IT6034 Course Design

*IT6034 Game Development*

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# Reason for New Course / Change to Course

NZQA’s reviewed ICT qualifications, in particular:

[2604 New Zealand Diploma in Software Development (Level 6)](http://www.nzqa.govt.nz/nzqf/search/viewQualification.do?selectedItemKey=2604)

# Course Requirements

## NZQA Requirements

This course is designed to meet the following Graduate Profile Outcomes:

GPO1. Analyse requirements, design and document software solutions for a range of problems in an organisational context. (LO4, 5)

GPO2. Write and maintain programs using design patterns, data structures and algorithms to meet specifications. (LO1, 2, 3)

GPO3. Apply a range of software quality assurance techniques to verify correctness of systems. (LO5)

GPO4. Apply data management and storage technologies to support the software application and the development process. (LO4)

GPO6. Choose, justify and apply architecture, technologies, and tools, to implement the software solution (LO6)

## CPP Course Descriptor

(Suggested changes to programme document, these need to be approved by the programme committee)

### Aim

To give students knowledge and skills of using another programming language and framework to enable them to build a game application, including game design, scripting, development and testing. (Suggested update)

### Learning outcomes

LO1. Write code using object oriented approach and inspect the strengths and weaknesses of object oriented and functional approaches in game development (Suggested update)

LO2. Design and write programs considering appropriate design patterns and following applicable software development standards

LO3. Analyse and apply software optimisation concepts and techniques

LO4 Design and implement application data access, management, and storage technologies appropriate to game development.

LO5. Research and implement core software development practices as they apply to game development

### Assessment schedule

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Weight** | **Pass Criteria** | **Learning Outcomes** |
| Practical Tasks | 20% | Pass/Not achieved | LO1-3 |
| Project | 70% | 50% | LO 1-5 |
| Research | 10% | 50% | LO 1, 5 |

# Assessment

*High-level outline of each Assessment item. Focus on how the assessment items will enable the students to demonstrate that they have met the learning outcomes.*

## Summative Assessment: Practical Tasks (20%)

Suggested having two sets of practical tasks.

1. First set will test their C# syntax knowledge, specifically implementing OO concepts in C#. This task will be done in Visual Studio and will have students to program a solution for a specific scenario. Students will need to use C# programming language in Visual Studio, specifically variables, comparison operations, loops, lists and arrays, functions and parameters, OO concepts.
2. The second set of tasks will test students’ practical application of the design patterns. Students will be presented with a working code/game and ask to modify its code where appropriate to use the specific design patterns.

List of tasks could include one or more of the following:

* Appropriate use and application of Singleton Design Pattern
* Appropriate use and application of Factory Design Pattern
* Appropriate use and application of Object Pool Design Pattern

1. In the third set of practical tasks, students will be given a simple game prototype and asked to perform optimisation of the Game objects’ scripts.

## Summative Assessment: Project (70%)

Throughout the Game Development course individual students will design and implement a game prototype to demonstrate knowledge of the game development environment and implement core software development practices as they apply to game development. This will involve requirements analysis, concept decision making, collaboration with peers, production of a design document, prototype development and testing as well as presenting their prototype and describing their experience to their peers.

**Part 1 – Project Design**

This assessment forms the first part of an ongoing project that runs throughout the Game Development course.

* **Task 1**: Analyse game requirements and generate a general game idea
* **Task 2**: Design a game based on the game requirements and a general game idea
* **Task 3**: Document your game’s design by providing a one-page overview of the game and a ten-page design document. Include only relevant information for your game and be as detailed as possible. At the very minimum a ten-page design document should include title page, game outline, character description, gameplay, game world description, game experience, gameplay mechanics.

**Part 2 – Project Execution**

This is a second part of an ongoing project that runs throughout the Game Development course.

This part will test student’s skills in building a game prototype based on the design document created in the previous part of the assessment. Students will also be expected to test the solution created and include appropriate documentation on the work completed, collaboration occurred and testing conducted.

* **Task 1**: Create new Unity project
* **Task 2**: Create required scenes within the project
* **Task 3**: Create prefabs used in the prototype levels 1 and 2
* **Task 4**: Add appropriate game objects to each scene
* **Task 5**: Set up game objects behaviour by adding C# scripts to the game objects
* **Task 6**: Create test plan with test cases documenting expected testing results
* **Task 7**: Test the game prototype documenting testing result outcomes against the expected results.
* **Task 8**: Record and troubleshoot the bugs found through initial testing and resolve any issues
* **Task 9**: Record updates to the game design document if any concept changes occurred

**Part 3 – Project Presentation**

This is a third part of an ongoing project that runs throughout the Game Development course.

First is a presentation of the game prototype. Students spend 5-10 minutes presenting the game prototype, outlining their game idea, describing what challenges they faced and what changes they had to make to the game design. They should also explain their design decisions in regards to UX and changes they had to make to the game prototype based on the user testing outcome. After this part of the presentation is done, other presenters play the game and leave their feedback.

## Summative Assessment: Research Presentation (10%)

This is a small group task presenting one of the topics on emerging game technology. Students may select one of the topics below, or, choose the topic of their liking, if tutor approved.

* VR vs AR vs MR
* How Augmented Reality (AR) could benefit our lives
* How Virtual Reality (VR) could benefit our lives
* Game Development industry in New Zealand
* Overview and comparison of the game engines
* Why we play (Ludology)

## Formative Assessment

Three workshops:

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Tutor Involvement** | **Workshop Length** | **Description** |
| Game design lab | 1 hour:   * 0.5 hours: setting the task * 0.5 hours: discussing the resulting design and documentation | 4-5 hours | A collaborative game design creation. Students will need to come up with a game idea based on the game requirements given. Students then required to build on that idea and create one page game outline and a ten-page design document. Students will have to come up with game label, game outline, character description, gameplay and game world description, describe game experience, gameplay mechanics and any other additional features applicable to the game. |
| Creating game prototype lab | 2 hours:   * 0.5 hours: setting the task * 1 hour: answering questions, guiding, facilitating * 0.5 hours: discussing the resulting game prototype | 5 hours | A collaborative game prototype creation. Students asked to develop a game prototype based on the ten-page game design document provided. The result of the workshop should be fully functional one level prototype of a game.  Students will need to assign tasks to group members as a team, where each group member works on one prefab creating its appearance and behaviour. One team member will work on creating level world and will later add prefabs to the project and the game objects to the world.  Students will then need to user test the prototype and troubleshoot any issues found. |
| VR lab | 3-4 hours | 3-4 hours | This workshop could vary based on the VR set we will get. Students will play and review some VR games. They will also have a chance to modify the existing VR game in development and test the changes made. This workshop is done after student have studied the Introduction to VR module in iQualify. |

# Course Structure

## Course Outline

Welcome to the IT6034 Game Development course.

In this course you will learn the principles of game design and development with the Unity game engine and will obtain the skills to use common game development tools and technologies. You will also learn about different phases of game development including testing using different game testing techniques. While learning about game development you will learn the basics of the C# programming language and coding using common design patterns.

When becoming a Game Programmer, you will learn best by doing. In this course you will have an opportunity to develop game converting a game idea into a working game prototype. You will come up with a game design, create game scenes, add different game objects to the scenes and add behaviour to the objects using scripting in the C# programming language. At the end of the course you will have a game prototype which you can develop into a finished product to include in your portfolio.

## Learning Activities

*Outline which learning activities will help students to develop skills, knowledge and attitudes required for the formative and summative assessments.*

* **Practical activities** throughout the course – for students to practice learned material and test their understanding of game development environment and concepts.
* **Self-assessments** at the end of each module for students to assess their understanding of the material studied, review specific topics based on the self-assessment results and ask tutor help on the areas where more explanation is required.
* **Tutor-led workshops** on difficult concepts to ensure students have proper understanding (at tutor’s discretion)
* **Tutor-led group workshops** to prepare students for the project tasks and give students an opportunity to collaborate and share ideas and skills at different stages in game development process

## Content

This course includes the following modules:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Module** | **Weight**  **(credits)** | **Content hours\*** | **LO** | **Content, Notes** | **Who** | **Status** |
| The basics of Game Design |  | 2 | LO5 |  |  |  |
| Unity Environment |  | 4 | LO4, 5 |  |  |  |
| Scripting with C# |  | 2 | LO1, 2 |  |  |  |
| Optimisation techniques |  | 2.5 | LO1, 2, 3 |  |  |  |
| Game Testing |  | 1.5 | LO1, 5 |  |  |  |
| Introduction to VR |  | 2 | LO1,5 |  |  |  |
| Game Deployment |  | 1 | LO5 |  |  |  |

## Learning Objectives of Modules

**Module:** **The Basics of Game Design**

* Identify roles in the game development team
* Describe tasks in game development
* Design for the best User Experience
* Identify Game Design Document components and Select Design Layout
* Create Game Design Document appropriate for the game

**Module:** **Unity Environment**

* ENVIRONMENT OVERVIEW
  + Install Unity
  + Create new Unity 3D project
  + Customise the Unity interface
  + Identify Different components of the Unity Editor
  + Explain the benefits of the Asset Store
* SETTING UP GAME OBJECTS
  + Differentiate GameObjects by their appearance
  + Identify GameObjects within a scene
  + Create a Prefab and add Game Objects to the scene based on the prefab created
  + Create materials and apply them to the Game Objects
  + Create terrain

**Module: Scripting in C#**

* C# BASICS
  + Identify different components of the Visual Studio IDE
  + Create and modify projects in the Visual Studio IDE
  + Understand basic C# language syntax and employ good coding practices
  + Create and use C# data types
  + Understand and use control structures for branching and looping
  + Break solution into classes and methods
* SCRIPTING IN UNITY
  + Understand Source Control options
  + Use C# Syntax to create new scripts
  + Attach scripts to game objects
* DESIGN PATTERNS
  + Apply Singleton Design Pattern
  + Apply Factory Design Pattern
  + Apply Object Pool Design Pattern
  + Apply Design patterns in game development
  + Refactor code using design patterns

**Module: Optimisation Techniques**

* Understand specifics of game optimisation
* Evaluate the effectiveness of the code fragment
* Utilise common optimisation techniques to optimise game object scripts

**Module: Game Testing**

* Identify Game testing types and methods
* Test driven design (TDD)
* Apply Game Testing techniques to test a game prototype

**Module: Introduction to VR**

* Compare different VR hardware
* Recognise the differences in designing for VR
* Design a simple VR game

**Module: Game Deployment**

* Prepare a game for deployment
* Develop for different platforms (e.g. Rift vs Gear VR)
* Investigate deployment options in Unity
* Deploy game to different platforms

# Design Decisions

* **Unity** was chosen as it is one of the most popular platforms for game development (based on the feedback from the NZGDC 2017)
* **C#** programming language was chosen as it is predominantly used to work with Unity platform and to expose students to a different programming language.
* **Introducing VR** in the course was chosen as it is one of the emerging trends that is getting more and more popular in game development.
* **Gear VR** is chosen to introduce programming to VR. It is one of the most popular VR sets which works with specific mobile phones, that later could be used for the mobile phone development course.
* **Group workshops** chosen to develop students’ soft skills and technical skills
* **Project** is chosen as main form of assessment to test students skills as shift towards project-based learning has been implemented throughout the new courses developed. Practical assessments favoured over theory examinations. The project is chosen as individual task due to constraints of the game engine and inability to work simultaneously on the same scene. Collaborative game development is done through the chain of tutor-led group workshops.

# IT Resources

## IT resources

* **General study:**
  + OS: Windows 7 SP1+, 8, 10
  + GPU: Graphics card with DX9 (shader model 3.0) or DX11 with feature level 9.3 capabilities.
  + Gear VR SM-R324 or 325 - <https://www.noelleeming.co.nz/shop/wearables/vr-headsets/samsung-sm-r324-gear-vr-with-controller/prod152232.html> - 2 or 3 per campus
  + Mobile phones compatible with the Gear VR - Galaxy Note8, S8, S8+, S7, S7 edge, Note5, S6 edge+, S6, S6 edge – 2 or 3 per campus
* **Group workshops:**

The workshops are practical and require a separate room with working computers that have access to Unity, MS Office and VR equipment (see General Study setup above).

* **Collaboration:** If cross campus group collaboration required for the workshops:
  + Zoom room facilities

## Software resources

* + MS Office – for creating design documents
  + Unity 5 version (<https://unity3d.com/files/store/files/Unity-License-Grant-Program-Qualification.pdf?_ga=2.140591794.1025767272.1507263240-525684954.1506744320>, needs sorting out licencing, need to investigate Unity for Education and whether we can apply) – could be newer version 2017.02
  + The latest Microsoft Visual Studio (2017 at the moment) – Community version might be OK
  + Access to internet

# References & Teaching Resources

## Video Tutorials

* From Lynda.com:

*Unity 5: 3D Essential Training*

*Cert Prep: Unity Fundamentals*

*Cert Prep: Unity Materials, Lighting, and Effects*

*Scripting in Unity*

*C# for Unity Game Development*

*Careers in the Game Industry*

*Unity: Scripting in C#*

*Unity Debugging scripts*

* From Ebook Central – Possibilities only, will be refined to no more than 5 items:

[Unity Virtual Reality Projects](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=4191240)

[Game Development with Unity by Michelle Menard and Bryan Wagstaff](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=3136735)

[Unity Game Development Scripting by Kyle D’Aoust](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=3136735)

[Mastering Unity 5.x by Alan Thorn](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=4794159)

[Unity 5.x Cookbook by Chico Queiroz, Matt Smith](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=4191128)

[Unity 5 Game Optimization by Chris Dickinson](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=4191216)

[Unity 5.x By Example by Alan Thorn](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=4520685)

[Getting Started with Unity by Patric Felicia](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=1389415)

[Unity for Absolute Beginners by Sue Blackman and Jenny Wang](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=1781945)

[Getting Started with Unity 5 by Edward Laveieri](https://ebookcentral.proquest.com/lib/weltec/detail.action?docID=2059368)

[Level Up! The Guide to Great Video Game Design by Scott Rogers](https://ebookcentral.proquest.com/lib/weltec/reader.action?docID=1674395&ppg=1)

## Textbooks

N/A

## Web Articles & Other References

The official website of the NZ Game Development Association:

<https://nzgda.com/>

Creating Game Design Document:

<https://www.gamasutra.com/view/feature/131791/the_anatomy_of_a_design_document_.php?page=2>

<https://www.gamasutra.com/view/feature/131632/creating_a_great_design_document.php>

<https://en.wikipedia.org/wiki/Game_design_document>

C# basics through game:

<https://www.codehunt.com/>

Coursera: multiple game development courses

<https://www.coursera.org>

# Working Group

|  |  |  |
| --- | --- | --- |
| **Role** | **Name** | **Contact** |
| Developers  (lead and co-developers) | Inna Medyannikova (IM), Benedicte Florin (BF), Jeff Williams (JW) |  |
| Industry Advisors | David Cummins (DC) – a programmer for the [Phantasmal](http://store.steampowered.com/agecheck/app/342550/) game |  |
| Tutor | Anchal Gupta (Auckland), John Wang (Chch) |  |
| Tech Reviewer |  |  |
| Proofreader |  |  |
| Pre Assessment Moderator |  |  |
| Post Assessment Moderator |  |  |

## Industry consultation

*Note any form of consultation with industry or attendance of professional events that inform your course development. This will need to be incorporated into the overall consultation log.*

| **Date** | **Type** | **Who / Contact details** | **Outcome** |
| --- | --- | --- | --- |
| 7/09/2017 | conference | NZGDC 2017 | Overwhelming majority uses Unity game development platform  I visited tutorial on VR game development with Google daydream  I also visited talk from the PikPok developer who emphasised importance of the game user testing and talked about how the user testing is done at PikPok |
| 11/10/2017 |  | DC | DC reviewed original version of the course design document and suggested updates that were implemented prior to submitting to the rest of the group. |
| 18/10/2017 |  | DC | DC reviewed the game solution idea and implementation in progress and added several suggestions on their improvements including a suggestions to display a frame for tutorial text to the prototype |
| 02/11/2017 |  | DC | DC reviewed the ebook Level Up! By Scott Rogers as an appropriate resource for students on creating game design documentation |
| 02/11/2017 | conference | Lance Bauerfind at “VR and AR solutions to daily challenges talk” | Lance suggested that within timeframe presented suggested not to develop VR game from scratch but rather modify existing game parameters and observe results. |