## SURV2230: Surveying Techniques and Computations

Callaghan Semester 2 - 2023



www.newcastle.edu.au CRICOS Provider 00109J

## **OVERVIEW**

**Course Description** 

This course introduces students to surveying techniques and necessary mathematical operations for the reduction of surveying field observations. It provides a basic introduction for error propagation and adjustment and presents various topics including coordinate system transformations, spherical trigonometry, cadastral survey computations, traverse adjustments, area calculations, as well as intersections and resections.

Assumed Knowledge SURV1200 Introduction to Surveying, SURV2210 Engineering Surveying

**Contact Hours** 

### Callaghan

Computer Lab

Face to Face On Campus 2 hour(s) per Week for 10 Weeks The above distribution of contact hours may alter on a weekly basis and will be confirmed by communications via Canvas.

#### **Field Study**

Face to Face On Campus 3 hour(s) per Week for 3 Weeks The above distribution of contact hours may alter on a weekly basis and will be confirmed by communications via Canvas.

#### Lecture

Face to Face On Campus 2 hour(s) per Week for Full Term The above distribution of contact hours may alter on a weekly basis and will be confirmed by communications via Canvas.

A preliminary timetable will be provided in the course outline handed to students in Week 1.

Unit Weighting Workload

#### 10

Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.



## CONTACTS

Course Coordinator

Callaghan Dr Mehdi Khaki Mehdi.Khaki@newcastle.edu.au (02) 4921 6626 Consultation: EA128

**Teaching Staff** 

**Staff** Other teaching staff will be advised on the course Canvas site.

**School Office** 

School of Engineering EAG02 EA Building Callaghan +61 2 4921 5798 9.00am-1.00pm and 2.00pm-5.00pm (Monday to Friday)

# **SYLLABUS**

| Course Content              | <ul> <li>Error propagation</li> <li>Introduction to least square adjustment</li> <li>Spherical trigonometry including a review of vector algebra</li> <li>Coordinate systems and coordinate transformations</li> <li>Intersection and resection</li> <li>Subdivisions of areas</li> <li>Road boundary intersections</li> </ul> |  |  |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| Course Learning<br>Outcomes | On successful completion of this course, students will be able to:<br>1. Perform a variety of surveying computations by commonly used procedures.                                                                                                                                                                              |  |  |
|                             | 2. Quantify surveying measurements errors.                                                                                                                                                                                                                                                                                     |  |  |
|                             | 3. Solve plane survey computational problems using a variety of approaches and computing resources.                                                                                                                                                                                                                            |  |  |
|                             | 4. Apply adjustments to the vertical and horizontal networks.                                                                                                                                                                                                                                                                  |  |  |
|                             | 5. Produce a subdivision plan.                                                                                                                                                                                                                                                                                                 |  |  |
| Course Materials            | <ul> <li>Lecture Materials:</li> <li>Course notes are available for downloading from Canvas.</li> </ul>                                                                                                                                                                                                                        |  |  |
|                             |                                                                                                                                                                                                                                                                                                                                |  |  |

### Recommended Text:

- Survey Computations, by Bruce Harvey, available on Canvas.



## SCHEDULE

| Week               | Week Begins | Торіс                                                    | Learning Activity             | Assessment Due           |
|--------------------|-------------|----------------------------------------------------------|-------------------------------|--------------------------|
| 1                  | 17 Jul      | Introduction and                                         | No lab                        |                          |
|                    |             | trigonometric levelling                                  |                               |                          |
| 2                  | 24 Jul      | Error Propagation                                        | Introduction and practice of  |                          |
|                    |             |                                                          | Microsoft Excel, coordinates, |                          |
|                    |             |                                                          | bearing and distance          |                          |
|                    |             |                                                          | calculations                  |                          |
| 3                  | 31 Jul      | Introduction to least square                             | Introduction and practice of  |                          |
|                    |             | adjustment                                               | Matlab for adjustment         |                          |
| 4                  | 7 Aug       | Least square adjustment -                                | Introduction and practice of  | In class quiz            |
|                    |             | observation equations                                    | Matlab for adjustment         |                          |
| 5                  | 14 Aug      | Coordinate systems, linear                               | Linear adjustment workshop    |                          |
|                    |             | coordinate transformation                                |                               |                          |
| 6                  | 21 Aug      | Traverse and network                                     | Field work (traversing),      | Linear adjustment        |
|                    |             | adjustment                                               | computations                  |                          |
| 7                  | 28 Aug      | Aug Intersections and resections Traversing computations |                               |                          |
| 8                  | 4 Sep       | Review of vector algebra,                                | Traversing computations       |                          |
|                    |             | spherical trigonometry                                   |                               |                          |
| 9                  | 11 Sep      | Areas and subdivision of                                 | LISCAD operations and         | Traverse Survey and      |
|                    |             | areas                                                    | computations                  | Calculations             |
| 10                 | 18 Sep      | Subdivision calculations                                 | Subdivision calculations and  |                          |
|                    |             |                                                          | plan workshop (LISCAD         |                          |
|                    |             |                                                          | operations)                   |                          |
| Mid Term Break     |             |                                                          |                               |                          |
| Mid Term Break     |             |                                                          |                               |                          |
| 11                 | 9 Oct       | Calculations for road                                    | Subdivision calculations and  | Subdivision Calculations |
|                    |             | intersections                                            | plan workshop (LISCAD         | and Plan                 |
|                    |             |                                                          | operations)                   |                          |
| 12                 | 16 Oct      | Review                                                   | Questions\answers             |                          |
| 13                 | 23 Oct      | No lecture                                               | No lab                        |                          |
| Examination Period |             |                                                          |                               |                          |
| Examination Period |             |                                                          |                               |                          |

# ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

|   | Assessment Name                     | Due Date                                                                  | Involvement | Weighting | Learning<br>Outcomes |
|---|-------------------------------------|---------------------------------------------------------------------------|-------------|-----------|----------------------|
| 1 | In Class Quiz                       | Week 4                                                                    | Individual  | 15%       | 1, 2                 |
| 2 | Linear Adjustment                   | Week 6                                                                    | Individual  | 20%       | 1, 2, 3              |
| 3 | Traverse Survey and<br>Calculations | Week 9. Subject to weather delays in completing the fieldwork components. | Individual  | 20%       | 1, 2, 3, 4           |
| 4 | Subdivision Calculations and Plan   | Week 11                                                                   | Individual  | 15%       | 1, 3, 5              |
| 5 | Formal Examination                  | To be notified.                                                           | Individual  | 30%       | 1, 2, 3, 4           |

### Late Submissions

The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.



### Assessment 1 - In Class Quiz

| Assessment Type     | In Term Test                                                                                                                                                              |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description         | This is to understand the fundamentals of the course and meet the course objectives. This is a 1-hour exam and covers the course content delivered between weeks 1 and 3. |
| Weighting           | 15%                                                                                                                                                                       |
| Length              | 1 hours                                                                                                                                                                   |
| Due Date            | Week 4                                                                                                                                                                    |
| Submission Method   | In Class                                                                                                                                                                  |
| Assessment Criteria |                                                                                                                                                                           |
| Return Method       | Online                                                                                                                                                                    |
| Feedback Provided   | Online - Within 2 weeks after the class exam.                                                                                                                             |

### Assessment 2 - Linear Adjustment

| Assessment Type     | Written Assignment                                                                                                                                                      |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description         | This assignment requires students to solve linear adjustment problems using different computational tools. Details will be provided in class and on course Canvas site. |
| Weighting           | 20%                                                                                                                                                                     |
| Due Date            | Week 6                                                                                                                                                                  |
| Submission Method   | Online                                                                                                                                                                  |
| Assessment Criteria | The assignment will be evaluated based on calculations, results, and the quality of report. Details will be provided on course Canvas site.                             |
| Return Method       | Online                                                                                                                                                                  |
| Feedback Provided   | Online General feedback will also be provided during formal course sessions.                                                                                            |

## **Assessment 3 - Traverse Survey and Calculations**

| Assessment Type     | Written Assignment                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description         | Students will perform a field survey by team work, from which the measurements will be submitted and used in assignment computations. Traverse and area calculations will be performed using Excel spreadsheets and Matlab for network adjustment. It is assessed on a combination of group field work and individual calculations. Details will be provided in class and on course Canvas site. |
| Weighting           | 20%                                                                                                                                                                                                                                                                                                                                                                                              |
| Due Date            | Week 9. Subject to weather delays in completing the fieldwork components.                                                                                                                                                                                                                                                                                                                        |
| Submission Method   | Online                                                                                                                                                                                                                                                                                                                                                                                           |
| Assessment Criteria | Field data collection, calculations and report. Details will be provided on course Canvas site.                                                                                                                                                                                                                                                                                                  |
| Return Method       | Online                                                                                                                                                                                                                                                                                                                                                                                           |
| Feedback Provided   | Online General feedback will also be provided during formal course sessions.                                                                                                                                                                                                                                                                                                                     |

### **Assessment 4 - Subdivision Calculations and Plan**

| Assessment Type     | Written Assignment                                                                                                                                                                             |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description         | This assignment includes computations using Excel spreadsheets, as well as materials presented and completed in CAD laboratories. Details will be provided in class and on course Canvas site. |
| Weighting           | 15%                                                                                                                                                                                            |
| Due Date            | Week 11                                                                                                                                                                                        |
| Submission Method   | Online                                                                                                                                                                                         |
| Assessment Criteria | Articulate and concise documents which convey correct solutions and evidence based on understanding of the concepts and topics. Details will be provided on course Canvas site.                |
| Return Method       | Online                                                                                                                                                                                         |
| Feedback Provided   | Online General feedback will also be provided during formal course sessions.                                                                                                                   |



### **Assessment 5 - Formal Examination**

Assessment Type Description Weighting Due Date Submission Method Assessment Criteria Return Method Feedback Provided Formal Examination

30% To be notified. Formal Exam

# ADDITIONAL INFORMATION

#### **Grading Scheme**

This course is graded as follows:

| Range of<br>Marks | Grade                       | Description                                                                                                                                                                                                                                                |
|-------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 85-100            | High<br>Distinction<br>(HD) | Outstanding standard indicating comprehensive knowledge<br>and understanding of the relevant materials; demonstration of<br>an outstanding level of academic achievement; mastery of<br>skills*; and achievement of all assessment objectives.             |
| 75-84             | Distinction<br>(D)          | Excellent standard indicating a very high level of knowledge<br>and understanding of the relevant materials; demonstration of<br>a very high level of academic ability; sound development of<br>skills*; and achievement of all assessment objectives.     |
| 65-74             | Credit<br>(C)               | Good standard indicating a high level of knowledge and<br>understanding of the relevant materials; demonstration of a<br>high level of academic achievement; reasonable development<br>of skills*; and achievement of all learning outcomes.               |
| 50-64             | Pass<br>(P)                 | Satisfactory standard indicating an adequate knowledge and<br>understanding of the relevant materials; demonstration of an<br>adequate level of academic achievement; satisfactory<br>development of skills*; and achievement of all learning<br>outcomes. |
| 0-49              | Fail<br>(FF)                | Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.                                                          |

\*Skills are those identified for the purposes of assessment task(s).

**Communication** Communication methods used in this course include: **Methods** 

**Course Evaluation** Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

- Oral Interviews (Vivas) As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the <u>Oral Examination (viva) Procedure</u>. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the <u>Student Conduct Rule</u>.
- Academic Misconduct All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to <a href="https://policies.newcastle.edu.au/document/view-current.php?id=35">https://policies.newcastle.edu.au/document/view-current.php?id=35</a>.

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| Adverse<br>Circumstances        | The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where: <ol> <li>the assessment item is a major assessment item; or</li> <li>the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;</li> <li>you are requesting a change of placement; or</li> </ol> |  |  |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
|                                 | 4. the course has a compulsory attendance requirement.<br>Before applying you must refer to the Adverse Circumstance Affecting Assessment Items<br>Procedure available at:                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |
|                                 | https://policies.newcastle.edu.au/document/view-current.php?id=236                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |
| Important Policy<br>Information | The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at <a href="https://www.newcastle.edu.au/current-students/no-room-for/policies-and-procedures">https://www.newcastle.edu.au/current-students/no-room-for/policies-and-procedures</a> that support a safe and respectful environment at the University.                                                                                                                                                                                            |  |  |

This course outline was approved by the Head of School on the 28/06/2023. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

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