Urban Modelling

CODE1230

Lectures: 9am – 10am, Wednesdays, Australian School Business 119
Tutorials: 10am – 1pm, Wednesdays, Red Centre West Wing 3034 / 3035/3036
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1. Course Description

The course is part of the second semester practice-orientated teaching trajectory ‘Contextualising’ in the Stream 3: Smart and Ubiquitous Cities.

There is an increasing need for the integration of GIS data, 3D city representation and Building Information Model (BIM) to support well-informed urban planning and decision-making. This course is designed to provide students with skills and understanding of how to link the three tiers of land, urban and building information to support analysis of urban planning and city management.

The course will enable students to understand a range of representations of urban data, e.g. image-based representation, spatial data representation, and urban dynamic information representation. In addition, students will learn how to conduct 3D urban modelling using a parametric approach and undertake solar access performance analysis of the model. Students will gain hands-on practical skills through assignment projects and further knowledge of urban application through guest lectures.

The projects to be designed in the course consist of Assignment 1 ‘Review – Urban Data and Modelling Approaches’, Assignment 2 ‘3D Parametric Urban Modelling’ and Assignment 3 ‘Urban Performance Analysis’.

2. Course Staff

<table>
<thead>
<tr>
<th>Course Convenor: Dr Lan Ding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room: 2021</td>
</tr>
<tr>
<td>Phone: 9385 5593</td>
</tr>
<tr>
<td>Email: <a href="mailto:Lan.Ding@unsw.edu.au">Lan.Ding@unsw.edu.au</a></td>
</tr>
<tr>
<td>(for questions please refer to the consultation times below and do not sent emails)</td>
</tr>
<tr>
<td>Consultation times: By appointment only</td>
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</table>

<table>
<thead>
<tr>
<th>Other Teaching Staff: TBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room: -</td>
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<tr>
<td>Phone: -</td>
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<tr>
<td>Email: -</td>
</tr>
<tr>
<td>Consultation times: Directly before or after tutorial class, please contact tutor one day in advance to make a booking.</td>
</tr>
</tbody>
</table>
3. Course Communication

Most course related announcements are made in the lectures. It is essential that you attend the lectures to receive these announcements. In addition to these formal communication paths, online discussion forums will be available that will allow everyone to post questions and respond to other people’s questions. All students will be expected to participate in the online discussions.

Individual student related communication, including the issue of assessment grades and feedback, will be via the course website. Student email (using the UNSW student account) will be used to communicate changes that occur with short notice. All students are assigned an email account on the University’s e-mail server, so that email address will be used as the primary means by which important correspondence are made. You must, therefore, get into the habit of checking your email regularly.

Details on setting up your university email are provided at:
https://www.it.unsw.edu.au/students/index.html

To manage your UNSW accounts and passwords, use the IDM site:
https://idm.unsw.edu.au/idm/user/login.jsp

Questions that cannot wait until the next allocated class are best handled by posting a message on the online forums. If there are important or urgent matters that require a personal meeting, you are able to make an appointment with Dr Lan Ding via the Discipline Director Unit on Level 4. See Course Staff and Contributors for more information of how and when to communicate with course coordinator and tutors.

4. Course Website

You will have an online course website via Moodle.

**Moodle** – this is the UNSW wide online teaching platform and has many capabilities, e.g. access to lecture and tutorial materials, uploading assignments, viewing assessment results and feedback, online discussions, etc.

You can access the online Moodle course site at:

Note: There is the potential that your lectures will be automatically recorded under the echo 360 platform:
https://teaching.unsw.edu.au/unsw-lecture-recordings-process

All OH&S and workshop training courses are as well located on Moodle. Please follow the Moodle instruction to complete UNSW’s OH&S requirements.
5. Lectures
The following course schedule may be subject to change during the semester. Students will be informed of changes in lectures and via Moodle.

<table>
<thead>
<tr>
<th>Week 1 Topic</th>
<th>Overview of the Concept of Urban Model and Course Introduction</th>
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<tbody>
<tr>
<td></td>
<td>The lecture will provide an overview of urban information demand, urban modelling methods, urban performance analysis and urban platform options, as well as an introduction to the course.</td>
</tr>
</tbody>
</table>


Tutorial activities: None

<table>
<thead>
<tr>
<th>Week 2 Topic</th>
<th>The Representations of Urban Data</th>
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<tbody>
<tr>
<td></td>
<td>Introduction to the representations of urban data, including image-based representation, spatial data representation, and urban dynamic information representation. Introduction to Assignment 1 literature review.</td>
</tr>
</tbody>
</table>


Tutorial activities: Assignment 1 Project Tutorial 1: Start Assignment 1: Review - Urban Data and Modelling Approaches; Hanes-on practices on the different types of urban data.

<table>
<thead>
<tr>
<th>Week 3 Topic</th>
<th>Urban Forms, Resource Flows and Performance Monitoring</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Introduction to urban resource flows and sustainability, the linkage between urban forms, resource flows and urban performance analysis, urban flows modelling methods, and VicUrban sustainable renewable examples.</td>
</tr>
</tbody>
</table>


Tutorial activities: Assignment 1 Project Tutorial 2: Continue to work on Assignment 1: Review - Urban Data and Modelling Approaches.

<table>
<thead>
<tr>
<th>Week 4 Topic</th>
<th>Introduction to Urban Modelling Platforms (CityEngine)</th>
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<tbody>
<tr>
<td></td>
<td>Introduction to 3D parametric urban modelling platform CityEngine including user interface, modelling functions, and applications examples. Introduction to Assignment 2 project.</td>
</tr>
</tbody>
</table>

Readings: ESRI CityEngine: http://www.esri.com/software/cityengine
### Tutorial activities:

**Assignment 2 Project Tutorial 1:** Start Assignment 2 3D Parametric Urban Modelling; Hands-on practices on user interface and key functions.  
**Submission:** Submit Assignment 1: Review - Urban Data and Modelling Approaches via Moodle by 5pm on Friday in Week 4.

**Week 5 Topic**  
**Guest Lecture (Jim Plume)**  
Introduction to the Precinct Information Model Project at CRC for Low Carbon Innovation

**Readings:** Non

**Tutorial activities:** Assignment 2 Project Tutorial 2: Continue to work on Assignment 2 3D Parametric Urban Modelling using CityEngine.

**Week 6 Topic**  
**Introduction to Semantic 3D City Model (CityGML)**  
Introduction to semantic 3D city modelling using CityGML including CityGML features, 3D city representations at the different levels of details, and application examples covering energy performance analysis and management, pedestrian path analysis for aged people, and city noise analysis.

**Readings**  

**Tutorial activities**  
Assignment 2 Project Tutorial 3: Continue to work on Assignment 2 3D Parametric Urban Modelling using CityEngine.

**Week 7 Topic**  
**Integration of BIM and GIS**  
Introduction to the key features of BIM and GIS, and challenges and approaches to the integration of BIM and GIS, as well as the process of extending BIM into a GIS context.

**Readings**  

**Tutorial activities**  
**Assignment 2 Project Tutorial 4:** Continue to work on Assignment 2 3D Parametric Urban Modelling using CityEngine; Introduce to the process of publishing the model online.

**Week 8 Topic**  
**Guest Lecture (John Moore)**  
Intelligent 3D building and infrastructure data model for the Sydney CBD.

**Readings:** None

**Tutorial activities:** Assignment 2 Project Tutorial 5: Complete Assignment 2 3D Parametric Urban Modelling.  
**Submission:** Submit Assignment 2 3D Parametric Urban Modelling.
via Moodle by 5pm on Friday in Week 8.

Week 9  FBE Non-Teaching Week

Mid Semester Break

Week 10 Topic  Urban Sustainability Performance Indicators and Assessment

Introduction to urban sustainability performance indicators, integrated sustainability assessment methods, and solar access analysis at the precinct level. **Introduction to Assignment 3 project.**

Readings


Tutorial activities: Assignment 3 Project Tutorial 1: Start Assignment 3 Urban Performance Analysis; Improve the parametric urban model done in Assignment 2 in order to meet solar access requirements.

Week 11 Topic  Guest Lecture (Dr Tim Baynes)

CSIRO project on stock and flows at the regional scale.

Readings: TBA

Tutorial activities: Assignment 3 Project Tutorial 2: Run solar access analysis of the improved parametric urban model.

Week 12 Topic  Guest Lecture (TBA)

Case studies of 3D city models and performance analysis.

Readings: None

Tutorial activities: Assignment 3 Project Tutorial 3: Continue to work on Assignment 3 Urban Performance Analysis; Publish the final improved model online; Write the group report.

Week 13 Topic  Consultation Time

Readings: None

Tutorial activities: Assignment 3 Project Tutorial 4: Complete Assignment 3 Urban Performance Analysis.

**Submission:** Submit Assignment 3 Urban Performance Analysis Report via Moodle by 5pm on Friday in Week 13, and publish the improved model online.

Please complete the CATEI feedback evaluations class.

Week 15  PARITY SESSION of all courses in the semester

Presentation of all work of all courses. THIS IS ONLY COMPULSORY FOR CODE PROGRAM STUDENTS via a selection of the five best images with descriptions presented on one poster for each course. Hand in on Wednesday in Week 15 before 1 pm at the DD unit on Level 4. See Parity Session for detailed information.

Online Learning: N/A

Tutorial activities: Parity session hand in at Wednesday week 1 prior to 1pm at DD unit.

Parity session set up for Year 1 students from 9 – 10pm;
Parity session for tutors with compulsory students attendance between 10 – 1pm;
Take down of work Year 1 from 1 pm onwards.
Parity session set up for Year 2 students from 1 – 3pm;
Parity session for tutors with compulsory students attendance between 3 – 5pm;
Take down of work Year 2 from 5 pm onwards, followed by drinks.
6. Assessment

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Weight</th>
<th>Learning outcomes assessed</th>
<th>Graduate attributes assessed</th>
<th>Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assignment 1: Review – Urban Data and Modelling Approaches</td>
<td>30%</td>
<td>1</td>
<td>H / L</td>
<td>Week 4</td>
</tr>
<tr>
<td>2. Assignment 2: 3D Parametric Urban Modelling</td>
<td>30%</td>
<td>2</td>
<td>H / I / L</td>
<td>Week 8</td>
</tr>
<tr>
<td>3. Assignment 3: Urban Performance Analysis</td>
<td>30%</td>
<td>4</td>
<td>H / I / K / L</td>
<td>Week 13</td>
</tr>
<tr>
<td>4. Quiz x 1</td>
<td>10%</td>
<td>1,3,4</td>
<td>H / I / K / L</td>
<td>Random week</td>
</tr>
<tr>
<td>5. “Best of Semester” Parity and Moodle Submission</td>
<td>*)</td>
<td>1,2,3,4</td>
<td>H / I / K / L</td>
<td>W15</td>
</tr>
</tbody>
</table>

*) No weight but overall mark will be reduced by 10% if not handed in on time.

**Assignment 1 (Review – Urban Data and Modelling Approaches) TOTAL 30%**

Students will study the concepts of urban data and modelling approaches and complete a literature review for submission of Assignment 1. This will be a staged task over 3 weeks, during which students will be given 3 face-to-face tutorials that will progressively explain how to complete a literature review of urban data and modelling approaches.

The **Review – Urban Data and Modelling Approaches Report Hand in Week 8** will count a 30% of total mark in the course. Hand in Date is on Friday of WEEK 5 by 5.00pm via the Moodle course site.

Detailed project brief will be provided in the Moodle course site.

**Name:** Assignment 1 Project Tutorial 1  
**Description:** Start Assignment 1: Review - Urban Data and Modelling Approaches; Hanes-on practices on the different types of urban data.

**Name:** Assignment 1 Project Tutorial 2  
**Description:** Continue to work on Assignment 1: Review - Urban Data and Modelling Approaches.

**Name:** Assignment 1 Project Tutorial 3  
**Description:** Continue to work on Assignment 1: Review - Urban Data and Modelling Approaches.
Assignment 2 (Parametric Urban Modelling) TOTAL 30%

Students will learn how to conduct 3D parametric urban modelling using CityEngine as Assignment 2 (Week 5 – 8). Students will collect data of a block at the UNSW campus and model it using a parametric approach provided by CityEngine. This will be a staged task over 4 weeks, during which students will be given 4 face-to-face tutorials that will progressively explain how to conduct parametric modelling using CityEngine and publish the model online.

The 3D Parametric Urban Modelling Project Hand in Week 12 will count a 30% of total mark in the course. Hand in Date is on Friday of WEEK 8 by 5.00pm via the Moodle course site.

Detailed project brief will be provided in the Moodle course site.

<table>
<thead>
<tr>
<th>Name:</th>
<th>Assignment 2 Project Tutorial 1</th>
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<tbody>
<tr>
<td>Description:</td>
<td>Start Assignment 2 3D Parametric Urban Modelling; hands-on practices on CityEngine user interface and key functions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name:</th>
<th>Assignment 2 Project Tutorial 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Continue to work on Assignment 2 3D Parametric Urban Modelling using CityEngine,</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name:</th>
<th>Assignment 2 Project Tutorial 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Continue to work on Assignment 2 3D Parametric Urban Modelling using CityEngine; Introduce to the process of publishing the model online.</td>
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<table>
<thead>
<tr>
<th>Name:</th>
<th>Assignment 2 Project Tutorial 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Complete Assignment 2 3D Parametric Urban Modelling.</td>
</tr>
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</table>

Assignment 2 (Urban Performance Analysis) TOTAL 30%

During the last four weeks of the semester, students will work in a group of 2 people to undertake a design analysis of an urban model selected from the two produced by the members of the group. The group will discuss how the model might be improved in response to the analysis of solar access. The group will then adjust the model in line with the conclusion and perform a second cycle of analysis. The final group submission will be a joint report made up of the analysis and a discussion of proposed model improvements, as well as published online model.

The Urban Performance Analysis Project Hand in Week 13 will count a 30% of total mark in the course. Hand in Date is on Friday of WEEK 13 by 5.00pm via Moodle course site.

Detailed project brief will be provided at Moodle course site.

<table>
<thead>
<tr>
<th>Name:</th>
<th>Assignment 2 Team Collaboration Project Tutorial 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Start Assignment 3 Urban Performance Analysis; Improve the parametric urban model done in Assignment 2 in order to meet solar access requirements.</td>
</tr>
<tr>
<td>Name:</td>
<td>Assignment 2 Team Collaboration Project Tutorial 2</td>
</tr>
<tr>
<td>Description:</td>
<td>Run solar access analysis of the improved parametric urban model.</td>
</tr>
<tr>
<td>Name:</td>
<td>Assignment 2 Team Collaboration Project Tutorial 3</td>
</tr>
<tr>
<td>Description:</td>
<td>Continue to work on Assignment 3 Urban Performance Analysis; Publish the final improved model online; Write the group report.</td>
</tr>
<tr>
<td>Name:</td>
<td>Assignment 2 Team Collaboration Project Tutorial 4</td>
</tr>
<tr>
<td>Description:</td>
<td>Complete Assignment 3 Urban Performance Analysis.</td>
</tr>
</tbody>
</table>

**Quizzes (x1) TOTAL 10%**

There will be one quiz to ensure students understand key concepts and knowledge in relation to urban modelling.

The quiz will be held in the lecture in a random week, which will count a 10% of total mark in the course.

**Assignment 4**

| Name: | Parity / Moodle submission |
| Description: | **For Moodle Submission:** Please refer to 16. Parity Session for information about what to hand in and 4. Course Website for how to upload.  
**For Parity Submission:** Please refer to 16. Parity Session for information on what to present and to 5. Lecture when to present in Week 15. |
7. Assessment criteria and standards

Assessment criteria and standards will be provided in detailed Project Brief at Moodle course site.

8. Assessment feedback

Students will gain information about their process in class via 3 basic levels.

Firstly, the goals of the class are clearly defined in the course outline and discussed at the beginning of each Assignment and the learning steps within the assignment in the weekly lecture and tutorials. Here students will understand how their performance relates to the broad goals of the course.

Secondly, students will get feedback in each class (during the three tutorial hours) upon their performance. Tutors will help students in one-to-one sessions to discuss and analyse how successful they have been at addressing the task and its criteria of each assignment and the learning steps within the assignment.

Thirdly, students will get structured written feedback on their assignment work and how improvements could be made via the online Moodle system.

9. Resources

9.1 Readings, textbooks and UNSW Library resources

Essential readings

- CityEngine, available from (http://www.esri.com/software/cityengine)

Recommended readings

- ArcGIS. www.esri.com
- CityGML. www.citygml.org
- Google Earth. www.google.com/earth

9.2 Online resources

Social network resources

UNSW CoDe has a Twitter, Instagram, Facebook and Youtube account and all lecturers are using these accounts to share information with their students. Thus please join and follow us on @UNSWCoDe (for all above listed networks) we will use “UNSW” + “CODE” + the course number as a hash tag to help finding the relevant info (for this course #UNSWCODE1230). Feel also free to post images of your design on social media using the hash tag.

Video resources

The lectures given in this course may have videos embedded as part to illustrate the concepts and application. These video links are incorporated within lecture slides and could be found on the internet. Students could also search the internet for relevant good clips and share them using social networks and use “UNSW” + “CODE” + the course number as a hash tag to help finding the relevant information (for this course #UNSWCODE1230).

Presentation resources

Final presentation poster template to be used for the final presentation exhibition in week 15 can be downloaded at the course website. It is a requirement to use this template with the fonts and logos embedded in the template.

10. Class requirement

Class material

Moodle will be used to provide all course materials including course outline, lecture notes, reference materials, assignment specifications, and links to online resources such as demonstration videos.

Software and hardware requirements
CityEngine software will be used in this course, which is available on the Faculty’s computers.

11. Expectations

This course represents one-quarter of your Session’s workload. Therefore, you will be expected to put in around 12 hours of time into this course each week (contact plus non-contact time). It is important that you allocate that time every week so that you develop your skills and understanding steadily throughout the semester.

The lectures and tutorials are compulsory and attendance will be monitored and recorded, forming a key participation component of the assessment. Anything less than full and active participation is considered unsatisfactory. The lectures will range in theme, but are designed to provide the necessary understanding of current and future trends in information modelling in the built environment disciplines. The lab tutorial classes will provide assistance about your project work, etc.

You will find that you have a steady stream of work to complete each week outside classes. Computing projects cannot be left to the last minute without causing you enormous stress and risking catastrophic failure.


12. Learning experience and teaching strategies

There are three aspects to the teaching in this course:

Face-to-Face Classes: the course is structured around a weekly lecture, tutorials and personal support face-to-face at specific times in the labs. The lectures will range in theme, but are designed to provide the necessary understanding of the new interdisciplinary area ‘computational sustainability’ and its industry application. The lab tutorial classes will provide assistance about project work, etc.

On-line Resources: Moodle is used in this course to provide the learning resources and general course management.

Homework: students are required to complete a steady stream of work each week outside classes.

The course has a total of 3 assignments (Assignment 1 ‘Review – Urban Data and Modelling Approaches’, Assignment 2 ‘3D Parametric Urban Modelling’, and Assignment 3 ‘Urban Performance Analysis’), and 1 quiz.

13. Course aims

Course Aim 1: The course will enable students to understand urban data and modelling approaches in support of urban planning and city management.

Course Aim 2: Further students will gain hands-on analysis and modelling skills and are able to conduct 3D parametric urban modelling and analysis.

14. Learning outcomes

At the successful conclusion of this course the student will be able to:

1: Understand a wide range of urban data, modelling methods and analysis platforms.

2: Apply parametric modelling methods to specify city objects and properties to produce a parametric urban model.

3: Explain ways of integrating GIS and Building Information Modelling (BIM) to support well-informed planning and decision-making.

4: Understand 3D visualisation and analysis of urban models.
15. **Course Graduate Attributes**

<table>
<thead>
<tr>
<th>CODE2170 course Graduate attributes</th>
<th>Learning outcome</th>
<th>Activity/Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>H / Scholars who are digitally literate</td>
<td>1,2,3,4</td>
<td>This course will sharpen your knowledge of digital representation of cities and enable you to understand how to apply advanced digital urban modelling techniques to support well-informed urban planning and performance analysis.</td>
</tr>
<tr>
<td>I / Leaders who are enterprising, innovative and creative</td>
<td>2,4</td>
<td>Computers are an essential tool to inform decision-making and creativity through analytical and critical thinking. This course will demonstrate how that can work for you as a future leader in your profession.</td>
</tr>
<tr>
<td>K / Leaders who are collaborative and effective team workers</td>
<td>4</td>
<td>This course not only gives you the skills to communicate digitally, but enhances teamwork and collaboration.</td>
</tr>
<tr>
<td>L / Professionals who are capable of independent, self-directed practice</td>
<td>1,2,4</td>
<td>This course will rely heavily on you developing your own deep understanding of the processes involved in urban modelling rather than just providing a step-by-step recipe for how to do it.</td>
</tr>
</tbody>
</table>

16. **Parity Session**

As part of creating a community and culture of showcasing work, students will be required to submit a selection of their best images (plans, renderings, model pictures, screenshots, etc.) from their final presentation as well as work in the progress during semester. This will also help in marking and feedback. The online submission is an essential requirement. Failing to do so will give you a (-) 10% of your overall mark. The collection of student works will also be employed for marketing purposes. As you know, we are a very young discipline and we want to share what you have designed and produced during the semester. The submission platform will be within Moodle.

The following defines the expectations of what to submit.

**For Moodle Submission:**

- Five indicative images with descriptions that best represent your work / designs during the semester.
- For landscape image (approx. 2480 x 3508 pixels @ 300 dpi) for portrait image (approx. 3508 x 2480 pixels @ 300 dpi)
- For each of the five images please provide five keywords in order to find images later.
- Upload the poster including images and descriptions as explained in 4. Course Website.
• Deadline is day before parity session 5pm. (Moodle page will close).

For the Week 15 parity session:

• Create a poster with the five images and descriptions you have uploaded onto Moodle. The poster will use the layout (parity layout template that can be downloaded on the Moodle page for each course) and has to be printed on white 3mm core flute.

• Pin up of poster with dates is outlined in Week 15 lecture / tutorial activity.

• The layout has either a portrait or a landscape format and students can use either one or the other or a mix of both to represent the four courses they have done in each semester.

• The size of the template is the same size as the black exhibition boxes UNSW uses for their exhibitions and you showed fix the core flute poster to the black boxes using i.e. adhesive tape.

• Students have each six of these black boxes to use four of them to attach their core flute posters and the remaining two to showcase any models or other physical outcome of the semester.

• Again you have to curate your work and choose the best to re-present your work.

17. Built Environment and UNSW Academic Policies

The Built Environment Protocols and UNSW Policies & Procedures document supplements this course outline providing detail on academic policies and other administrative matters. It is your duty as a student to familiarise yourself with the expectations as not adhering to them will be considered as academic misconduct. Ignorance of the rules is not an acceptable defence.

The document can be found in your Moodle course as well as: http://www.be.unsw.edu.au/student-intranet/academic-policies

It covers:
• Built Environment Student Attendance Requirements
• Units of Credit (UOC) and Student Workload
• Course and Teaching Evaluation and Improvement (CATEI)
• Academic Honesty and Plagiarism
• Late Submissions Penalties
• Special Consideration - Illness & Misadventure
• Extension of Deadlines
• Learning Support Services
• Occupational Health & Safety