ANU College of Engineering & Computer Science

Postgraduate Programs
2017
The PhD (Doctor of Philosophy) and MPhil (Master of Philosophy) are research degrees, awarded based on the submission and subsequent independent assessment of a thesis that describes original research undertaken by the author while enrolled as a student in a relevant degree program at ANU. In both programs the student is expected to acquire specialised knowledge. They will be exposed to a network of research contacts and will also gain skills in bibliographic search and problem solving.

The main differences between the two programs are the depth of the knowledge acquired, and the expectation that a PhD student will gain skills in problem formulation.

To guide students towards the successful submission of their thesis the College has a variety of innovative study programs, that are at the forefront of Australian best practice. For example, students have the opportunity to access a broad range of specialist courses, attend seminars, conferences and summer schools, and to contribute to the various undergraduate teaching activities.

In short, the PhD and MPhil study programs provide students with comprehensive research training that will equip them, should they decide to pursue a research career.

A wide range of pure and applied research is undertaken within the College. There are close ties to the NICTA centre of excellence, government bodies such as CSIRO, and several industrial organisations. Many of our students work on collaborative projects involving a number of partners, and often spend extended periods of time in the relevant partner organisations.

Application process

Applicants are required to hold the equivalent of an Australian Bachelors degree with Honours 2A level or above in a relevant field. Overseas equivalent requirements may vary depending on grading scales. As a guide, students will normally be in the top five to ten per cent of graduates from well regarded universities. Students will also be required to arrange for referee reports. Applicants who are in doubt about the eligibility of their qualifications are encouraged to contact the College for advice.

Admission is also dependent on the ability of the College to provide adequate supervision for the proposed research. Applicants are therefore strongly encouraged to discuss their proposed research topic with a member of the College prior to submitting their application for admission. Students who have not completed their first degree in English are required to meet the University’s English language proficiency criteria.

How to apply

Go to cecs.anu.edu.au/study/graduate-research

Complete the self assessment tool to determine your eligibility to do research at ANU.

Complete the pre-application process and identify a research group and supervisor.

Complete a formal application either online or through an agent representative.

You’ll need:
> CV
> Transcripts
> Three referee reports
> Statement of support from your potential supervisor
> Thesis proposal - written with your supervisor
> Proof of meeting English language requirements
ENGINEERING RESEARCH THEMES

Energy
- Energy Storage
- Photovoltaics
- Solar Thermal

Fabrication
- Manufacturing
- Micro and Nano Systems
- Optical Devices
- Sensors

Information
- Acoustics and Audio
- Communications
- Computer Vision
- Networked Systems
- Quantum Cybernetics
- Robotics
- Signal Processing

Materials
- Biomaterials
- Composite Materials
- Computational Mechanics
- Nanomaterials
COMPUTER SCIENCE RESEARCH THEMES

Intelligence
> Data Mining and Matching
> Intelligent Agents
> Knowledge Representation and Reasoning
> Machine Learning
> Planning and Optimisation

Systems
> High Performance Computing
> Human-Centred Computing
> Programming Languages, Design and Implementation
> Software Engineering

Theory
> Algorithms
> Databases
> Logic
MASTER OF ENGINEERING
IN DIGITAL SYSTEMS & TELECOMMUNICATIONS

Academic Plan: NDSTE
Duration: 2 years full-time
Minimum: 96 units
CRICOS Code: 077326G
UAC Code: 830822

This two-year program will provide students with a qualification in Engineering at the Masters level. Students will obtain advanced knowledge in signal processing and information engineering which is at the heart of modern digital systems. Areas of application include microelectronic systems, communication networks, computer vision, audio and acoustic signal processing. The program contains a targeted professional development component as well as an opportunity to select electives from other areas of study anywhere in the University.

Upon successful completion, students will be able to:

- apply systems-engineering approaches to address complex and multi-disciplinary real-world engineering problems
- demonstrate a high level of technical knowledge in subjects relevant to digital systems and telecommunication engineering
- communicate effectively with colleagues, other engineering professionals and the broader community using a range of communication media and tools
- work professionally as an individual and in a team environment
- demonstrate knowledge of engineering research methods and carry out applied research in the area of digital systems and telecommunication.

Entry requirements
A Bachelor degree or international equivalent in a cognate discipline with an average mark of at least 70 per cent.

All applicants must meet the University's English Language Admission Requirements for Students.

Cognate disciplines

Credit Exemption/Status
Eligible students may be awarded up to one year (50 per cent) of status (credit). This may include students:

- who have completed a Masters in engineering
- who have a High Distinction average (or equivalent) in a Bachelor degree in engineering
- who have a Distinction average in an ANU Bachelor of Engineering
- with an appropriate combination of relevant work experience and qualification.

Degree structure
Digital Systems & Telecommunications
The Master of Engineering in Digital Systems and Telecommunications requires the completion of 96 units, of which:

96 units must come from completion of 6000-level, 7000-level and 8000-level courses
The 96 must consist of:

66 units from completion of the following compulsory courses:
- ENGN6213 Digital Systems and Microprocessors
- ENGN6536 Wireless Communications
- ENGN6537 Discrete-Time Signal Processing
- ENGN8100 Introduction to Systems Engineering
- ENGN8120 Systems Modelling
- ENGN8150 Professional Communication I
- ENGN8160 Professional Communication II
- ENGN8534 Information Theory
- ENGN8537 Embedded Systems and Real Time Digital Signal Processing
- ENGN8538 Probability and Stochastic Processes in Engineering
- ENGN8637 Advanced Topics in Communications and Signal Processing
12 units from completion of ENGN8170 Group Project, which must be completed more than once, in consecutive semesters
6 units from completion of courses from the following list:
- ENGN6513 Fibre Optics Communication Systems
- ENGN6625 Power Electronics
12 units from completion of elective courses offered by ANU
MASTER OF ENGINEERING
IN MECHATRONICS

The aim of this two-year program is to provide students with a qualification in Engineering at the Masters level. Students will gain advanced technical knowledge in Mechatronics, an area where ANU has world-leading research strength.

Mechatronics graduates are highly sought after because their combined knowledge and cross-discipline skills in three major engineering areas: mechanical, electrical, and computing. This allows them to participate in and lead multi-disciplinary teams in research and product development, in automation and manufacture, in computing and electronics, offering exciting career prospects.

The program contains a targeted professional development component as well as an opportunity to select electives from other areas of study anywhere in the University.

Upon successful completion, students will be able to:
> apply systems-engineering approaches to address complex and multi-disciplinary real-world engineering problems
> demonstrate a high level of technical knowledge in subjects relevant to mechatronics and associated technologies
> communicate effectively with colleagues, other engineering professionals and the broader community using a range of communication media and tools
> work professionally as an individual and in a team environment
> demonstrate knowledge of engineering research methods and carry out applied research in the area of modern mechatronics systems.

Entry requirements
A Bachelor degree or international equivalent in a cognate discipline with an average mark of at least 70 per cent.

All applicants must meet the University's English Language Admission Requirements for Students.

Cognate disciplines
Electrical and Electronics Engineering, Automation and Intelligent Systems, Information Engineering, Computer Science and Engineering, Physics Science and Engineering, Biomedical engineering, Mathematics.

Credit Exemption/Status
Eligible students may be awarded up to one year (50%) of status (credit). This may include students:
> who have completed a Masters in engineering
> who have a High Distinction average (or equivalent) in a Bachelor degree in engineering
> who have a Distinction average in an ANU Bachelor of Engineering
> with an appropriate combination of relevant work experience and qualification.

Degree structure
Mechatronics
The Master of Engineering in Mechatronics requires the completion of 96 units, of which:
> 96 units must come from completion of 6000-level, 7000-level and 8000-level courses
The 96 units must consist of:
72 units from completion of the following compulsory courses:
> ENGN8100 Introduction to Systems Engineering
> ENGN8120 Systems Modelling
> ENGN8150 Professional Communication I
> ENGN8160 Professional Communication II
> ENGN6213 Digital Systems and Microprocessors
> ENGN6627 Robotics
> ENGN6223 Control Systems
> ENGN6528 Computer Vision
> ENGN8537 Embedded Systems and Real Time Digital Signal Processing
> ENGN8538 Probability and Stochastic Processes in Engineering
> ENGN8535 Engineering Data Analytics
> ENGN8536 Advanced Topics in Mechatronics Systems
12 units from completion of ENGN8170 Group Project, which must be completed more than once, in consecutive semesters
12 units from completion of elective courses offered by ANU
The aim of this two-year program is to provide students with an advanced technical specialisation within a systems engineering framework.

Students will gain in-depth knowledge in Photonics Technologies, an area of world-leading research strength at the ANU.

The global photonics industry is growing rapidly, offering exciting career prospects in research and development, telecommunications industry, sensing and biomedical diagnostics.

The program contains a targeted professional development component as well as an opportunity to select electives from other areas of study anywhere in the University.

Upon successful completion, students will have the knowledge and skills to:

- apply systems-engineering approaches to address complex and multi-disciplinary real-world engineering problems
- demonstrate a high level of technical knowledge in subjects relevant to Photonics and associated technologies
- communicate effectively with colleagues, other engineering professionals and the broader community using a range of communication media and tools
- work professionally as an individual and in a team environment
- demonstrate knowledge of engineering research methods and carry out applied research in the area of Photonics Technologies.

Entry requirements

A Bachelor degree or international equivalent in a cognate discipline with an average mark of at least 70 per cent.

All applicants must meet the University's English Language Admission Requirements for Students.

Cognate disciplines

Electrical Engineering, Electronic Engineering, Physics.

Credit Exemption/Status

Eligible students may be awarded up to one year (50 per cent) of status (credit). This may include students:

- who have completed a Masters in engineering
- who have a High Distinction average (or equivalent) in a Bachelor degree in engineering
- who have a Distinction average in an ANU Bachelor of Engineering
- with an appropriate combination of relevant work experience and qualification.

Degree structure

Photonics

The Master of Engineering in Photonics requires the completion of 96 units, which must consist of:

- 66 units from completion of the following compulsory courses:
  - ENGN6512 Optical physics
  - ENGN6513 Fibre optic communication systems
  - ENGN6613 Optical waveguide sensing
  - ENGN8100 Introduction to Systems Engineering
  - ENGN8120 Systems Modelling
  - ENGN8150 Professional Communication I
  - ENGN8160 Professional Communication II
  - ENGN8528 Optics for Solar Energy
  - PHYS8014 Photonics in Bio and NanoTechnology
  - PHYS8015 Photonics Laboratory
  - PHYS8016 Advanced Topics in Photonics
- 6 units from completion of a course from the following list:
  - ENGN6334 Semiconductors
  - ENGN6626 Digital Communications
  - ENGN6524 Photovoltaic Technologies
- 12 Units from completion of PHYS8170 Group Project
- 12 units from completion of 6000-level, 7000-level and 8000-level elective courses offered by ANU
his new two year Master degree is intended as a direct replacement for the current Master of Engineering in Solar Energy Technologies, adding technical breadth and the flexibility to accept students from a wider range of engineering backgrounds – not just electrical engineering as is currently the case. The revised technical content extends the coverage of renewable energy topics in the program from the current concentration on solar (photovoltaics and thermal), and puts more emphasis on systems design and integration to be better aligned with key areas of industry growth in this rapidly-evolving field.

The Renewable Energy degree maintains the research-led elements of the Solar Energy Technologies degree and builds on world-leading and unique solar and renewable energy research expertise at ANU. Individual and group research and design projects are a strong feature of ANU engineering education, and are integrated into many of the courses in this degree.

The degree provides students with specialised knowledge and professional engineering skills to prepare them for a career in the rapidly-growing renewable energy industry. It builds on the University's interdisciplinary engineering focus and research expertise to give students the skills to address complex multi-disciplinary problems, while at the same time providing advanced technical knowledge in renewable energy.

The degree includes specialised courses in solar, wind and other renewable technologies, utility-scale systems design, grid integration and energy efficiency. Students also have the opportunity to select electives from across the University, including courses in the complementary areas of energy policy, law and economics. Work Integrated Learning is an important part of the program and is delivered through the group project.

Entry requirements
A Bachelor degree or international equivalent in a cognate discipline with an average mark of at least 65 per cent.

All applicants must meet the University's English Language Admission Requirements for Students.
The Master of Computing is a two-year full-time (or equivalent part-time) degree that provides students with exposure to best practice in computing, cutting edge courses in areas of relevance to computing professionals, an opportunity to specialise in a computing sub-discipline and professional development opportunities.

Advanced specialisations are currently available in:

- Artificial Intelligence
- Computational Foundations
- Computer Systems
- Information and Human Centred Computing
- Professional Computing
- Software Engineering

Entry requirements
A Bachelor degree in computing, or a relevant discipline or the international equivalent, with a high credit average (65 per cent or above) and at least one programming course and two mathematics courses in the areas of discrete mathematics, calculus, linear algebra and statistics.

Individual research project
Students with outstanding results (70 per cent or above) in their first year may receive an invitation to undertake a six-month (24 units) Computing Research Project. This provides students with a pathway to study a PhD and the opportunity to undertake research in a field of personal or professional relevance.

Students pursuing this path will graduate with a Master of Computing (Advanced).

*Credit Exemption/Status
Students may be awarded up to one year (50 per cent) of status (credit). This may include students:

- who have completed a Graduate Diploma of Computing with a distinction (70 per cent) average
- who have completed a master’s degree in a computing or it discipline
- who have a distinction average (or equivalent) in a four year bachelor honours degree in a computing or it discipline
- with an appropriate combination of relevant work experience and qualification.

Students who have completed a three year Australian bachelor degree in a relevant discipline may receive up to one semester (25 per cent) of status (credit).

Degree structure
The Master of Computing requires the completion of 96 units, of which:

A minimum of 90 units must come from completion of 6000-level, 7000-level and 8000-level courses in the subject area COMP Computer Science.

The 96 units must consist of:

18 units from completion of the following compulsory courses:
- COMP6442 Software Construction
- COMP8701 Communication for Computing Professionals I
- COMP8705 Communication for Computing Professionals II

24 units from completion of one of the following specialisations:
- Artificial Intelligence
- Computational Foundations
- Computer Systems
- Information and Human Centred Computing
- Software Engineering

12 units from completion of courses in the subject area COMP Computer Science

6 units from completion of elective courses offered by ANU

Either: 24 units from completion of the Professional Computing specialisation

Or: 24 units from completion of courses in the subject area COMP Computer Science
Specialisations

Artificial Intelligence
Completion of 24 units, including:
> Artificial Intelligence
> System Architecture and the Human Brain
> Document Analysis
> Algorithms and Techniques for Data Mining
> Bio-inspired Computing: Applications and Interfaces
> Introduction to Statistical Machine Learning
> Advanced Topics in Artificial Intelligence
> Advanced Topics in Logic and Computation
> Computer Vision and Image Understanding: Theories and Research
> Strategic Thinking: An Introduction to Game Theory

Computational Foundations
Completion of 24 units, including:
> Information Theory
> Principles of Programming Languages
> Theory of Computation
> Advanced Algorithms
> Advanced Topics in Logic and Computation
> Number Theory and Cryptography
> Foundations of Mathematics

Computer Systems
Completion of 24 units, including:
> Operating Systems Implementation
> Principles of Programming Languages
> High Performance Scientific Computing
> ICT Sustainability
> Parallel Systems
> Real-Time Embedded Systems
> Multicore Computing: Principles and Practice
> Digital Systems and Microprocessors

Software Engineering
Completion of 24 units, including:
> Systems Engineering for Software Engineers
> Requirements Elicitation and Analysis Techniques
> Managing Software Projects in a System Context
> Software Engineering Process
> Systems & Software Safety
> Model-Driven Software Development
> Free & Open Source Software Development
> Unravelling Complexity

Information and Human Centred Computing
Completion of 24 units, including:
> System Architecture and the Human Brain
> HCI and Usability Engineering
> Computer Graphics
> Document Analysis
> Algorithms and Techniques for Data Mining
> Bio-inspired Computing: Applications and Interfaces
> Bioinformatics and Biological Modelling

Computing Project
The computing project is completed in the student’s final year of study and may be completed as an individual research project in a single semester or as a group project over two consecutive semesters. Students completing the group project may take part in the University’s innovative TechLauncher program (cs.anu.edu.au/techlauncher).

ACS Professional Accreditation
Students seeking professional accreditation from the Australian Computer Society must complete both the professional Computing Specialisation and the computing project in group mode.

Professional Computing
Note: Professional accreditation requires the completion of the Professional Computing specialisation.

12 compulsory courses including:
> Relational Databases
> Managing Software Projects in a System Context

6 units from the following:
> Computer Networks
> Networked Information Systems

A further 6 units from the following:
> Software Analysis and Design
> Model-Driven Software Development
The Master of Computing (Advanced) is a two* year full-time (or equivalent part-time) degree targeting a research role that provides students with exposure to best practice in computing, cutting edge courses in areas of relevance to computing professionals, an opportunity to specialise in a computing sub-discipline and professional development and substantial research opportunities.

Advanced specialisations are currently available in:

- Artificial Intelligence
- Computational Foundations
- Computer Systems
- Information and Human Centred Computing
- Professional Computing
- Software Engineering

Entry requirements

Entry is by transfer from the Master of Computing, with a weighted average mark of at least 70 per cent in the first 48 units of course work attempted as well as the approval of an identified supervisor for the research theses.

Students will be awarded up to 48 units of course credit for completed courses listed in this Masters (Advanced) degree.

Degree structure

The Master of Computing (Advanced) requires the completion of 96 units, of which:

A minimum of 90 units must come from completion of 6000-level, 7000-level and 8000-level courses in the subject area COMP Computer Science.

The 96 units must consist of:

18 units from completion of the following compulsory courses:

- COMP6442 Software Construction
- COMP8701 Communication for Computing Professionals I
- COMP8705 Communication for Computing Professionals II

24 units from completion of one of the following specialisations:

- Artificial Intelligence
- Computational Foundations
- Computer Systems
- Information and Human Centred Computing
- Software Engineering

Either:

24 units from completion of the Professional Computing specialisation

Or:

24 units from completion of courses in the subject area COMP Computer Science

24 units from completion of COMP8800 Computing Research Project

6 units from completion of elective courses offered by ANU

Specialisations

Artificial Intelligence

Completion of 24 units, including:

- Artificial Intelligence
- System Architecture and the Human Brain
- Document Analysis
- Algorithms and Techniques for Data Mining
- Bio-inspired Computing: Applications and Interfaces
- Introduction to Statistical Machine Learning
- Advanced Topics in Artificial Intelligence
- Advanced Topics in Logic and Computation
- Computer Vision and Image Understanding: Theories and Research
- Strategic Thinking: An Introduction to Game Theory
Computational Foundations
Completion of 24 units, including:
> Information Theory
> Principles of Programming Languages
> Theory of Computation
> Advanced Algorithms
> Advanced Topics in Logic and Computation
> Number Theory and Cryptography
> Foundations of Mathematics

Computer Systems
Completion of 24 units, including:
> Operating Systems Implementation
> Principles of Programming Languages
> High Performance Scientific Computing
> ICT Sustainability
> Parallel Systems
> Real-Time Embedded Systems
> Multicore Computing: Principles and Practice
> Digital Systems and Microprocessors

Software Engineering
Completion of 24 units, including:
> Systems Engineering for Software Engineers
> Requirements Elicitation and Analysis Techniques
> Managing Software Projects in a System Context
> Software Engineering Process
> Systems & Software Safety
> Model-Driven Software Development
> Free & Open Source Software Development
> Unravelling Complexity

Information and Human Centred Computing
Completion of 24 units, including:
> System Architecture and the Human Brain
> HCI and Usability Engineering
> Computer Graphics
> Document Analysis
> Algorithms and Techniques for Data Mining
> Bio-inspired Computing: Applications and Interfaces
> Bioinformatics and Biological Modelling

Individual Research Project (24 units)
This is a substantial piece of individual research conducted under the supervision of an academic. It is completed over 2 semesters (12 units each semester) and requires submission of a formal thesis as well as two presentation seminars.

ACS Professional Accreditation
The Master of Computing (Advanced) is not accredited by the ACS. Students may nonetheless complete courses from the Professional Computing specialisation.

Professional Computing
Note: Professional accreditation requires the completion of the Professional Computing specialisation.
12 compulsory courses including:
> Relational Databases
> Managing Software Projects in a System Context
6 units from the following:
> Computer Networks
> Networked Information Systems
A further 6 units from the following:
> Software Analysis and Design
> Model-Driven Software Development
GRADUATE DIPLOMA OF COMPUTING

Academic Plan: 6706XGDCP
Duration: 1 year full-time
Minimum: 48 units
CRICOS Code: 078938E
UAC Code: 830805

The Graduate Diploma of Computing is a one year, full-time (or equivalent part-time) program that will educate graduates in modern aspects of computing in a way that will provide a route into the information technology (IT) industry. This program also provides students with a foundation to do more advanced study in computing disciplines.

Entry requirements
An approved Bachelor degree with a high credit (65 per cent) average or international equivalent with completion of at least one programming course and two mathematics courses in the areas of discrete mathematics, calculus, linear algebra or statistics.

Students without a degree, but with at least three years relevant work experience, or a combination of qualifications and experience may also receive admission.

Degree structure
Students must complete a minimum of 48 units including:

30 units from the following courses:
> Relational Databases
> Software Analysis and Design
> Computer Networks or Networked Information Systems
> Any two courses from:
  > Introductory Programming or Introduction to Software Systems
  > Computing for Engineering Simulation
  > Programming for Scientists
  > Software Construction

Completion of a further 18 units of approved courses, including a minimum of six units from the 6000-8000 series computing courses.

Transfer to the Master of Computing
Students completing the Graduate Diploma in Computing with a distinction average wishing to transfer to the Master of Computing program may be granted up to one year of credit.

Elective courses examples

<table>
<thead>
<tr>
<th>COMPUTING COURSES</th>
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<tbody>
<tr>
<td>COMP6300</td>
<td>Introduction to Computer Systems</td>
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<tr>
<td>COMP6260</td>
<td>Formal Methods in Software Engineering</td>
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<td>COMP6261</td>
<td>Information Theory</td>
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<tr>
<td>COMP6310</td>
<td>Concurrent &amp; Distributed Systems</td>
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<td>COMP6390</td>
<td>HCI &amp; Usability Engineering</td>
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<td>COMP6720</td>
<td>Art &amp; Interaction in New Media</td>
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<tr>
<td>COMP6780</td>
<td>Web Development &amp; Design</td>
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<tr>
<td>COMP7310</td>
<td>ICT Sustainability</td>
</tr>
<tr>
<td>COMP8100*</td>
<td>Requirement Elicitation &amp; Analysis Techniques</td>
</tr>
<tr>
<td>COMP8110*</td>
<td>Managing Software Projects in a System Context</td>
</tr>
</tbody>
</table>

* Requires permission from a Program Convener