General Information

<table>
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<tr>
<th>Unit convenor and teaching staff</th>
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<tbody>
<tr>
<td>Gavin Brennen</td>
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<tr>
<td><a href="mailto:gavin.brennen@mq.edu.au">gavin.brennen@mq.edu.au</a></td>
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<th>Lecturer</th>
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<tr>
<td>Thomas Volz</td>
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<tr>
<td><a href="mailto:thomas.volz@mq.edu.au">thomas.volz@mq.edu.au</a></td>
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<table>
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<tr>
<th>Credit points</th>
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<td>10</td>
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<th>Prerequisites</th>
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<td>Permission by special approval</td>
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<th>Corequisites</th>
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<th>Co-badged status</th>
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Unit description
This unit introduces students to the growing field of quantum information science and technology. A general formalism is introduced involving the concept of Hilbert space, states represented by density matrices, open systems evolution via operator sum decompositions, and generalised measurement theory. Much of the unit covers the physics and quantum information aspects of leading physical implementations for a quantum engineered device, including: atomic, (neutral and trapped ion), photonic, superconducting and semiconductor devices. There is a laboratory component based on photonic systems with experiments on quantum correlations in single photons, tests of quantum nonlocality, and generation of entangled photons.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are available at [https://www.mq.edu.au/study/calendar-of-dates](https://www.mq.edu.au/study/calendar-of-dates)

Learning Outcomes
On successful completion of this unit, you will be able to:

- **ULO1**: explain the basic theoretical concepts and elements needed for quantum information processing
- **ULO2**: solve basic analytical and numerical problems in quantum information theory
ULO3: reflect on the true potential and limitations of a quantum computer
ULO4: describe and model currently existing atom-based implementations of a quantum computer and their technical limitations

Assessment Tasks

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<tr>
<th>Name</th>
<th>Weighting</th>
<th>Hurdle</th>
<th>Due</th>
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<tr>
<td>Final Examination</td>
<td>40%</td>
<td>No</td>
<td>[TBA]</td>
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Final Examination
Assessment Type 1: Examination
Indicative Time on Task 2: 20 hours
Due: [TBA]
Weighting: 40%

On successful completion you will be able to:
- explain the basic theoretical concepts and elements needed for quantum information processing
- solve basic analytical and numerical problems in quantum information theory
- reflect on the true potential and limitations of a quantum computer
- describe and model currently existing atom-based implementations of a quantum computer and their technical limitations

Problem-based assignments
Assessment Type 1: Problem set
Indicative Time on Task 2: 32 hours
Weighting: 60%

A set of problems based on lecture content

On successful completion you will be able to:
- explain the basic theoretical concepts and elements needed for quantum information processing
- solve basic analytical and numerical problems in quantum information theory
- reflect on the true potential and limitations of a quantum computer
• describe and model currently existing atom-based implementations of a quantum computer and their technical limitations

1 If you need help with your assignment, please contact:
• the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
• the Writing Centre for academic skills support.

2 Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

**Delivery and Resources**

Online Delivery with recorded lectures.

**Policies and Procedures**

Macquarie University policies and procedures are accessible from [Policy Central](https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

• Academic Appeals Policy
• Academic Integrity Policy
• Academic Progression Policy
• Assessment Policy
• Fitness to Practice Procedure
• Assessment Procedure
• Complaints Resolution Procedure for Students and Members of the Public
• Special Consideration Policy

Students seeking more policy resources can visit [Student Policies](https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central](https://policies.mq.edu.au) and use the search tool.

**Student Code of Conduct**

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/admin/other-resources/student-conduct](https://students.mq.edu.au/admin/other-resources/student-conduct)

**Results**

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the
University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity
At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support
Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

The Writing Centre
The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

• Workshops
• Chat with a WriteWISE peer writing leader
• Access StudyWISE
• Upload an assignment to Studiosity
• Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

• Subject and Research Guides
• Ask a Librarian

Student Services and Support
Macquarie University offers a range of Student Support Services including:

• IT Support
• Accessibility and disability support with study
• Mental health support
• Safety support to respond to bullying, harassment, sexual harassment and sexual assault
• Social support including information about finances, tenancy and legal issues
• Student Advocacy provides independent advice on MQ policies, procedures, and processes
Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Changes since First Published

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
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<tbody>
<tr>
<td>15/02/2023</td>
<td>Due dates for assessments added.</td>
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