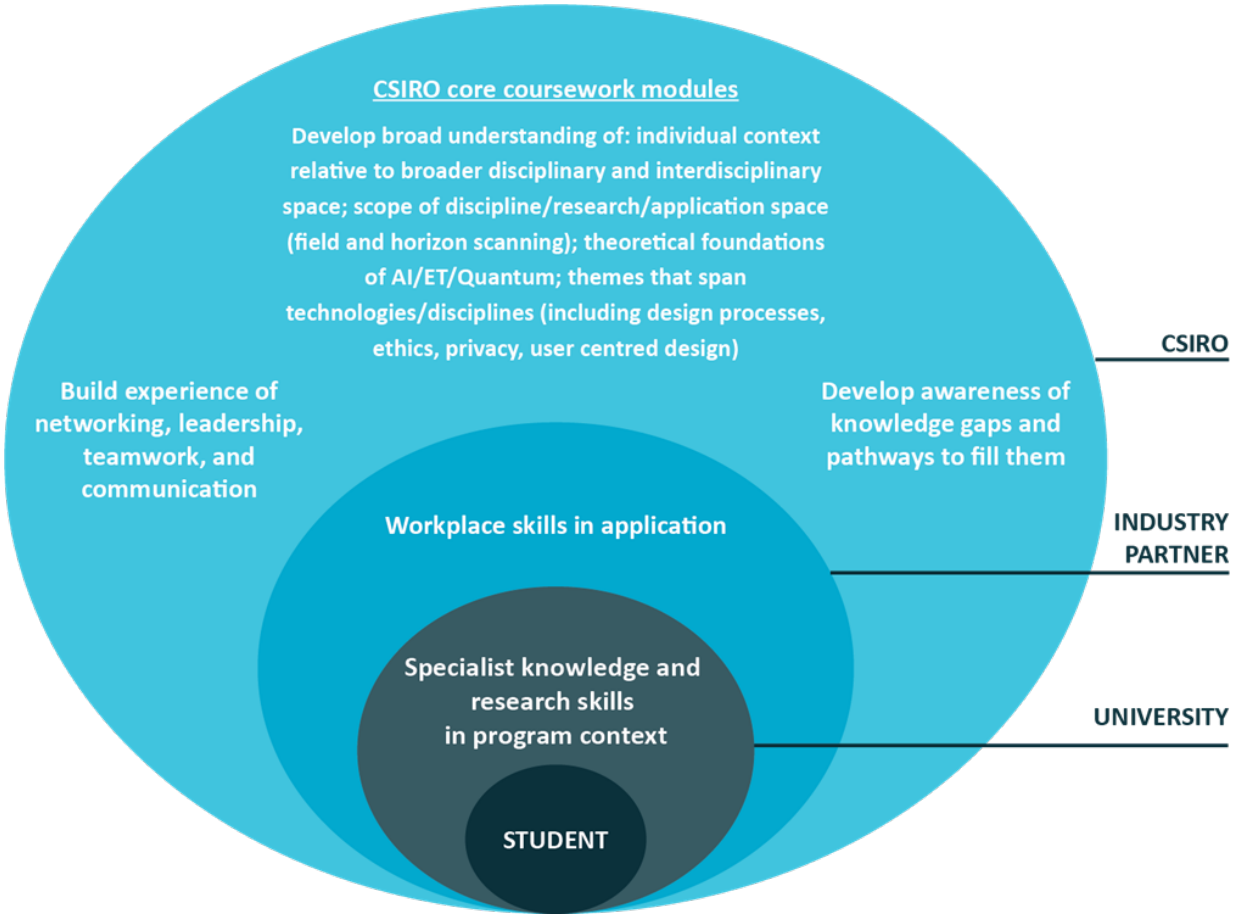
Next Generation Graduates Program (NGGP) Coursework Overview

May 2024

About NGGP

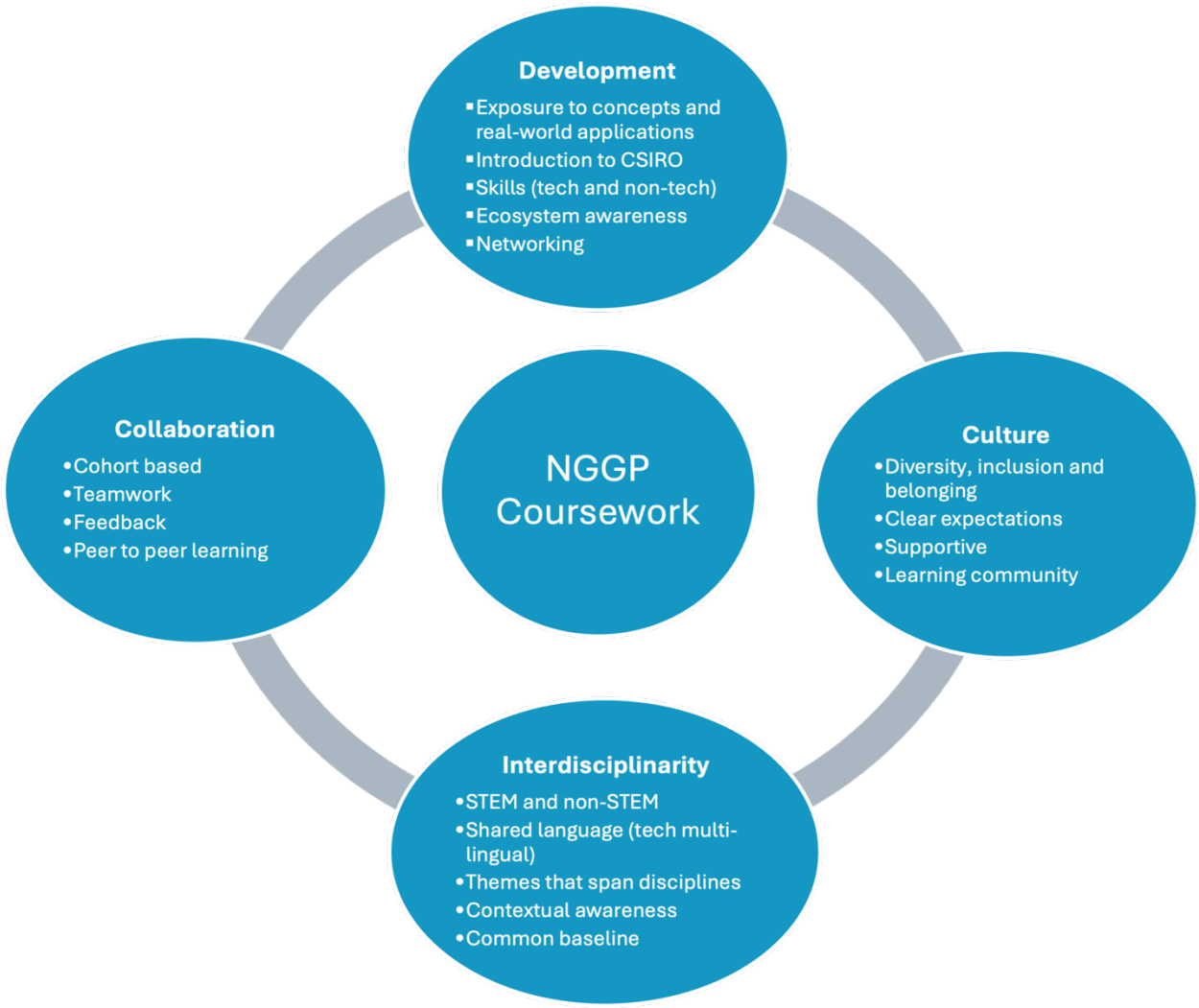
The Next Generation Graduates Program (NGGP) is a cohort-based, industry driven, multi-disciplinary graduate training program. PhDs, MPhils, Masters and Honours students will undertake coursework and in-depth training, providing them with a comprehensive understanding of problem-based environments in industry. They will explore trends in AI, Emerging Technology and Quantum, while cultivating entrepreneurial and innovative thinking required to thrive in a dynamic and fast-moving space.

The NGGP framework



Purpose

The purpose of NGGP Coursework is to build collaborative, interdisciplinary, industry-focused cohorts of individuals who are aware of where they sit within the ecosystem of technology development. It will provide students with unique opportunities to engage with a broad range of topics, themes, and research domains.



Based upon feedback and continuous improvement, the NGGP Coursework Overview may be updated from time to time.

Coursework Modules

While undertaking the following four modules, participants will complete an independent, in-depth project about their own research and industry context.

Data Centric Engineering

The development of AI and emerging technology systems in the real-world requires dealing directly with complex, heterogeneous, multimodal, and disorganised data. The implementation and deployment of these systems involves challenges which can only be tackled in a principled manner by following best practices from an engineering perspective – allowing efficient processing of large and incomplete datasets, deploying robust code, and scaling the processing capabilities in the cloud.

This unit integrates fundamentals from data science and engineering: It introduces basic data structures and data modelling, discusses techniques of data pre-processing, and analyses real-world datasets. Students will be exposed to a range of data intensive applications, and gain experience using practical tools, engage in collaboration activities and live workshops. From an engineering perspective, this unit covers the most significant data-engineering concepts and principles, such as DevOps, site reliability engineering, cloud services, and engineering design patterns.

Ethical Technology: Designing with Purpose

Emerging technologies and AI are already having an impact in the world around us, with governments and large corporations deploying systems which affect us directly. Developing and implementing AI-based solutions to real-world problems involves thinking out of the box, combining innovative ideas and tools while maintaining a user centred design and aligning with ethical frameworks.

This unit provides breadth of knowledge that will allow students to familiarise with moral dilemmas involved in socio technical systems – while keeping track of latest techniques, frameworks and building a viable roadmap for AI and emerging technology projects. Students will be guided by industry specialists and guest speakers to apply these concepts (with other fields of learning) in a debate and a series of live workshops. Student will discuss how their projects are aligned with AI ethical frameworks.

Foundations of Deep Tech

Artificial intelligence and emerging technologies are increasingly prevalent and changing the world we live in. The foundations of current AI innovations date back to the early 1900s: an understanding of this history and the theoretical foundation of AI is crucial to responsible practice in AI development. Familiarity with the scope of technology development in this space is also crucial to building interdisciplinary networks that drive innovation.

This unit provides a historical overview of the development of AI and its theoretical foundations, surveys the scope of application in society, and explores current trends and future directions.

Students will explore themes around safety that span technologies, including cybersecurity, data privacy and ethics, before taking a deeper dive into the range of emerging technologies including developments in hardware, blockchain, IoT, robotics, augmented and virtual reality and immersive analytics.

Advanced AI/Emerging Technologies

Machine learning has gained traction as a powerful solution to complex problems using data. This unit covers both probabilistic machine learning, in which quantities of interest are represented as random variables, and deep learning, which uses neural networks to learn from large amounts of data. Probabilistic machine learning provides a framework for quantification of uncertainty – a crucial component for decision making in unstructured and stochastic environments, by developing a strong link between statistics and computer science.

This advanced unit covers the core aspects of probabilistic machine learning, including modelling, inference and decision making, providing an overall understanding of the general framework used in realistic scenarios.

The rise of neural networks as a flexible modelling tool, combined with powerful optimisation routines in high dimensional spaces, has resulted in an explosion of advanced computer vision and natural language processing, revolutionising many domain applications. Deep learning models are present throughout the internet and are responsible for search optimisation, recommender systems, image search and categorisation, language translation, and generative models among many others.

This unit covers the structural components of any computational system which uses deep learning, diving deeper into specific model structures that have recently proved very successful in specific applications, such as convolutional neural networks, recurrent neural networks, and transformers.

Throughout the module, students will engage in several collaboration activities and workshops to explore these ideas with their cohort and subject-matter specialists.

PhD and Master of Philosophy (MPhil) Students

PhD and MPhil students will complete up to 11 weeks of learning in total, with online content complemented by some in person opportunities to come together as cohort. The program design is 'flipped' in delivery, allowing students to watch guest lectures and complete activities asynchronously on the online Learning Management System, they then come together for facilitator-led synchronous sessions and workshops to further consolidate learning and to provide opportunities for peer-to-peer learning.

While some assessments (e.g. project tasks, quizzes and presentations) are included, completion of modules will not depend on graded assessment tasks, but on undertaking the learning with genuine engagement and participation. Students must complete the NGGP Coursework to the satisfaction of CSIRO.

Students will complete all four modules within **18 months** of commencement:

Begins February each year **5 weeks in total for 2 modules** **24 hours a week of learning content**	✚	**Begins April each year** **6 Weeks in total for 2 modules** **18 hours a week of learning content**
• Data Centric Engineering		• Foundations of Deep Tech
• Ethical Technology: Designing with Purpose		• Advanced AI/Emerging Tech

Masters and Honours Students

Masters and Honours students are required to complete two modules during their candidature:

Run in November each year **up to 4 weeks in total for 2 *modified* modules** **Up to 20 hours a week of learning content (asynchronous and live)**
*Data Centric Engineering
*Ethical Technology: Designing with Purpose

Masters and Honours Students will engage with components of the module content online and have opportunities to come together for live sessions. The delivery methodology for this cohort is tailored to meet the students' needs and is more industry focused and designed to enhance their professional development, and does not include assessment tasks. This prepares the students to transition into organisations where they can apply their skillsets with confidence.

Students must complete the NGGP Coursework to the satisfaction of CSIRO.