PROPOSAL TO INTRODUCE A NEW COURSE

1. COURSE DETAILS

1.1 Course ID

GSOE9220

1.2 Course name - Long

Quantum Information and Computation

1.3 Course name - Abbreviated

Quantum ICT

1.4 Course Authority ext/email

Arthur Ramer, CSE 56875 ramer@cse.unsw.edu.au

1.5 Organisational Unit responsible for course

Faculty: Engineering Code: ENG

School:
Computer Science and Engineering Code: E25

1.6Justification of Proposal

Quantum computing and communication are becoming core technologies of the 21st century. First quantum communication systems have already appeared in the commercial world.
There is an intense worldwide effort, pursued by all leading industrial nations, to build fully operational quantum computing devices. The Quantum Technology Center at the UNSW is one of the leaders in developing quantum hardware.

This course will address the software issues of quantum computing – its basic algorithms, methods for assuring fault-tolerance and implications for quantum programming.
The UNSW currently has no formal course that specifically addresses these technologies. The new course would be accessible to all engineering students; it has no prerequisites other than linear algebra and programming with data structures. The course would also be attractive new research students intending to pursue advanced research in this area.

The course will be closely coordinated with a new course, to be offered by the School of EE&C, on quantum networking and communications. Taken together they will provide for a year-long training in quantum technology from the engineering perspective.

1.7 Consultation Process

This proposal has been developed following extensive consultation within the Faculty,
esp. Schools of EE&T and CSE, and without, esp. QCT – Quantum Technology Center and
School of Mathematics.

1.8 Units of credit (UOC)	Session/s offered	Hours Per Week
6 UoC	S1 & S2	3

1.9 Pre-requisites: Nil

Co-requisites: Nil
Exclusions: Nil

1.10 Proposed Entry in the Faculty Handbook

The course gives an overview of the basic quantum software processes that are, in the near future, expected to complement the emerging quantum computer devices and technology. Emphasised are the applications to security of communications and quantum cryptography, already a practicable technology.
Course topics introduce:

-- Basic notions of quantum formalism and technology
-- Composite quantum systems
-- Quantum computing and algorithms
-- Quantum information
-- Quantum random walks

The course prepares for independent research at MS or PhD levels. There are no formal prerequisites; however a good background in data organisation, probability, and linear algebra is advised. No quantum physics or theory are needed.

1.11 Is this course replacing an existing course?

NO

1.12 Postgraduate

Undergraduate – Lecturer permission expected

1.13 Elective

1.14 Program stage

Initial offering (no prerequisites)
First given - S2'2008

1.15 Program/s in which course is be available

Master of Engineering Science	MEngSc	8538
Master of Engineering Science Extension	MEngSc Ext	8539

1.16 Proposed teaching methods and assessment practices

Lectures, each including a tutorial practicum.
Assessment by assignments, projects and examinations (midterm and final), aiming to enhance individual and team learning and resulting in strengthening of graduate attributes.

1.17 Assessment grades to be used

Full range of grades: HD, DN, CR, PS, FL

1.18 Mode of delivery

Internal	X

1.19 Information Technology Requirements for students

Standard computing resources, provided to all postgraduate students.

1.20 Textbooks (recommended)

-- Pittenger, Arthur O., 1936 - *An introduction to quantum computing algorithms /* 2000, 004.1/7
-- Nielsen, Michael A., 1974 - Quantum computation and quantum information / 2001 P 004.1/8

The bulk of the existing UNSW collection is adequate; a couple of individual textbook titles might be required closer to the starting date. These are easily picked up in alignment with the T&R policy.

1.21 Industrial experience component

N/A

2. RESOURCE STATEMENT

2.1 Enrolments (estimated)

2008: 20--25

2009: 30--35

2010: 35--40

2.2 Resource Requirements

Staffing Requirements:

One full-time Academic Staff

Field Costs:	No additional cost
Materials Requirements:	No additional cost
Equipment Costs:	No additional cost
Computing Requirements:	No additional cost
Library Requirements:	No additional cost
Capital Funds Requirements:	No additional cost

2.3 Servicing Implications:

N/A

2.4Teaching Arrangements:

Will other units contribute on a regular basis to the teaching of this course?

YES

If so, which units are involved and what proportion of the course will they teach?

EE&T - one week
QTC - one week

2.5 Alternative Delivery Arrangements:

N/A

2.6 Details of Tuition Fees:

Standard UNSW fees will be applied where appropriate.

3. AUTHORISATION

3.1 University Librarian's Endorsement

I have examined the Library needs related to the above proposal and certify that existing Library holdings, staffing, services and accommodation are adequate to cover the demands that are inherent in it. Appropriate arrangements for the use of digitised material to support this course have been made by the Course Authority with the University Librarian.

Further Comments:

University Librarian
/ /2007

3.2 Head of School of CSE Approval

I have examined the resource implications of the above proposal in regard to staff, space, materials, equipment, capital funds, and computing, and certify that the School can cover the demands that are inherent in it.

Further Comments:

Head of School
/ /2007

3.3 Dean's Approval

I have examined the resource implications of the above proposal in regard to staff, space, materials, equipment, capital funds, and computing, and certify that:

3.3.1 The proposal involves no additional resources.

3.3.2 The proposal conforms to the University's commitment to Equal Opportunity in Education.

Dean
/ /2007