



## Bachelor of Games and Virtual Worlds (Programming)

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# Information for Prospective Students

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# Welcome

## Background to the course

This program will provide you with skills in computer game / simulation design and programming. You will create interactive 2D and 3D computer games for entertainment and serious real life scenario visualisation (virtual worlds). You will also learn how to research the market, develop business concepts and manage computer game/simulation development projects. This Canberra Institute of Technology (CIT) Degree program course is taught in partnership with the Academy of Interactive Entertainment (AIE).

## Delivery Mode

Six semesters full-time (approx. 39 hours per week) **OR** four semesters full-time and four semesters part-time equivalent (approx. 20 hours per week). The program will be delivered in a mixture of online activities through Canberra Institute of Technology (CIT) at Reid (CIT e-learn) and face-to-face activities at the Academy of Interactive Entertainment (AIE) campuses (Currently at Watson (ACT) and Melbourne campuses; with the addition of the Sydney campus awaiting approval).

Subjects taught by CIT are delivered using an online learning environment (CIT e-learn, currently based on Moodle) which provides instructional lecture slides and required readings, electronic discussion forums, details of assessment items and links for their submission. CIT uses Internet conferencing sessions (Virtual classroom, currently Adobe Connect), to provide live weekly tutorial sessions for each subject so that students can ask questions and receive immediate answers and feedback from lecturers. Also, CIT lecturers provide a face-to-face Introductory Workshop (in the early weeks of the semester) and a Revision Workshop (later in the semester) at each AIE campus. Additionally all Students and lecturers have electronic mail facilities for individual interaction.

In the first four semesters all AIE subjects at all AIE campuses are delivered in a face-to-face computer laboratory environment. Subjects are delivered holistically in a simulated work/ team environment with lecture, tutorial and practical activities being seamlessly integrated into a two and a half day a week, 9:00am to 5:00pm contact period. Semesters five and six AIE subjects are all delivered using an online learning environment (currently based on Moodle).

## Job Opportunities

Because you will be a highly competent analyst and programmer you can expect your skills to be in high demand across the whole computing employment spectrum. You will have programmed computer interfaces, databases and networks, and have used state of the art software and equipment. Your specialized skills in games and virtual worlds will make you a particularly attractive potential employee as a 3D Games Programmer or Simulation Software Engineer.

## Entry Requirements

You must:

- have an ACT Year 12 Certificate, or equivalent; including at least a major (110 hours) in Mathematics Methods or Specialist Mathematics, and English major; or NSW Mathematics and English (Advanced)
- OR be of mature age with relevant work or other practical experience
- OR have successfully completed the *Advanced Diploma of Professional Games Development (Software Development)* or the *Diploma of Information Technology (Software Development)* AND the approved bridging program;

You must have basic computing skills including being able to operate a personal computer, other hardware (for example printers, games consoles, PDAs etc), create and manage basic files, perform simple operating system tasks and work with more than one standard software package such as word processing, spreadsheets, databases or web browser. (If you do not have these skills you may enrol into the *Certificate II in Information Technology*.)

If you are from a culturally and linguistically diverse background, and are using English as a second language (both oral and written), you must have English skills equivalent to ASLPR Level 3, or IELTS 6, or Cambridge Proficiency 0 Level English, or TOESL equivalent.

### Additional Selection Information

Recommended studies: ACT: Specialist Mathematics (major/minor); NSW: HSC Mathematics Extension 1

All applicants must submit a Personal Statement and attend an interview.

At interview, the applicant must demonstrate:

- an understanding of programming
- a coding example
- past group work
- computer use proficiency
- an aptitude for learning programming
- communication ability
- an understanding of what programming involves

## Subject Summaries

### First Semester

#### Software Development 1

On completion of this subject students will be able to apply basic programming and problem solving skills in a 3<sup>rd</sup> generation object-oriented programming language (such as the syntax of C++). They will have an understanding of fundamental data types and how they are stored in memory, control structures, arrays, pointers, memory management and basic functions contextualized by real time applications. The students will also have a basic understanding of related concepts in a procedural language (such as C), compilers, managing multiple source files, variable and function scope considerations, using pseudo code to design applications and recognising common errors.

Prerequisite: Nil

#### Introduction to information technology practice

On completion of this subject students will have developed working knowledge of a variety of software scripting languages and the supporting user documentation. The students will also have developed underpinning calculus skills related to computer programming, and have an understanding of the concepts of ethics and codes of conduct in the computer games industry.

Prerequisite: Nil

#### Maths for Games and Simulation Programming 1

On completion of this subject, students will be able to apply linear algebra and vector spaces to calculate angles and distances between game objects. Matrix mathematics is introduced to calculate 2D dimensional transformations for motion, simple geometry creation and orthogonal, multi-view, axonometric and oblique projections. The subject also covers Boolean logic, linear interpolation, 2D physics formulas, 2D collision detection and resolution and basic math for artificial intelligence.

Prerequisite: Nil

#### Introductory Data Structures and Algorithms

On completion of this subject students will be able to use static and dynamic multiple dimension arrays, reading from / writing to common data file types (text, binary and XML) and create new data types using structures. They will also be able to apply knowledge of compilers and pre-processors, function design, function overloading, function pointers and design of algorithms for accessing and manipulating data in structures covered in this subject. Students will also learn the importance of concurrent version control for larger projects.

Prerequisite: Nil

### Introduction to research and academic writing

CIT and AIE have included this subject, to be undertaken in the first 5 weeks of semester 1, to refresh or enhance the student's ability to undertake research and write academic papers at the required level. After completing this subject a student's progress is monitored in subsequent semesters to ensure that the desired English level is either maintained or improves. If any subsequent problems are identified then the student is counselled and appropriate remedial action is explored with the student.

Prerequisite: Nil

## Second Semester

### Software Development 2

On completion of this subject a student will be able to demonstrate a deeper understanding and competence in object oriented programming in a 3<sup>rd</sup> generation language ( such as c++), compared to a 4<sup>th</sup> generation language (such as C# ). Students will also understand encapsulation, polymorphism, selective in-lining and basic design patterns, including singleton, abstract factory, factories, to design and develop real time applications.

Prerequisites: Software Development 1; Introduction to IT Practice

### Advanced Data Structures and Algorithms

Students explore and learn to implement advanced data structures such as linked lists, stacks, queues, finite state machines, trees, hash tables and graphs. Students also learn to design and implement algorithms used for dealing with inserting, traversing, deleting, merging and sorting of simulation program assets plus algorithms for compression/ decompression and encoding / decoding. Efficiency and complexity of data structures and algorithms and appropriateness for various simulation applications are addressed as well as the importance of concurrent versioning.

Prerequisites: Software Development 1; Introductory Data Structures and Algorithms

### Virtual World Development

On completion of this subject a student will be able to demonstrate knowledge and competence in communicating acquired data, for simulations, games or scientific research, in a meaningful way using visual and aural output. Topics covered include data analysis, balancing functionality and graphics, human computer interfaces, image formats and alpha blending, user interface integration, frame independent movement, sound integration, cross platform programming libraries, 2D artificial intelligence and 2D particle systems.

Prerequisites: Software Development 1; Introduction to IT Practice; Introductory Data Structures and Algorithms; Maths for Games and Simulation Programming 1

## Development Life Cycles

On completion of this introductory subject, the student will have developed an understanding of the elements of computer program development life cycles covering the eight basic project management elements and multidisciplinary teams. The student will also be able to describe the various development methodologies and introductory risk management theories.

Prerequisite: Nil

## Third Semester

### Graphics and Simulation Programming

On completion of this subject students will be able to program advanced computer graphics and simulation models. These include procedural mesh and animation generation, lighting and shadow calculations, shader programming and particle system modelling. Students will also develop an understanding of geometry culling, optimisation techniques and camera handling techniques. The subject also surveys artificial intelligence techniques, theories, and applications including: knowledge representation, navigation, decision making and machine learning.

Prerequisites: Virtual World Development; Advanced Data Structures and Algorithms; Software Development 2

### Games and Simulation Middleware

This subject focuses on real time application development using middleware and software development kits to look at the features and constraints of commonly used middleware. On completion of this subject students will be able to demonstrate an understanding of middleware architecture and development tools, the process of assessing the feasibility of suitable middleware for an application, and the implementation into real time applications using the appropriate level of fidelity. Resource loading, positioning and orienting for simulations and the complexities of communication between various middleware and API is explored through the development of an exporting tool for a 3D modelling package and creating and importing module for a project.

Prerequisite: Advanced Data Structures and Algorithms

### Maths for Games and Simulation Programming 2

On completion of this subject a student will understand 3D spaces, coordinate systems, homogenous coordinates. They will also be able to use vectors, matrices and quaternion (4D mathematics) for 3D graphics programming, entity translation, collision detection, physics and artificial intelligence.

Prerequisite: Maths for Games and Simulation Programming 1

### Project Architecture 1

On completion of this subject, the student will be able to gather requirements from clients, undertake systems analysis, confirm the requirements and then model these using Universal Modelling Language (UML) as a development methodology.

Prerequisite: Development Life Cycles

## Fourth Semester

### Applied Development Project

On completion of this subject students will be able to apply the theories of game design in a multidisciplinary team environment by taking a game from the conceptual stage, to a completed project, within a specified time frame. Students will continue the exploration of game theory by discussing and demonstrating how it is applied to production based projects. Students will leave this subject with an extension of good game design as a completed project that demonstrates their understanding of the topic.

Prerequisites: Maths for Games and Simulation Programming 2; Graphics and Simulation Programming

### Game Design

On completion of this subject a student will be able to integrate all the component elements to produce a professional game design and game pitch. It incorporates storyboarding, level design, user interface design, program and development tool architecture theory, user learning curves, game balancing, prototyping core game play and play testing. The subject provides exposure to the challenges of working in a multidisciplinary team including, team building, asset and code management, converging ideas to form and present a single, clear game concept.

Prerequisite: Games and Simulation Middleware

### Professional Practice 1

On completion of this subject student will be able to discuss the structural design of various sized game programs and the impact game features have on the program components developed. Students will be able to analyse games and game play elements, simulation types, examine genres and trends in gaming plus social and business issues and pressures related to gaming. They will be able to make presentations and will develop interview techniques, writing skills for applications and portfolio user documentation, and understand career stream options.

Prerequisite: Nil

### Project Architecture 2

On completion of this subject students will have an understanding of the theoretical and practical issues involved in the software development environment, including quality system design; disaster recovery; privacy; copyright and software system testing.

Prerequisite: Project Architecture 1

## **Fifth Semester**

### **Software Development 3**

On completion of this subject the student will have an in-depth understanding of database connectivity, network architecture, security and cryptography as well as internet content and copyright in the context of game and simulation development.

Prerequisite: Software Development 2

### **Preparation of Final Project Business Case**

On completion of this subject, students will be able to make a sound business decision to proceed with the development of a low level module of a game engine. The student will research the latest technologies and decide on a module that is required for an existing game engine. The business case will be accompanied by a presentation applicable to an investment board decision on whether to proceed with an implementation.

Prerequisites: Applied Development Project; Game Design

### **Application Testing and Metrics**

On completion of this subject students will be able to design and apply testing theories to computer games development. Students will be able to explain how testing is implemented and what processes are used in a project to integrate these. Students will be able apply sound information architecture and web usability principles when using web based programming to design computer games programs, and use metrics to measure these.

Prerequisite: Project Architecture 2

### **Professional Practice 2**

On completion of this subject, students will be able to correctly identify and handle the rights of others and themselves in terms of ethics, intellectual property, marketing and business practices. They will understand common approaches for marketing a product and assessing business risks. This subject reviews and extends a student's understanding of ethics and widens the focus from the games programming and reality simulation industries to the role of the professional within society and the law. Issues of copyright, patents and trade secrets are introduced. An overview of game packaging and marketing activities is presented, and the recognition, quantification and responses to business risk are explored.

Prerequisite: Professional Practice 1

## Sixth Semester

### Software Development 4

On completion of this subject students will be able to apply specific high-end concepts to games programming technology and techniques. Students will also be able to demonstrate an awareness of emerging technologies and apply one or more to create a simulation (design and code fragments) to illustrate a novel application of the concept.

Prerequisite: Software Development 3

### Project Architecture 3

On completion of this subject the student will be able to investigate, analyse and compare various development methodologies such as Agile and SCRUM and their application to a games development project.

Prerequisite: Project Architecture 2

### Final Project (Double length Subject)

On completion of this subject students will have fully developed and implemented the concept developed in *Preparation of Final Project Business Case* subject. This subject is a capstone subject that draws together and assesses the skills and knowledge developed by the students throughout the program.

Prerequisites: Software Development 3; Preparation of Final Project Business Case; Professional Practice 2

## Degree Schedule

### Full-time course option

#### First Year

Semester 1	Software Development 1 (AIE)	Introduction to IT Practice Introduction to Research and Academic Writing (CIT)	Maths for Games and Simulation Programming 1 (AIE)	Introductory Data Structures and Algorithms(AIE)
Semester 2	Software Development 2 (AIE)	Advanced Data Structures and Algorithms (AIE)	Virtual World Development (AIE)	Development Life Cycles (CIT)

#### Second Year

Semester 3	Graphics and Simulation Programming (AIE)	Games and Simulation Middleware (AIE)	Maths for Games and Simulation Programming 2 (AIE)	Project Architecture 1 (CIT)
Semester 4	Applied Development Project (AIE)	Game Design (AIE)	Professional Practice 1 (AIE)	Project Architecture 2 (CIT)

#### Third Year

Semester 5	Software Development 3 (CIT)	Preparation of Final Project Business Case (AIE)	Professional Practice 2 (CIT)	Application testing and Metrics (CIT)
Semester 6	Software Development 4 (AIE)	Final Project (AIE & CIT)		Project Architecture 3 (CIT)

## Part-time course in Third Year

Please note that due to the immersive and integrated delivery in a team environment, the first two years must be undertaken full-time. The third year may then be undertaken part-time.

### First Year

Semester 1	Software Development 1 (AIE)	Introduction to IT Practice Introduction to Research and Academic Writing (CIT)	Maths for Games and Simulation Programming 1 (AIE)	Introductory Data Structures and Algorithms(AIE)
Semester 2	Software Development 2 (AIE)	Advanced Data Structures and Algorithms (AIE)	Virtual World Development (AIE)	Development Life Cycles (CIT)

### Second Year

Semester 3	Graphics and Simulation Programming (AIE)	Games and Simulation Middleware (AIE)	Maths for Games and Simulation Programming 2 (AIE)	Project Architecture 1 (CIT)
Semester 4	Applied Development Project (AIE)	Game Design (AIE)	Professional Practice 1 (AIE)	Project Architecture 2 (CIT)

### Third Year (Part-time)

Semester 5	Software Development 3 (CIT)	Professional Practice 2 (CIT)
Semester 6	Software Development 4 (AIE)	Project Architecture 3 (CIT)

### Fourth Year (Part-time)

Semester 7	Preparation of Final Project Business Case (AIE)	Application testing and Metrics (CIT)
Semester 8	Final Project (AIE & CIT)	

## Pathway from the AIE Advanced Diploma of Professional Game Development (Software Development) to the Degree

First Year (AIE Advanced Diploma Full-time)

<b>Semester 1</b>	(Advanced Diploma Full-time study)
<b>Semester 2</b>	(Advanced Diploma Full-time study)

Second Year (AIE Advanced Diploma Full-time)

<b>Semester 3</b>	(Advanced Diploma Full-time study)
<b>Semester 4</b>	(Advanced Diploma Full-time study)

After successful completion of the AIE Advanced Diploma of Professional Game Development (Software Development Major), you may enter the Bridging Course.

Third Year (Bridging Course Part-time)

<b>Semester 5</b>	<b>Introduction to IT Practice Introduction to Research and Academic Writing (CIT)</b>	<b>Project Architecture 1 (CIT)</b>
<b>Semester 6</b>	<b>Development Life Cycles (CIT)</b>	<b>Project Architecture 2 (CIT)</b>

After successful completion of the Bridging Course, you may then enter the final year of the Degree.

Fourth Year (Part-time) or can be merged with the Fifth Year to form a final full-time year of study.

<b>Semester 7</b>	<b>Software Development 3 (CIT)</b>	<b>Professional Practice 2 (CIT)</b>
<b>Semester 8</b>	<b>Software Development 4 (AIE)</b>	<b>Project Architecture 3 (CIT)</b>

Fifth Year (Part-time)

<b>Semester 9</b>	<b>Preparation of Final Project Business Case (AIE)</b>	<b>Application testing and Metrics (CIT)</b>
<b>Semester 10</b>	<b>Final Project (AIE &amp; CIT)</b>	

## Pathway from the CIT Diploma of Information Technology (Software Development) to the Degree

Please note – the CIT Diploma of Information Technology (Software Development) may also be undertaken in part-time mode.

First Year (CIT Diploma Full-time)

<b>Semester 1</b>	(Diploma Full-time study)
<b>Semester 2</b>	(Diploma Full-time study)

Second Year (CIT Diploma Full-time)

<b>Semester 3</b>	(Diploma Full-time study)
<b>Semester 4</b>	(Diploma Full-time study)

After successful completion of the CIT Diploma of Information Technology (Software Development), you may then enter the Bridging Course.

Third Year (Bridging Course Full-time for 6 months)

<b>Semester 5</b>	
<b>Semester 6</b>	Six (6) month immersive full-time (5 days a week, 9:00am to 5:00pm) Intensive Games Programming Team workshop (AIE)

After successful completion of the Bridging Course, you may then enter the final year of the Degree.

Fourth Year (Part-time) or can be merged with the Fifth Year to form a final full-time year of study.

<b>Semester 7</b>	<b>Software Development 3 (CIT)</b>	<b>Professional Practice 2 (CIT)</b>
<b>Semester 8</b>	<b>Software Development 4 (AIE)</b>	<b>Project Architecture 3 (CIT)</b>

Fifth Year (Part-time)

<b>Semester 9</b>	<b>Preparation of Final Project Business Case (AIE)</b>	
<b>Semester 10</b>	<b>Final Project (AIE &amp; CIT)</b>	