GMAT2500 SURVEYING COMPUTATIONS A

Semester 1, 2016

Never Stand Still | Faculty of Engineering | School of Civil and Environmental Engineering

COURSE DETAILS

Units of Credit	6
Contact hours	5 hours per week
Lecture Class	Tuesday: 2:00pm – 4:00pm Room: Mathews 102
Computer Lab	Wednesday, 3:00pm – 6:00pm Room: CE201
Course Coordinator and Lecturer	A/Professor Jinling Wang (JLW) email: **Jinling.Wang@unsw.edu.au** office: CE413 phone: 9385 4203
Lecturer	Dr Yincai Zhou (YZ) email: Y.Zhou@unsw.edu.au office: CE205 phone: 9385 5252

COURSE PROGRAM SEMESTER 1, 2016

Changes will be notified in class and on the class Moodle web site. Lecturer's initials included.

Week	Date	Lecture Topic-Tuesday	Lab Topic-Wednesday	Assignment Due
1	29 February	Introduction to Course. Principles of Calculation. Revision of Trig, Coord./Bearing/Dis calcs. JLW		
2	7 Mar	Intersection and Resection. JLW	Intersection. Resection: graphical & numerical. JLW	
3	14 Mar	Loop Close "Missing Data" Problems. Traverse Method. JLW	Prac: EDM Loop Traverse, Quad. Lab: Missing Data Problems. JLW & YZ	
4	21 Mar	Traverse Adjustment Calculations. Bowditch. Blunder detection. JLW	Prac: MGA Closed Line Traverse, Willis St. JLW & YZ	EDM Prac 1 due Wednesday
Break				
5	4 Apr	CivilCAD program setup, feature coding and data types. YZ	Familiarise with CivilCAD YZ	
6	11 April	Traverse Calculations. JLW Revision. JLW	**MID SESSION TEST in lab. YZ**	MGA Prac 2 due Tuesday
7	18 Apr	Survey plan drawing & editing, terrain modelling and text annotation. YZ	Lab prac: Sokkia Total Station data collection for detail survey, entry of codes for CivilCAD, electronic recording. YZ	
8	25 Apr	Autodesk Civil3D for Surveyors. YZ	CivilCAD, Manual and downloaded data entry, data editing and plan drawing, Terrain Modelling. YZ	
9	2 May	Cadastral calculations: areas, rural roads, subdivisions (not in CAD), PO comparison. JLW	Cadastral calculations. Road Centreline Calculations JLW	Detail Plan due Wed
10	9 May	Subdivision in CivilCAD and Road Curve Calculation (not in CAD). YZ	Subdivision drawings using COGO functions & subdivision design with use of Insert, COGO & Survey functions. YZ	
11	16 May	Road design in CivilCAD: alignment, cross section, long section and volume calculations. YZ	CivilCAD Road exercises: alignments, cross sections, long sections. 3D views YZ	Subdivision Plan due Wed
12	23 May	Problem solving. Revision. Future of survey computations. JLW	Problem solving "Horner's" problems Typical "past" Final Exam paper JLW	Road Plans due Wed
13	30 May	No class	Finalise lab and lab exercises. YZ	

INFORMATION ABOUT THE COURSE

This course builds on previous surveying calculation courses in first year, especially GMAT1110. You should have already passed or been exempt from that course. If you have not attempted GMAT1110 or attempted it but failed, then you should contact the course convenor. The course also builds on MS Excel knowledge and skills learnt in ENGG1811. Most of the topics in this course are useful for future survey courses: GMAT- 2550, 3150, 4150, 4400, and 4450. There is also a connection to GMAT2120 that many students study at the same time as this course. You can use the data from one of the practical classes in GMAT2120 to practice resection calculations that are taught in this course.

HANDBOOK DESCRIPTION

See link to virtual handbook: **www.handbook.unsw.edu.au/undergraduate/courses/2016/GMAT2500.html**

ASSESSMENT

Assessment criteria and methods used will be discussed in class, including reasons for the educational approach taken. We have small class sizes so we have considerable flexibility with assessment methods. For example tests can be conducted in our computer lab with all students present at one time. Computers used in tests will not have network or email access. Students can get more on assessment content, criteria, and mode via class discussions or discussions with the course convenor.

Proposed assessment for the course includes:

- Mid-session test 30% week 6
- Lab and Prac work 30% 2 Pracs 6 ea, 2 CAD labs 5 ea, else Σ= 8
- Final Exam 40% In formal exam period

Any changes to the above assessment details will be notified in class and on the class web site. After each test a list will be available giving the marks obtained by each student. Each student will be given individual and detailed feedback on their exam paper soon after the exam has been marked by visiting the office of the course convenor. Further details of assessment and exam rooms will be given in classes, if in doubt contact the lecturer.

Demonstrate all your computer **Lab exercise** programs to a supervisor for comments and marking. You are allowed to help each other learn in lab classes but are not allowed to blindly copy someone else's work. You may be asked to demonstrate and explain the work you have done in the computer lab classes. The requirements for lab work are given in the lecture and textbook files. Students are urged to manage their workload and make regular submissions during session.

The lab work will be marked in the student's presence by viewing the students' notes or computer screens and immediate feedback will be given. There is no need to rewrite the work or to submit formal well written reports. Generally the work will not be collected or be examined in detail unless a student has had difficulties getting correct or good quality output. Generally, lab marks will be assigned using a mastery scheme, i.e. if the work is acceptable it will get full marks if it is not acceptable it will get zero marks, students can resubmit in this case.

The field work reports, and computer lab exercises (except those in weeks 12 and 13), should be submitted for marking within one week of when they are covered in class. For example the week 3 exercises are due in the lab class in week 4. If in doubt contact the lecturer. All work must be completed by the end of week 13. The two practicals are worth 6 marks each and the CivilCAD labs on subdivision and road design are worth 5 marks each. The other labs are worth a total of 8 marks. This component of the assessment also includes students' contributions to the class text book such as worked examples.

The **Mid session test** will be conducted in CE201 computer lab. It will involve written questions on the exam paper. A sample 'past paper' will be supplied well before the exam. 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.

The **Final exam** will be in the exam period and will be conducted in a computer lab. 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.

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.

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The formal exam scripts will not be returned. Students who perform poorly in the mid-session test are recommended to discuss progress with the lecturer during the semester.

OBJECTIVES

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. Computers make our work easier and usually better quality.

Using computer aided drafting (e.g. CivilCAD and AutoCAD) software to process surveying data for design and plan production purposes is an important and essential skill for surveying 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 CivilCAD 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.

This course provides an environment that fosters in our students the following attributes, those not covered in this course are dealt with in other courses in your program:

the skills involved in scholarly enquiry	Significant. For example, you will learn “how to learn” a software package that is new to you.
an in-depth engagement with relevant disciplinary knowledge in its interdisciplinary context	Significant, at the level of competence with survey calculations and CAD that would enable summer employment in this field
the capacity for analytical and critical thinking and for creative problem solving	Significant. You are especially encouraged to find more than one way to solve the problems and ways to check or know that our answers are correct or valid.
the ability to engage in independent and reflective learning	Optional. There is opportunity for students to learn more about the CAD software, to try alternative solutions to those presented in class, to read ahead through the text book, or to write their own computer programs for some of the tasks.
the skills to locate, evaluate and use relevant information (Information Literacy)	Minor. Study the textbook provided and explore the software options and its own Help.
the capacity for enterprise, initiative and creativity	Significant – find alternative solution methods to some challenging problems.
an appreciation of and respect for, diversity	Some group fieldwork where you may not succeed if you do not appreciate and respect the abilities and opinions of your team members.
a capacity to contribute to, and work within, the international community	You might be part of a group doing fieldwork with students who come from other parts of the world.
the skills required for collaborative and multidisciplinary work	The field practical exercises will be done as group work. Importantly note that the exercises cannot physically be done by one person “doing all the work”, so quality results depend on good collaboration
an appreciation of, and a responsiveness to, change	Significant. You will not pass this course if you are not willing to learn new techniques and new software.
a respect for ethical practice and social responsibility	Important. For example, it will be stressed that you are able to know you are giving a client correct answers to calculation and measurement tasks and not simply “hoping” your answers are correct.
the skills of effective communication	Some group work – field practicals, which require communication amongst the group while doing the fieldwork and reports.

Former students have asked the course coordinator to keep the course profile as short as possible, others want details. However, UNSW does require detailed discussions of educational aspects. Be assured that personally the course convenor and the other lecturers do treat the educational aspects as very important and spend considerable effort designing and improving the course. So in order to keep this document short, the aims objectives goals expectations and outcomes of the various class topics and assessment tasks will be discussed in class and/or within the individual documents for the assignments, lecture notes etc. An advantage of our small class enrolment is that each individual student can have many one to one discussions with the course convenor in his office or by phone or email. These discussions can be at the level of for example “why are we learning this topic” to the level of “I get the wrong answer or I don’t know how to do the calculations for this question, please help me”.

In 2015 two lecturers are involved. The individual lecturers will be introduced with their backgrounds etc in class. The course convenor has taught the entire course in some previous years.

Feedback from the students via the CATEI process. In previous years the ratings of all 10 CATEI questions were very high, well above School and Faculty averages. The written comments were all very positive and pleasing. There weren't many suggestions for improvements. Based on previous year's student comments in CATEI we added worked solutions for the text book problems. But I still wish to encourage students to think and try to solve the problems themselves and avoid the act of simply reading a solution. Reading a solution without attempting your own solution first can lead you into a false confidence.

TEACHING STRATEGIES

The teaching will include 2 hour lectures and 3 hours of guided / instructed practice in the school's Computer Lab. There is a long history of teaching the computations and the CAD topics in our school.

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

We have a small class enrolled so the lecturer of a topic will also attend all computer laboratory and field classes related to that topic. Some of the lectures will include discussions interspersed with traditional PowerPoint based lecturing. Generally pdf files of the lecture slides will be available on the class web site before the lectures. However some of the lecturers like to change the content slightly during the lecture in response to student learning at the time. Sometimes questions are asked in the lecture to promote student involvement in the learning – in these cases the pdf files available before the lecture may not reveal the 'answers' to the questions. After the lectures new versions will be uploaded to the class web site. Students are asked to consider the environment before printing files onto paper.

A significant effort is being made to improve the CAD part of the course. The lab questions are now less detailed and should lead to more understanding of the process. In earlier years teachers have given 'hundreds' of step by step instructions for some exercises. Whilst this does make the students more productive, the concentration on miniature matters can lead to lack of confidence and understanding.

Each year we will change the contents and teaching methods of this course based on student's performance at assessment and their feedback.

Suggested Learning Methods

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 hours per week study time (in addition to class time) using a computer in the lab as well as the usual study methods. There will be a lot of practical surveying data calculations and map editing work in lab exercises. In the CAD section we will have an instructed practice following each lecture to lead you go through a CAD software package.

The workload is reasonable constant during the session and starts at a considerable rate in the first week to revise material learnt in previous courses. Intentionally, there are no extremely heavy loaded weeks or easy weeks after that.

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.

EXPECTED LEARNING OUTCOMES

At UNSW we currently teach CAD with CivilCAD. There are a few, mostly historical, reasons for the use of CivilCAD. We don't have to have the best software, and how do you define that anyway? We do not have time to teach more than one package and we do not try to teach all aspects of the software. We aim to make students aware of some features of CAD 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 will use CivilCAD. Students who already have experience and access to other CAD software may use it, but staff may not be able to assist with specific technical and debugging style questions.

By the end of this course 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) and CAD software with surveying modules:

- Bearing and Distance, Coordinates
- Intersection and Trilateration

- Resection
- Traverse Adjustment Calculations
- Missing Data Problems
- Road Intersections
- Subdivision calculations
- More complex road calculations
- Theodolite, level, GPS.

You will also have some experience with upload and download of Survey Instrument data to computers.

By the end of this course students should be able to produce surveying, road design and subdivision drawings/plans using CivilCAD software package including:

- Import and edit surveying data: manually booked and electronic downloads from Total Stations
- Traverse data entry, reduction and adjustment
- Draw detail survey plans with contours using DTM/TIN methods
- Perform surveying plan editing and plotting including annotation
- Subdivision calculations and prepare subdivision plans
- Road alignment, cross sections extraction and level book data entry
- Perform basic road design principles including template design, and long and cross section plotting.

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

RELEVANT 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 session because it will be updated regularly. The website material is only for use by students enrolled in this course.

Text Book

A text book has been written specifically for this course by the main lecturer. It is available in pdf form on the class website. 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 session.

Computational Aids

A computer based Calculator application program specially written for surveying calculations will be provided to students in our lab and on the class website. 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 CivilCAD version 7 software in our labs. CivilCAD software is too expensive for most students to buy, but we do have a ways that copies of the software that can be borrowed by students for home use if required, contact Dr Zhou. We may also be able to provide free educational versions of another CAD software for students to use and explore at home. 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.

Additional materials are provided on Moodle.

DATES TO NOTE

Refer to MyUNSW for Important Dates available at: **https://student.unsw.edu.au/dates**

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

All practical reports should be submitted with a signed Plagiarism / Assessment Cover Sheet, e.g.

I/We declare that this assessment item is my/our own work, except where acknowledged, and has not been submitted for academic credit elsewhere, and acknowledge that the assessor of this item may, for the purpose of assessing this item:

Reproduce this assessment item and provide a copy to another member of the University; and/or,

Communicate a copy of this assessment item to a plagiarism checking service (which may then retain a copy of the assessment item on its database for the purpose of future plagiarism checking).

I certify that I have read and understood the University Rules in respect of Student Academic Misconduct.

Signed: .....date: ☐☐ ☐☐ ☐☐

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ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism,
- School policy on Supplementary exams,
- Special Considerations,
- Solutions to Administrative Problems,
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- SURVSOC and CEVSOC.

Refer to Academic Advice on the School website available at:
http://www.engineering.unsw.edu.au/civil-engineering/resources/academic-advice