



Master of Complex Systems

Anticipate, control and manage the complexity of the unexpected



Smart cities, megaprojects, power and data grids, ecosystems, communication and transport networks are all complex systems. They generate rich interactions among components with interdependencies across systems. This interdependent behaviour creates challenges for designing and managing complex systems.

Complex systems are composed of large numbers of diverse interacting parts, making them susceptible to unexpected, large-scale, and apparently uncontrollable behaviours.

Small changes can generate large, amplified effects. For example, a single malfunction in a local substation can lead to cascading state-wide electricity grid failures, or the emergence of a new pathogen in a remote village can give rise to a devastating global epidemic.

The Master of Complex Systems will provide you with the expertise to model, analyse and design resilient technological, socio-economic and socio-ecological systems as well as develop strategies for crisis forecasting and management.

It will develop your skills in quantitative modelling and computational simulation of system dynamics, complementing your existing skills in engineering, computer science, information technology, physics, mathematics, health, biology or business.

As an expert in complex systems, you could pursue a career in major multinational research and development companies, government and crisis management agencies, health, construction or transport organisations.

These unique skills will enable you to operate across discipline boundaries, providing key input and insights to help solve complex global challenges.

Leveraging the University's research strengths, you have the flexibility to tailor your learning to your professional interests with the choice of four specialisations:

- Engineering
- Biosecurity
- Ecology
- Transport

You will undertake an industry-based capstone project. A research pathway is also available.

Specialisations

Engineering

Modern day infrastructure is growing more interconnected. For example, roads are reliant on power systems which are dependent on data networks and so on. This specialisation will enable you to analyse the dynamics of cascading failures in such interconnected systems and develop prevention and intervention strategies across a diverse range of industries, under different demand and stress levels, and in various component failure and human error scenarios.

You could apply your expertise as a systems engineer or architect, vulnerability analyst, or research and development manager within integrated logistics support, business process re-engineering analysis, hardware-software integration in cyber-physical systems, or crowd dynamics management.

Biosecurity

In this specialisation you will learn how to use computational forecasting tools in predicting and estimating epidemic dynamics, triggered by infectious diseases and bioterrorism. You will also learn how to quantify the effectiveness of prevention, mitigation and crisis management approaches.

As a biosecurity analyst you could contribute to improved quality of prevention and containment strategies, provide policy advice and analysis, or explore modern systems biology and biotechnology.

Ecology

Small changes can trigger strong or even catastrophic responses in the Earth's climate or ecosystem dynamics. This specialisation will help you develop and use early-warning indicators combined with dynamic modelling to quantify the effects of disruption on the management of water and environmental resources, and develop effective risk reduction policies.

As a system ecology scientist, environmental engineer or consultant, or geographical information systems analyst, you could apply your expertise in areas such as the design and management of sustainable resilient landscapes, greenhouse gas mitigation economics, habitat modelling for environmental conservation or the design of market-based instruments for environmental management.

Transport

Fragile transportation system hubs can become overloaded and vulnerable to disruptions. In this specialisation you will learn to design intelligent and adaptive transport services, as well as use real-time data to analyse human behaviour and dynamic transport patterns.

You will also explore innovative predictive analytics and dynamic load sharing to help increase the efficiency and resilience of modern transport systems and avoid transport failures and traffic congestion. You could apply this expertise in transport and logistics engineering or consulting, as an infrastructure planner or urban and regional planner.

Course duration

2 years full time

Depending on your professional experience and/or the level and type of your prior studies, you may be eligible for recognition of prior learning. This will reduce the length of your degree.

Admission requirements

Applicants require:

- a recognised bachelor's degree with a minimum credit average in a quantitative discipline such as engineering, computer science, information technology, mathematics, statistics, transport, physics, business or finance, or
- any honours degree from the University of Sydney, or
- a Graduate Diploma in Complex Systems from the University of Sydney with a credit average, or
- qualifications deemed equivalent by the University.

More information

View detailed information including units of study at sydney.edu.au/courses/master-of-complex-systems

Or contact us

sydney.edu.au/ask

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