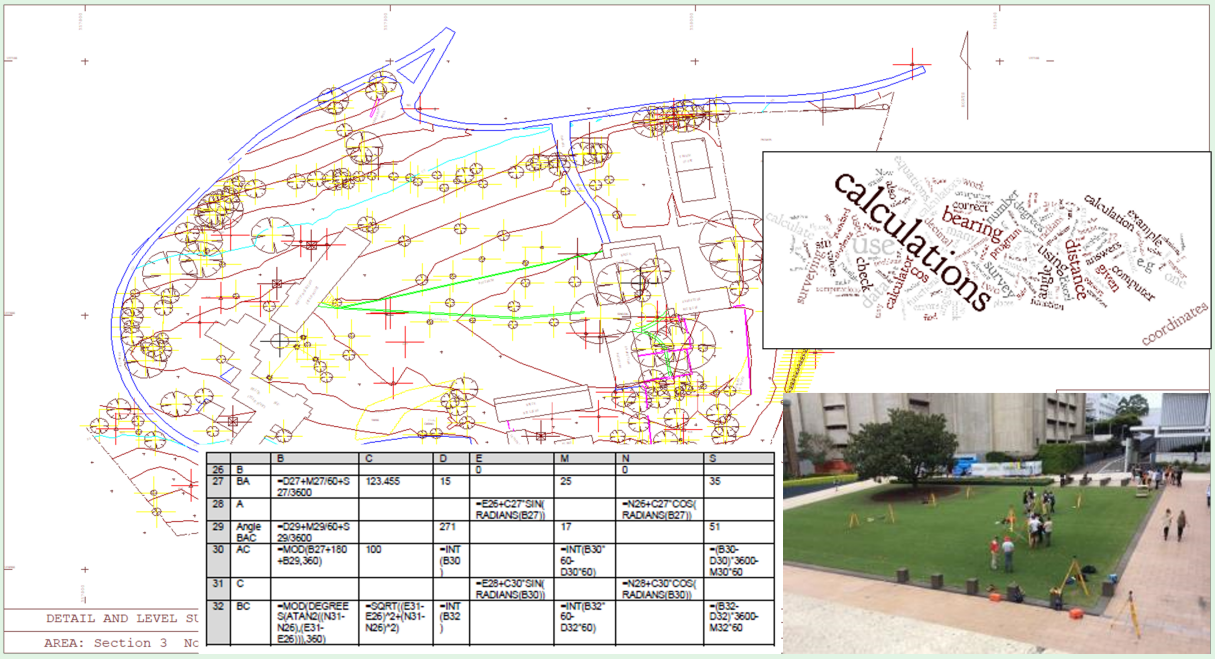
School of Civil and Environmental Engineering

UNSW Engineering

GMAT2500

Surveying Computations A

Term 2, 2022



		B	C	D	E	M	N	S
26	B				0		0	
27	BA	=D27+M27/60+S27/3600	123.455	15		25		35
28	A				=E26+C27*SIN(RADIANS(B27))		=N26+C27*COS(RADIANS(B27))	
29	Angle BAC	=D29+M29/60+S29/3600		271		17		51
30	AC	=MOD(B27+180+B29,360)	100	=INT(B30)		=INT(B30*60-D30*60)		=(B30-D30)*3600-M30*60
31	C				=E28+C30*SIN(RADIANS(B30))		=N28+C30*COS(RADIANS(B30))	
32	BC	=MOD(DEGREES(ATAN2((N31-N26),(E31-E26))),360)	=SQRT((E31-E26)^2+(N31-N26)^2)	=INT(B32)		=INT(B32*60-D32*60)		=(B32-D32)*3600-M32*60

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Bruce Harvey	B.Harvey@unsw.edu.au	No appointment needed. Walk in or email.	CE 207	02 9385 4178

Lecturers

Name	Email	Availability	Location	Phone
Samsung Lim	S.Lim@unsw.edu.au			

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

Principles of survey calculations. Radiation, intersection, resection, and trilateration calculations. Traversing: fieldwork, calculations, error detection and adjustment. Detail surveys with engineering surveying CAD software: data transfer with survey instruments, plan editing, and contouring from a digital terrain model. Cadastral calculations. Land Subdivisions in CAD. Design and computation of horizontal and vertical curves for roads, rail and pipelines in CAD.

Course Aims

Calculations and plan drawing are a traditional part of surveyors' work and many fields of surveying involve data collection, calculations and presentation of results using computers. Using computer aided drafting (CAD) (e.g. Magnet Office CAD and Civil3D CAD) software to process surveying data for design and plan production purposes is an important and essential skill for surveying and geospatial engineering graduates. This course introduces surveying/civil CAD packages commonly used in engineering surveying. Instructions are given in data entry, data reduction, graphics and attributes editing, contouring and plan drawing for detail survey, subdivision and road design. The aim of this course is **not** to acquire a vast knowledge of all the options/steps available in Magnet Office CAD, nor is it to remember all the equations used in plane survey computations. The aim of the course is to enable students to solve plane survey computation problems and to be able to learn to use any of the currently available surveying CAD packages or those developed in the future.

At UNSW we currently teach using the Magnet Office CAD software. There are a few, mostly historical, reasons for the use of this package. We aim to make students aware of some features of a generic/representative CAD package, and to gain some experience. Further training can often be obtained during students work experience, e.g. summer employment. The lab exercises and assessment tasks in this course use Magnet Office CAD.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Be able to solve calculation problems using a variety of approaches and computing resources including manual calculation, calculators, spreadsheets (MS Excel or open source equivalents) and CAD software with surveying modules.	PE1.1, PE1.2, PE1.3, PE2.1
2. Be able to produce surveying, road design and subdivision drawings/plans using Magnet Office software package.	PE1.3, PE1.5, PE2.2
3. Ability to function effectively as an individual and in multicultural teams, as a team leader or manager as well as an effective team member.	PE1.3, PE3.1, PE3.2, PE3.5, PE3.6

Teaching Strategies

Lectures will be delivered face to face (F2F) and via BlackBoard Collaborate Ultra (BBCU) software. A link to each class will be provided in Moodle. The teaching will include 2 + 1 hour lectures and 3 hours of guided / instructed practice in the Computer Lab.

Two major field practical exercises and an educational bushwalk are included in the course so that students can better understand the full process from data collection to data analysis and final presentation, i.e. "field-to-finish". Thus students do calculations of their own data, not always using text book supplied data.

Lectures recordings are not intended to be a substitute for class attendance, but may be useful for students who cannot avoid missing a class and for those who attend the class but want to rehear part of it to aid their understanding. Our computer labs will not be recorded to protect the privacy of students who share their work when seeking staff assistance.

We typically have small classes so the lecturer will also attend tutorial, laboratory and field classes related to that topic. Many of the lectures will include tutorial style discussions interspersed with traditional PowerPoint based lecturing. Generally pdf files of the lecture slides will be available on the class Moodle web site.

A significant effort is being made to improve the CAD part of the course.

Suggested Learning Methods (as described to students in the course outline):

This is a practical course, the more practice and experience you get the better you will understand the topic, and the faster you will be able to solve problems. We suggest you spend some of your 5-6 hours per week study time (in addition to class time) using a computer in the lab as well as applying the usual study methods. There will be a lot of practical surveying data calculations and map editing work in the lab exercises. In the CAD component of the course we will have an instructed practice following each lecture to lead you go through the CAD software package.

It is strongly recommended that students: attend all classes; do not get too far behind with the lab work; and ask for help if you need it. It is not necessary to take detailed notes in lectures. However, it is important to complete all the lab tasks and to keep up to date. Also feel free to work independently - read references and try to solve problems yourself, do not just sit in class and follow the leader.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Final Exam	45%	set by UNSW	2
2. Mid-term Test	25%	21/06/2022 12:00 PM	1
3. Field Practicals	12%	Group report for loop traverse prac 1 is due on or before 4pm Mon Week 7. Group report for MGA traverse prac 2 is due on or before 4pm Fri week 8. The bushwalk field exercise is submitted at the end of the bushwalk.	3
4. Computer lab tasks	18%	Not Applicable	1, 2

Assessment 1: Final Exam

Start date: set by UNSW
Assessment length: 2 hour + reading and submission time
Due date: set by UNSW
Marks returned: Via formal UNSW course results

The Final exam will be in the exam period and will be conducted in a computer lab, probably CE201. It will involve written questions on the exam paper plus use of software on a computer. A sample past paper will be supplied well before the exam. Large data sets are usually supplied to the students on computer files and CAD software is available and expected to be used in the exam. The test environment will be similar to the mid term test and there will be thorough invigilation by course coordinator.

Assessment criteria

The marking criteria will place a strong emphasis on the student's ability to use CAD. There will also be some questions on surveying computations that involve creative problem solving.

Marks are awarded for successful completion of each component of each question.

A sample 'past paper' will be supplied.

Assessment 2: Mid-term Test

Start date: 21/06/2022 10:00 AM
Assessment length: 110 minutes
Due date: 21/06/2022 12:00 PM
Marks returned: Within 2 weeks. Usually much sooner.

The topics are surveying computations part of the course not CAD. The test is conducted in the school's computer lab using the computers with limited specific access, and thorough invigilation by course coordinator. The test environment and conditions will be discussed with students well before the test.

Assessment criteria

The marking criteria will place a strong emphasis on correct answers for calculation style questions, so students will be advised in this course on how to provide independent checks for their work and sufficient time will be provided in the examination to do the check calculations.

There is usually a large range of marks in this test. Marks are awarded for correct answers and for proper checking.

Students who get high marks in this test have been well prepared for the test by practising the computer lab exercises and they have included independent checks by a second calculation method. They leave the test knowing they have got the calculation answers correct. They have coped well with time constraints and pressures of consequences of wrong answers – these are abilities that will serve them well in the workplace later.

Students who score mid-range in the test have answered the calculation questions with one method only (no second method as a check), or have done well on some topics but not on other topic / questions.

Students who score very low marks are usually poorly prepared. They have not done the lab questions or have simply read the textbook, lecture slides or worked solutions. The test does not require extensive memory skills – all the equations are given in the paper.

Additional details

The topics are surveying computations part of the course, not CAD.

Primarily we test whether you can do survey computations yourself in exam conditions. An important learning outcome is to be able to reliably check your calculations, so you know they are correct and not just hope they are correct. Students should be able to solve the following calculation problems using a variety of approaches and computing resources including manual calculation, calculators, spreadsheets (MS Excel or open-source equivalents): Bearing and Distance, Coordinates; Intersection and Trilateration; Resection; Traverse Adjustment Calculations; and Missing Data Problems. Also, the test links to attributes: an in-depth engagement with relevant disciplinary knowledge; and the capacity for analytical and critical thinking.

Assessment 3: Field Practicals

Start date: Various - see course timetable below
Assessment length: Usually about 4 hours each
Due date: Group report for loop traverse prac 1 is due on or before 4pm Mon Week 7. Group report for MGA traverse prac 2 is due on or before 4pm Fri week 8. The bushwalk field exercise is submitted at the end of the bushwalk.
Marks returned: Usually within 1 week of submission.

Field practicals are included in this course so that you experience survey computations with your own real data with all its nuances, not just text book data. There are two Field Practicals worth 5 marks each and an educational bushwalk related to surveying skills worth 2 marks. They are group work. Most

practicals will be done in groups of 4 students.

Assessment criteria

Marking scheme:

Pass, OK: Completed fieldwork, submitted a report on time, with plagiarism statement, which presented your results.

Better: as above, plus the report included evidence of independent checks of the calculations and is well written

Best: as above, plus a plan of the surveys and the report included thoughtful comments and discussion of the possible error sources involved, how the survey could be improved if a similar task was done in future, and any other interesting aspects of the task.

If a student participates in the field work but does not make a significant contribution to the report then that student gets the mark for the field component only.

Additional details

The practical exercises form an important part of the subject. A good deal of time and care has gone into the organisation of these classes to ensure that you get the maximum benefit. It is important that each student understands the field process and participates in all aspects of the fieldwork.

Assessment 4: Computer lab tasks

Assessment length: NA
Marks returned: Moodle quizzes give marks directly upon submission. CAD plans are usually marked within 1 week of submission.

The computer lab tasks in this course for the computations part of the course will be delivered, managed and assessed via Moodle quizzes and auditing. These Moodle quizzes total 6 marks for the course. Using Moodle to administer the tasks will enable students to see their progress and to work on the tasks at a pace that suits them. The requirements for lab work are given in the Moodle quizzes and assistance is available in the textbook files. Students are urged to manage their workload and make regular submissions during term.

For the CAD part of the course students will submit their plans. The CAD labs total 12 marks for the course.

It is possible for students to do the computer lab tasks in blended/hybrid learning mode, but assistance from the teacher is usually better in on campus lab mode.

Assessment criteria

See description notes above.

Our aim is to assist students as they work with their plans so that they can complete them successfully with full marks.

Attendance Requirements

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

Course Schedule

Provisional course schedule. BRH = Dr Bruce Harvey, SL = AProf Sumsung Lim

Week	Fieldwork Mon 9am	Monday Lecture 3-5pm CE101 hybrid	Tue Computer Lab CE201 10am-1pm	Tue Lec CE G1 or CE201 4-5pm
1 30th May		Intro to Course. Principles of Calculation. Revision of survey calculations. BRH	**Lec** 10-11: Intersection calculations Lab: Revision of year 1 calculations. BRH	Lab CE201: Intersection calculations. BRH
2		Resection. Loop Close “Missing Data” Problems. BRH	Lab: Resection: graphical & numerical. Missing Data Problems BRH	Lec CEG1: Traverse Field Method BRH
3		**Public Holiday**	**Lec** 10-11: Traverse Adjustment Calcs. Blunder detection. BRH Lab: Electronic “Field to Finish” Detail Survey. Magnet Office and Sokkia BRH	Lec CEG1: Developing 2D - 3D Spatial Skills, Visualisation. BRH
4	Traverse loop fieldwork BRH	Revision. BRH	**MID TERM TEST CE201** BRH Lab CE201. Missing Data Problems. BRH	Lab CE201. Missing Data Problems. Traverse Calculations BRH
5	Sunday 10am – 2pm Bushwalk – navigation and mapping skills BRH	Cartography. Intro to digital mapping. Terrain modelling, contouring, and break-line in CAD. SL	**CAD Lab 1** – Familiarise with Magnet Office (MO). Feature point survey, entry of codes SL	Lec CEG1: CAD, Map editing, feature coding. Detail Surveys & CAD SL
6		No classes this week		

7	Traverse MGA fieldwork BRH	Plan Editing, text annotation. Data types and subdivision in MO. SL	**CAD Lab 2** – MO setup, plan editing, terrain modelling, annotation SL	Lec CEG1: CoGo in CAD Lab: CoGo questions. BRH
8		Cadastral calculations: areas, rural roads, subdivisions (not CAD), PO comparison. Traditional Road Curve Calculations. BRH	**CAD Lab 3** - subdivision parcel design. SL	Lab CE201: Cadastral calculations BRH
9		Road design in MO, alignment, cross section, long section, volume calculations. Autodesk Civil3D intro to electronic detail survey, road design and parcel design SL	**CAD Lab 4** - Road design - centreline alignment, cross section, and long section and volume calculation SL	Lab CE201: CAD lab 4 SL
10		Problem solving. Future of survey computations. Course summary BRH	**CAD Lab 5** - Survey plan editing, road design and parcel design using Civil3D SL	Lab CE201: “Horner’s” problems BRH

View class timetable

Timetable

Date	Type	Content
Week 4: 20 June - 24 June	Assessment	Mid-term Test

Resources

Prescribed Resources

Lecture Material The lecture slides are available for download as pdf files at the course website: **http://moodle.telt.unsw.edu.au** Monitor the site during term because it will be updated regularly. The website material is only for use by students enrolled in this course.

Textbook A textbook has been written specifically for this course mostly by the course convenor. It is available in pdf form on the class website - free. The contents of the book change as the software and instruments change, and as the lecturer learns better ways to communicate the material. If you want a paper copy you organise that yourself, but note that some pages may change during term.

Computational Aids Students are expected to have a calculator. Students may use any calculator they wish in this course, however in examinations they may not use pre-programmed calculators with, for example, close or resection programs. Computer software relevant to this course is available in the School's computer lab. We will use MS Excel spreadsheets in the lab; students who do not have that software on their home computers will be advised on how to get free open source equivalent software and how to use it. We will use CAD software that is installed in our labs. Magnet Office CAD software is too expensive for most students to buy so we will show you have to install an educational version at no cost.

Course Evaluation and Development

Feedback from the students via the myExperience process and from discussions in class and on campus outside class time. In previous years the ratings of all aspects of the course were very high, well above School and Faculty averages. The written comments were very positive and pleasing. There were not many suggestions for improvements though, in 2021, there were some comments about the challenges of studying fully online without students and staff "in the room" to help learn and motivate.

Laboratory Workshop Information

Details about installing Magnet office will be supplied on the class Moodle site.

Dear Student, If you have read all the way to here, then you have done well. I apologise for making it such a long document. 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. Here is a summary of this document. It is a good course. It is worthwhile to put considerable time and effort into learning this course. If you do well in this course then, in your future career, your boss and your clients will be able to rely on your results. So attend all classes, and do the exercises. I will be with you in lectures, in the computer lab, in the field, by email, and you can visit my office for help. Let us get on with the learning :-).

Bruce.

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 T2 2022 will be held online between 12th - 25th August 2022 inclusive, and supplementary exams between 5th - 9th September 2022 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
- Book an Academic Advising session: https://app.acuityscheduling.com/schedule.php?owner=19024765

Disclaimer

This course outline sets out 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 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 (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

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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	✓