THE UNIVERSITY OF NEW SOUTH WALES
SYDNEY · 2052 · AUSTRALIA

SCHOOL OF SURVEYING & SPATIAL INFORMATION SYSTEMS

GMAT 2700

Geometry of Coordinate Reference Systems

Course Outline – Session 1, 2009

Version: 18/2/2009

This document, and other material, is available at the Course Website:
http://www.gmat.unsw.edu.au/wang/gmat2700/home.htm

(User name and password supplied in class)

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1. Staff involved in the Course and their Contact Details

1.1 Lecturer(s): Dr. Jinling Wang

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Email: Jinling.Wang@unsw.edu.au
Phone: 9385 4203

1.2 Practical/Computing Supervisor: Mr Nathan Knight

Contact details:
Office: EE402 (Whenever present, you may just drop in)
Phone: 9385 4185
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Advisor for the Sun Tracking Assignment: Assoc. Prof. AHW Kearsley (WK)

Contact Details:
Office: EE421 (Available Tuesdays)
Phone: 9385 4188
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1.3 Staff absences during session:

N/A

2. Educational Aspects of the Course

2.1 How this course relates to others in the program

This 6 UoC course is one of the core subjects in the undergraduate program (3741). It is based on the first year course GMAT1110. This course introduces several fundamental concepts in surveying, geodesy, spatial information systems, which will be used in forthcoming courses during your studies, such as GMAT3700, 3600, 4900, 4910 and 9211.

2.2 Aims of the Course

This course aims to introduce you to:

(a) the basic concepts of geodesy;
(b) the reference and coordinate systems fundamental to geo-positioning in both the global and regional context; and
(c) the map projections and their applications.

2.3 Learning Outcomes

By the end of this session you should be able to:

(a) Explain the definition of geodesy and its major tasks;
(b) Understand the basic concepts of the reference and coordinate systems;
(c) Implement the practical procedures of the transformation between the coordinate systems;
(d) Describe the purposes and methods of map projections;
(e) Transform terrestrial observations onto the projection plane;
(f) Identify the geodetic reference frames (datums) and map projection systems used in practice in Australia (and in the state of New South Wales in particular).

2.4 Teaching Strategies

A variety of teaching activities will be conducted to achieve optimal teaching and learning outcomes. Major teaching activities in this course are:

1) Regular lectures;
2) Tutorials and computing tasks;
3) Sun tracking assignment;
4) Regular quizzes, and discussions on the questions from the quizzes;
5) Essay writing;
6) Class discussions.

2.5 Suggested Learning Methods

The most important factors in learning are students' commitment and learning methods. You are encouraged to attend all the lectures and other teaching activities. In addition, relevant resources on the web (visit the course website for details) are of great help in understanding the basic concepts discussed in the lectures and the trends in the discipline of surveying and spatial information systems. Due the nature of the course, the course materials are more theoretical than other courses in the program. *Linking the abstract concepts to the real world applications will improve your learning outcomes.*

Based on some studies by John Biggs, most active students in the class do not just listen, see, collect notes and take notes, but most importantly, they will *"express understanding; raise issues, speculate, solve problems, discuss, answer questions and reflect"*.

Students are strongly encouraged to attend all the lectures and do sufficient preparation for class discussions on selected topics.

2.6 UNSW Graduate Attributes

This course provides an environment that fosters in our students the following attributes:

the skills involved in scholarly enquiry	Significant
an in-depth engagement with relevant disciplinary knowledge in its interdisciplinary context	Significant
the capacity for analytical and critical thinking and for creative problem solving	Significant
the ability to engage in independent and reflective learning	Some
the skills to locate, evaluate and use relevant information (Information Literacy)	Some
the capacity for enterprise, initiative and creativity	Minimal
an appreciation of and respect for, diversity	
a capacity to contribute to, and work within, the international community	Minimal
the skills required for collaborative and multidisciplinary work	
an appreciation of, and a responsiveness to, change	Some
a respect for ethical practice and social responsibility	

2.7 Course Evaluation and Development

The University has implemented a former procedure to collect your feedback on the course through the Course and Teaching Evaluation and Improvement (CATEI) Process.

Feedbacks from previous years have been considered in the course design in this session. For example, based on the suggestions from S1 2008, the planned improvements for S1 2009 are: 1) the timing of quizzes will be given to the class; 2) more visual aids are used to explain the concepts.

To achieve the optimal teaching and learning outcomes, your feedback on the course and the teaching activities will be periodically gathered during the session, using various means. All the constructive suggestions will be carefully considered during the teaching activities.

3. Proposed Course Schedule

(The time slots for invited lectures/visiting Sydney Observatory as well as any other changes will be notified in the class and at the course website).

Week No. (Start Date)	Monday- Lecture 10am-12pm ASBus 119	Wednesday - Lecture 11am – 1pm ASBus 119	Wednesday -Tutorial 2pm -3pm EE401A
1 (9/3)	Course outline, Introduction to Geodesy, Discussions	Geodesy and Earth Motion	Tutorial: Introduction to Matlab (Sun Tracking Assignment)
2 (16/3)	Concepts of Reference Systems	Transforming Coordinates	Tutorial: Coordinate Transformation
3 (23/3)	Reference Systems in Geodesy and Astronomy	Earth-fixed Coordinates	Essay Task
4 (30/3)	Earth's Gravity Field	Geoid and Gravity Models	Tutorial: Gravity (Sun tracking review)
5 (6/4)	Time Systems	Terrestrial Positioning	Tutorial: Web Resources on reference frames**/Sun Tracking Report I due**
(10/4-19/4)	**Mid-Session Break**	**Mid-Session Break**	**Mid-Session Break**
6 (20/4)	Horizontal Geodetic Datums	Datum Heights and Vertical Datums	Tutorial: Geodetic Datums
7 (27/4)	Image coordinates and transformations	Spherical trigonometry and its applications	Tutorial: Computations with spherical trigonometry.
8 (4/5)	Overview of Map Projections Geometry of Ellipsoid	Reduction of Observations onto a reference Ellipsoid	Tutorial: Computing Radii of Curvatures
9 (11/5)	Computations on the Ellipsoid	Map Projections: Concepts and Classifications	Tutorial: Direct/inverse solutions (Sun tracking review)
10 (18/5)	Basic Map Projection Theory	Transversal Mercator Projection	Tutorial: Coordinate Transformation between GDA-MGA
11 (25/5)	Grid Computation 1/2;	Lambert Conformal Conic Projection	Tutorial: Grid computations **Sun Tracking report II Due**
12 (1/6)	Class discussions	Class Discussions	Revision

4. Assessment in the Course

Assessment for the course includes:

- Essay task 15% (due week 8)
- Mini-quizzes during lectures 10%
- Tutorial submissions 15%
- Sun tracking assignment 10% (due week 5/11)
- Class discussion/participation 15%
- Final exam 35% (during the formal exam period)

***Minin-Quizzes**:*
To reinforce the learning experience, mini-quizzes will be given during the lectures. Simple questions will be asked on the material presented in the PREVIOUS lecturing period.

***Class Discussions/Participation**:*
Students should regularly attend the lectures and participate in class discussions during the lectures. In addition, students are invited to give a short presentation to the class workshop in week 12. The attendance at the scheduled classes is necessary to achieve a satisfactory learning outcome from this course. (***Marks are evenly given to participation, Presentation Slides and Discussions)***

Sun Tracking Assignment, **Essay Task** and **Tutorial Exercises** will be documented separately and distributed to you during the lectures and tutorial sessions. *Any changes to the above assessment arrangement will be notified in the class and will also be updated at the course website*. ***All the marking schedules will be explained to the class.***

Final Exam will be in 'closed book' format, but the 'complicated' formulae to be used in the exam will be provided in the examination paper.

All assignments and assessment items should be submitted with a signed Assessment Cover Sheet:

I declare that this assessment item is my 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: ☐☐ ☐☐ ☐☐

5. Course Resources

5.1 Lecture Material (check the course website):

http://www.gmat.unsw.edu.au/wang/gmat2700/home.htm

The Powerpoint lecture slides are available for download as PDF files at the course website.
Electronic resources on the lecture topics are available at the course website.

5.2 Text and Reference Books

Hooijberg, M. (2008) Geometrical geodesy: Using information and computer technology, Springer.
Torge, W. (2001) Geodesy, 3rd Edition, de Gruyter, Berlin.
Stolz, A (2001) An Introduction to Geodesy, Monograph 16, School of Surveying & SIS, UNSW.
Mather, R.S (1972) The Theory and Geodetic Use of Some Common Projections, Monograph 1, School of Surveying & SIS, UNSW, 1972.

The class notes, latest journal articles and references will be referred to or distributed during the lectures.

5.3 Computational Aids

Pocket calculators are required during lectures and tutorials in this course. They have to be hand-held, internally powered and silent.

Pocket calculators for examinations in this course are provided by the University (CASIO fx-911W). Some hints about the use of the CASIO fx-911W for surveying computations may be found at the course website.

Computer software relevant to this course and available in the School's computer lab EE401a, includes: Matlab.

6. Administrative Matters

6.1 Expected work load

At UNSW, the normal workload expectations of a student are 24-28 hours per session for each unit of credit, including class contact hours, preparation and time spent on all assessable work.

To assist students with the organisation of their studies, the expected workloads of the various components of the course are listed below. It is strongly suggested that students use the listed hours to plan their work during session.

Lectures (22 x 2hr)	44hr
Tutorials (10x1hr)	10hr
Class discussions (4hr)	4hr
Sun Tracking Assignment	16hr
Preparation of tutorial/essay reports	22hr
Revision of Lectures, background reading (approximately 5hr x 12wk)	60hr
Total	156hr

6.2 Rules

Students should read the University Calendar or Student Guide for details of University Rules and special considerations.

Students are reminded that the University regards academic misconduct as a very serious matter. Unauthorised material must not be taken into a test or examination. The penalty for any suspected academic misconduct ranges from zero mark for the assignment or exam involved, through failure of the subject, to expulsion from the University. If absent from an examination, class test or practical, students must submit written documentation to the University, via the Student Centre in the Chancellery.

All assignments or practical reports are compulsory parts of the course and must be handed in by the due date. A mark of zero will be given for any submission which violates this rule. OR **The marks for late submissions will be reduced as follows:** -20% (of the maximum mark) for up to 24 hours after the scheduled submission time, then -10% (of the maximum mark) for each additional 24 hour period late. (For example, a student submitting a report/assignment 4 days late has his/her mark reduced by 4 if the maximum mark of the submission is 10.). Any late submission must be made before solutions are issued to the class.

If a student is unable to submit on time due to illness or other legitimate reason, then a brief written explanation must be given to the lecturer for consideration as soon as is feasible. In some cases the lecturer may grant an extension to the submission date provided he has been contacted before the due date.

Further assessment may be granted in this course at the lecturer's discretion. If further assessment is granted then performance in tutorials may be considered as well as an oral exam including use of a computer.

If students attend less than 80% of their possible classes they may be refused final assessment.

6.3 Plagiarism

Plagiarism is the presentation of the thoughts or work of another as one's own.*

Examples include:

- direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and,
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.

The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;

- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students 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 items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.
† Adapted with kind permission from the University of Melbourne.

The School's Plagiarism Statement can be found at:
http://www.gmat.unsw.edu.au/currentstudents/general/plagiarism.htm

6.4 Grievances

In the first instance all grievances should be discussed with the lecturer involved. If the problem cannot be resolved, students should contact the School's Grievance Officer in writing.

6.5 Rules for practical / field classes

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, water proof jackets, hats, sun cream, sturdy footwear (thongs or sandals are not acceptable), warm clothes, etc.

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 from the time that you spend and the equipment which is available. Most practicals will be done in groups of students, however the calculations and reports require individual work. 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 OHS matters at the briefings. If you have any questions or doubts about an OHS matter discuss it with your supervisor.

Students are required to read the supplied instructions well before the exercise is commenced.

ISSUING OF EQUIPMENT

During the issue of equipment, a large crowd around the store causes difficulties for everyone, so one group collects their equipment and the remaining groups should stand well back. A group is responsible for all equipment issued to it, with the student signing for the equipment as the representative.

1. *You should first inspect all equipment and make sure that it is in working order, otherwise you will be held responsible.* When returning equipment at the end of the field class, it should be handed back to the Stores Officer, piece by piece, so that he can check it off. Not until all your equipment has been returned and signed off, does your responsibility end.

2. ***It is not sufficient to leave the equipment near the store and depart.***

3. ***Any equipment lost or damaged will have to be paid for by the group.*** In the field, there is less danger of losing items if everything is laid close to an instrument box or in a group where pedestrians can safely bypass it.

INSTRUMENTS

The equipment used in surveying is sometimes delicate and often valuable (> $10,000). Please make sure that you take due care of the equipment and give some thought to the way in which you handle it. The staff member in charge of your class will give detailed instructions about its use. *Theodolites and electronic tacheometers*, have fragile optical mechanical and electronic components and are delicately adjusted. ***Shut instrument boxes immediately after removing/replacing the instrument.*** Carrying theodolites (on tripods) over the shoulder will not be tolerated in this School. Do not force any parts to move, check whether clamps are set, and do not over tighten clamps.

IN THE PUBLIC EYE

It is hoped that students taking part in surveying practicals on the campus will create a favourable impression on passers-by, **so behave like professionals**. The field classes give you an opportunity to handle interesting equipment and should be a welcome break from lectures. It is hoped you find them enjoyable as well as instructive.

Students should not normally leave the field work location during the practical sessions. However students leaving the field for short periods must ask another student to look after their equipment and must inform the student (and the supervisor, if present) of their time of return. No equipment is to be left unattended in the field at any time.

SUBMISSION OF REPORTS ON PRACTICAL WORK

Time: Reports may be submitted at any time prior to the due date. **Late submissions will not be marked**, unless accompanied by an appropriate reason. Reports should be submitted to your practical supervisor.

Contents of Reports: Your report should have a front/title page, then a summary of results page, then the rest of the report including computations and plans. Reports may consist of original field notes or a photocopy of the originals, but not rewritten field notes. The requirements for each practical will be discussed at the briefings before the practicals, if in doubt ask the supervisor. The front cover of all submissions should include: Course No. and Name, Group number and names of students in the group, Title of Exercise

Field Notes: All field notes must be recorded on proper field sheets available from the Store except for exercises where forms are supplied. On the first page of your notes for a particular exercise the following information should be given: Title of Exercise, Date, Names of students present in the group, Instrument number and Make of instruments used

Field notes should be written in neatly, not overcrowded and pencils are recommended. Use tabular form where possible and draw neat sketches or diagrams where applicable. You should include a locality sketch plan. Overwriting is not permissible in the field sheets and wrong figures or words should be crossed and the true one written above it and initialled by the booker whose name must appear at the top of each page.

At the end of the exercise **original field notes** should be presented to a supervisor for signature.

Computations: Computations must be done individually by every member of the group. The Group No., Name of a student, Date of exercise and Title of exercise should be shown. There is no need to show in the computation sheet all observed quantities as they are in the field notes. Tabular form must be used as much as possible. Formulae used must be shown, and symbols or letters used explained.