



OLLSCOIL NA GAILLIMHE
UNIVERSITY OF GALWAY

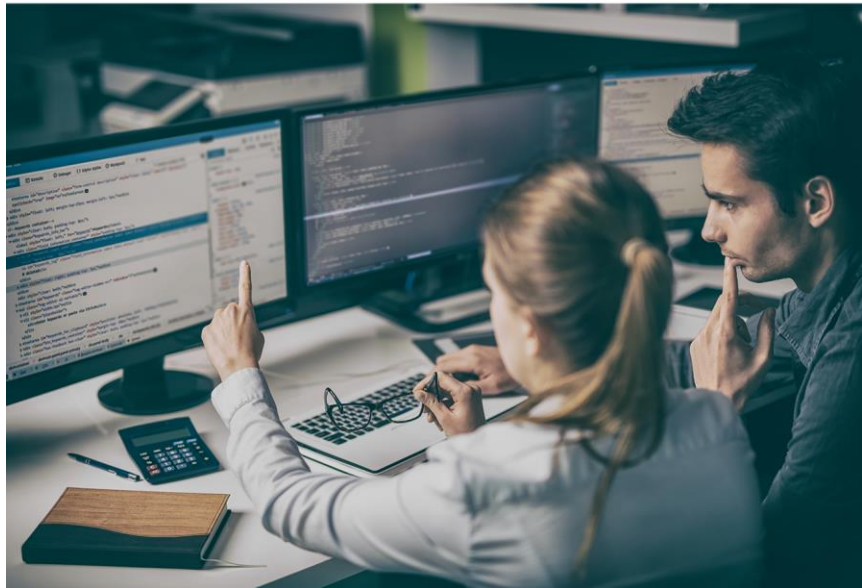
Coláiste na hEolaíochta agus na hInnealtóireachta
College of Science and Engineering

Scoil na Ríomheolaíochta
School of Computer Science



OLLSCOIL NA
GAILLIMHE
UNIVERSITY
OF GALWAY

Scoil na Ríomheolaíochta
School of Computer Science



GYE03

Software Design
and Development

Masters of Science

cs.UniversityofGalway.ie



MSc. in Software Design and Development

STUDENT HANDBOOK 2024 | 2025

University of Galway School of Computer Science requires all students to have exclusive use of a laptop for use in lectures and labs, for home use of online materials and for participation in online sessions.

The minimum and recommend spec are detailed at <https://www.universityofgalway.ie/science-engineering/school-of-computer-science/currentstudents/laptops/>.

We also operate a laptop loan scheme for students who cannot afford a suitable laptop (see same address).

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Please note: This handbook is for information only and is correct at time of compilation. However, processes and procedures may change throughout the academic year. Please contact the relevant websites and Administrative Offices for up to date information.

Section 1: Programme Descriptions

M.Sc. in Software Design & Development (GYE03)

This two year MSc is aimed at candidates with little or no IT experience. In the first year, it provides a comprehensive academic foundation and focused technical training in software design & development techniques and tools, and also develops students' research capabilities. In the second year, students pursue a substantial research project in some aspect of computing, culminating in a thesis submission.

Graduates can expect to compete effectively for positions in the software industry as software developers and/or researchers in a specific domain.

Students can exit this programme after year one with a Higher Diploma. Contact the Programme Director by June if you wish to do this.

Section 2: General Information

2.1 Academic Calendar 2024-2025

The Academic Calendar is available on:

<https://www.universityofgalway.ie/registry/academic-term-dates/#d.en.186426>

| Academic Year 2024-2025 | |
|--|---|
| Semester 1 | |
| Start of Teaching (UG years (excluding Year 1) and Postgraduate Taught programmes) | Monday 9 th September 2024 |
| End of Teaching all years | Friday 29 th November 2024 |
| Study Week (All Years, UG & PGT) | Monday 2 nd December - Friday 6 th December 2024 |
| Semester 1 Exams | Monday 9 th December – Friday 20 th December 2024 |
| Semester 2 | |
| Teaching (All Years, UG & PGT) | Monday 13 th January – Friday 4 th April 2025 |
| Easter | Good Friday 18th April – Easter Monday 21st April 2025 |
| Field Trips | Monday 7 th April – Thursday 10 th April 2025 |
| Study Week (All Years, UG & PGT) | Friday 11 th April – Thursday 17 th April 2025 |
| Semester 2 Exams | Tuesday 22 nd April – Friday 9 th May 2025 |
| Autumn Repeat Exams | Tuesday 5 th August - Friday 15 th August 2025 |
| Easter Holidays: Good Friday 18th April to Easter Monday 21st April 2025 | |
| Bank Holidays: Monday 28th October 2024 / Monday 3rd February 2025 / Monday 17th March 2025 / Monday 5th May 2025 / Monday 2nd June 2025 / Monday 4th August 2025 | |

2.2 Key Contact Details

Programme Director

| Programme | Programme Director | Room | E:mail |
|--|-------------------------------|----------|--|
| M.Sc. in Software Design & Development | Dr. Sam Redfern (Year 1) | CSB-3043 | sam.redfern@universityofgalway.ie |
| | Dr. Jawad Manzoor (Year 2) | CSB-3012 | jawad.manzoor@universityofgalway.ie |

Administrative and Technical Staff

| Administrative Staff | | Room | E-mail |
|----------------------|---------------------------|----------|--|
| Ms Deirdre King | School Manager | CSB-3013 | Deirdre.king@universityofgalway.ie |
| | | | |
| Ms Thérèse McIntyre | School Operations Officer | CSB-3014 | Therese.mcintyre@universityofgalway.ie |
| | | | |
| Ms Geraldine Healy | Administrative Assistant | CSB-3014 | Geraldine.healy@universityofgalway.ie |
| | | | |
| IT Technical Staff | | | |
| Mr Peter O’Kane | Chief Technical Officer | CSB-3038 | Peter.okane@universityofgalway.ie |
| | | | |
| Mr Joe O’Connell | Senior Technical Officer | CSB-3037 | Joe.oconnell@universityofgalway.ie |
| | | | |
| Mr Pearse Carroll | Senior Technical Officer | CSB-3037 | pearse.carroll@universityofgalway.ie |

The School of Computer Science is located in the Computer Science (CS) Building, Floor 3
For directions to the CS Building please click (Ctrl+Click) [here](#)

Student Registry Help Desk

The Student Registry Help Desk provides the following services:

- Admissions, Registration, Exams and Conferring queries
- Prospectus pick up
- Replacement ID Cards
- Exam Transcript requests
- Course Withdrawal / Leave of Absence
- Validation and Stamping of Forms e.g. social welfare, medical card application
- Change of Name/ Change of Address requests
- Registration and Statements
- Employment and verification requests

Student Registry Help Desk: Location: Ground floor, Áras Uí Chathail, which is situated on the main campus. Tel: (091) 495999 / askregistry@universityofgalway.ie

Registered Students can visit the Front Desk service which is open Monday to Friday 9:30am-12:30pm & 1:30pm-4:00pm. Web link for further details as follows:

<https://www.universityofgalway.ie/student-registry-helpdesk/>

Useful Contact Numbers (<https://www.universityofgalway.ie/about-us/contact-us/>)

| | |
|--------------------------------|--------------------------|
| Student Registry Help Desk | (091) 495999 |
| ISS Help Desk | (091) 495777 |
| Admissions Office | (091) 495999 |
| Accommodation & Welfare Office | (091) 493540 |
| Disability Support Service | (091) 492813 |
| Fees Office | (091) 492386 |
| Health & Safety Office | (091) 492678 |
| Campus Security / Emergency | (091) 493333 |
| Student Counselling | (091) 492484 |
| Student Health Unit | (091) 492604 |
| Students Union Shop | (091) 492411 |
| General Emergency | 999 / 112 |
| Local Garda Station | (091) 538 000 |
| Hospital (UHG) | (091) 524222 |
| Samaritans | 116 123 (freephone 24/7) |

Student Support

For a summary of supports and services available to students please click (Ctrl+Click) [here](#)

College of Science & Engineering Student Support Officer

Kelly Moore is the Student Support Officer in the College of Science & Engineering, and provides support for students during their time at university. The role of the Student Support Officer is to provide confidential, non-judgmental support and an empathetic space for students to share their concerns. In addition, a student advisor can offer personal support and advice on topics such as study planning, time management and any personal challenges that may compromise their ability to study. For further details please visit the following web link: <https://www.universityofgalway.ie/cosestudentadvisor/>

Student Support Officer: Location: Mondays, Wednesdays and Thursdays in Room 218, Arts/Science Concourse Building. Tuesdays in Room 1046, Alice Perry Engineering Building. Fridays available remotely via online meetings.

Direct Tel: 086 0834435 / Email: kelly.l.moore@universityofgalway.ie

2.3 Registration

Online registration opens on **Thursday, 15th August 2024** for postgraduate taught students. Details of relevant dates can be found on: (<https://www.universityofgalway.ie/registration/quick-links/registration-dates/>). Students will receive an email from Registration before online registration opens inviting students to register online. Students should register as soon as possible for their programme and following receipt of an email from ISS, activate their University of Galway campus account (see paragraph 2.4 below). Further registration details can be found on: <https://www.universityofgalway.ie/registration/>.

2.4 Activating your University of Galway Campus Account

New students will receive a welcome email from ISS "*Activating your new University of Galway campus account*" which will be sent to a student's personal email address following registration.

This email will provide students with a **University of Galway email address** and a **temporary activation password**. It also describes the steps new students need to take to activate their new University of Galway campus account. A campus account will allow students to access [many important services](#) during their time at University of Galway.

Further details on the steps to follow to activate a new student campus account can be found here: <https://www.universityofgalway.ie/information-solutions-services/studentrecordssystem/studentaccess/newstudents/>

For existing students, please follow the steps outlined in the following link: <https://www.universityofgalway.ie/information-solutions-services/studentrecordssystem/studentaccess/existingstudents/>

2.5 Student ID Cards

Students can collect their ID cards from the Student Reghelp Desks, first floor, Áras Uí Chathail from the start of term: <https://www.universityofgalway.ie/registration/quick-links/id-cards/>. Alternatively, students can request their ID card to be posted: <https://www.universityofgalway.ie/registration/quick-links/id-cards/1styearpostgraduatestudentidcarddistribution/>

2.6 Maps

University of Galway Campus maps can be located on the University's website at: <https://www.universityofgalway.ie/buildings/maps/>

2.7 Examinations

The Examinations Office posts all results to the home address of each candidate. It is the responsibility of students to ensure that their home address is correct on their record. Click on the link for info on how to [register an address change](#). Please note you must allow 2 weeks for your change of address request to be processed.

Results

Results will **NOT** be given on the telephone to candidates, or to anyone acting on their behalf.

Examination Timetables

Examination timetables may be viewed on the University of Galway's web page at the following address: <https://www.universityofgalway.ie/exams/timetable-advice/examtimetable/>. Students personalised timetables will be available on the WEB [here](#) on a date to be advised by the Exams Office and Exam Timetable and Amendments can only be accessed either On-Campus or via Remote Access.

Timetables will NOT be posted to students.

Please be advised:

- Check the Amendments web page OFTEN as changes may occur up to day of exam.
- Revisions to timetables will be published only on the Examinations Office web page.
- Revisions to timetables will not be posted to individuals or appear on personal timetables.

Repeat, Appeals and Re-checks

Strict deadlines apply for appeals and re-checks and completed online application forms must be submitted to the Examinations Office by the relevant deadlines as detailed on the website links as follows: <https://www.universityofgalway.ie/exams/results/appeals/> and <https://www.universityofgalway.ie/exams/results/rechecks/>. A fee must be lodged with both the Appeal and Re-check Forms. Fees are refunded if the outcome is positive. Further detailed information is provided in the above links.

Exam Board Sitings

The examinations board will sit in June and October where relevant examination, project and theses grades will be processed by the College of Science & Engineering.

Deferral of Exams

A guide for exam deferrals is available at: <https://www.universityofgalway.ie/exams/timetable-advice/deferrals/>. This guide is to assist students with the process and provides a direct link to the College of Science & Engineering's online specific Deferral Form.

2.8 Student Services

Coming to University is a major milestone in your life and a point of changeover in your life. You are facing into some challenges and many opportunities. You will encounter the enjoyment and challenges of independence and decision-making and responsibility for your own well-being and lifestyle.

Student Services is a team that are core to the personal and academic development of students. Student Services is under the management of the Vice President for the Student Experience. Student Services is committed to enhancing the individual student experience by providing an excellent service which supports the holistic development of the person, thereby enabling each student to achieve their full academic potential. Through valuing, recognising and supporting each staff member and by forging strong alliances within the University Community, Student Services will assist University of Galway to become a truly Student Centred University.

Student Services provides many services as follows:

- Access Centre; Career Development Centre; Societies and Sports; Welfare and Wellbeing.

Further detailed information and contact details on all the Student Services offered by University of Galway may be found at: <https://www.universityofgalway.ie/student-services/>.

Student Services Staff contact details can be located on the following weblink:

<https://www.universityofgalway.ie/student-services/about-us/>

2.9 Student Counselling

The counselling service is part of a network of support services offered by University of Galway. It provides professional counselling, which is **free** and **confidential** to all students of University of Galway. Life as a student is exciting and challenging, an achievement usually gained after much hard work and preparation. It can also be stressful at times. You may find you are experiencing personal difficulties which are affecting your ability to study and to take full advantage of the opportunities available to you at University of Galway. This is where student counselling can help. Student counselling are a team of qualified and experienced counsellors

and psychotherapists. The service operates within the Code of Ethics and Practice agreed by their respective accrediting bodies including IACP, IAHIP and PSI. The services provided include:

- Pre-counselling assessment, individual counselling and psychotherapy
- Group work
- Information and referral
- A consultation service for those who may have concerns about a student.

Further information including available online services and emergency contact details can be located on the following weblink: <https://www.universityofgalway.ie/counsellors/>

Counselling Services: Location: No. 5 Distillery Road, University of Galway

Direct Tel: 091 492484 Ext. 2484

E-mail: counselling@universityofgalway.ie

2.10 International Students

The **International Office** provide advice, information and support service for all International Students. For incoming international students information is available on <https://www.universityofgalway.ie/international-students/>

All international students are strongly encouraged to attend English for Academic Purposes (EAP) classes which are specifically designed to equip international students with specific English skills to help them with their studies. Please refer to <https://www.universityofgalway.ie/englishlanguage/ourcourses/> for more details.

The International Student Officer, Ms. Louise Kelly may be contacted at International Office, University of Galway. Tel 353 91 493581, E-mail: louise.kelly@universityofgalway.ie. Ms. Kelly acts as an identifiable point of contact with the various Student Services in the University to ensure that any problems of adjustment are minimised. Louise helps International Students adjust as quickly as possible to their new environment, so that they can derive maximum benefit and enjoyment from their life at University of Galway.

2.11 Computer Science Account and Swipe Card Access to Labs

The School of Computer Science has several undergraduate and postgraduate rooms which are available for use by our students. The rooms have hot swap desks, with laptop docking stations allowing use of external monitor, keyboard, mouse and the high-speed network. Students must provide their own laptops <https://www.universityofgalway.ie/science-engineering/school-of-computer-science/currentstudents/laptops/>. All students who are taking a module/course with the School of Computer Science are entitled to use the open access labs in the CS Building outside of scheduled timetable use (Note: CSB-G001 is available to all University of Galway students using main University of Galway account). Depending on their course, they may also have swipe card access to further project rooms in the CS Building.

Computer Science students are also given access to print on our shared printers, and to use our web and database servers which can be used for course or project work. To gain access to these resources, students will be given Computer Science accounts automatically after a student registers for one of our modules/courses, and students will receive an email to their University of Galway email to indicate the account is ready for use. The initial password is included in the email. Students can login to our intranet to setup the web/database/linux resources <https://web1.cs.universityofgalway.ie/intranet/>

Students who have issues with their Computer Science computer account, docking stations, monitors or swipe card access in the Computer Science Building should log a call to Computer Science Technical officers at: support@cs.universityofgalway.ie. Useful links for further related info: <https://www.universityofgalway.ie/science-engineering/school-of-computer-science/currentstudents/>.

Students who have issues with their main University of Galway account, Wi-Fi, Canvas, personal laptops or any PC/printer on the rest of campus should refer to the University of Galway helpdesk: <https://www.universityofgalway.ie/information-solutions-services/services-for-students/>.

2.12 DISC - Computer Programming Drop-In Support Centre

Computer DISC is a Computer Programming Drop-In Support Centre for all University of Galway students who are taking any programming/software development courses. The DISC is a free service that supports all students with their self-directed learning in computing topics at all years and levels in University of Galway. The centre is located in room CSB-1001 on 1st floor of the Computer Science (CS) Building.

What services does Computer DISC provide to students?

- Facilities for students to sit and work on programming problems
- One-to-one advice and support for students, and focused small group tutorials
- Books, courseware, web links, and other learning resources for programming students
- A website with information and an email service for all queries
- Advice for students who wish to learn new programming languages autonomously
- Assistance with new technologies for project work such as Final Year Projects.

DISC Website: <https://www.universityofgalway.ie/science-engineering/school-of-computer-science/currentstudents/computerdisc/>

2.13 Canvas

Canvas is the Virtual Learning Environment (VLE) used at University of Galway. Canvas is a modern, user-friendly VLE that allows students to access learning materials, reading lists, assessment information and other course-related content.

<https://universityofgalway.instructure.com/>

When a student registers for a course or module with the University of Galway, they are automatically enrolled on the corresponding course on Canvas. Enrolments are recognised by Canvas within 24 hours of registration. If students have problems accessing Canvas, they should contact the Library and IT Service Desk. The Service Desk can assist students with queries regarding problems with their password, e-mail account or logging in to Canvas.

If students are unable to see courses when they log into Canvas, they will need to check their registration statement to ensure they are correctly registered. Within Canvas, University of Galway students have access to 24x7x365 support via the Help menu. This Canvas support team can answer most queries related to the Canvas environment including how to submit assignments, how to see the gradebook, and where to access course materials. They also provide advice on how Canvas features can be used.

2.14 Plagiarism

Plagiarism refers to copying another author's work without due reference or acknowledgement of the author. Plagiarism is not acceptable. It is essential that the candidate acknowledge other people's work, when used by the student. The submitted work must be prepared by the candidate alone, and must be the result of the candidate's own effort, skills and knowledge. It is unacceptable for candidates to knowingly permit others to copy their work. University of Galway has a strict code of practice for dealing with plagiarism, please refer to the following link for further details: <https://www.universityofgalway.ie/plagiarism/>.

2.15 Information Solutions and Services (ISS)

ISS aim to provide students with access to the ICT facilities which they need to succeed in their studies at University of Galway. These facilities include high speed Internet access, a University of Galway email account, access to the resources of the James Hardiman Library and assist with accessing Canvas, the virtual learning environment. These services are accessible from the on-campus PC suites and from suitably equipped laptops using the on-campus wireless network. A Campus Account (CASS) provides students access using a single User ID and Password to all computing services, other than E-mail. To activate your Campus Account (*see paragraph 2.4 above*), students should follow the instructions as outlined in the following weblink: <https://www.universityofgalway.ie/information-solutions-services/studentrecordssystem/studentaccess/>.

ISS Service Desk: Location: Ground Floor of the James Hardiman Library
Contact by raising a service ticket: [Service Desk Ticketing System](#)
Direct Phone: 091 495777 or the Library & I.T. Service Desk: 091 495399

2.16 Career Development Centre

The Career Development Centre provides students of University of Galway with a quality career guidance and information service focused on facilitating and empowering students to manage their own career development and empowering students to make successful transitions towards fulfilling careers.

Details of the services provided to students by the Career Development Centre include:

Guiding students in their career journey through:

- One-to-one career guidance
- Career seminars and events
- Psychometric testing
- Dedicated careers information hub for students (on-campus and virtual)
- Self-guided modules

Connecting students with employers through:

- Jobs fairs and employer events
- Job vacancy system
- Networking opportunities

Helping students to compete in the jobs market to the best of their ability through:

- CV workshops, e-learning, and unlimited AI feedback
- Interview skills workshops, e-learning, and software to practice and improve
- Applications advice: including Postgraduate and Job Applications
- Employment skills workshops and employability award

Further information on the range of services provided by the Careers Development Centre can be found at: <https://www.universityofgalway.ie/career-development-centre/>

Career Development Centre: Location: Arts/Science Building (1st Floor)

Tel: +353 (0)91 493589

2.17 Out of Hours Working

Out of hours work refers to all University operations conducted outside normal hours.

For up to date details on the University's Safety Statement Policy and Out of Hours Working, please click on the following web link: [University of Galway Safety Statement](#)

2.18 Parking on Campus

Parking spaces in University of Galway fall into a number of categories:

- Staff Only; Student Only; Shared use (staff & student permit holders); Visitor/non-permit holder; Pay-and-display/Pay by Phone (P&D) spaces; "Reserved" spaces and loading bays.

Student parking permits are available for registered students, details as below.

To purchase/renew your Student Parking Permit carefully read the instructions contained in the following guide [PermitApplicationsGuide2024](#) then visit the [Online Payment System](#) to book your permit.

If you park in a "Pay and Display" space, you must buy a ticket from the nearby machines or use the Pay by Phone option and display your ticket on your dashboard face up, regardless of what

other type of permit you might have. If you buy a P&D ticket you can only park in spaces marked with blue lines and text ("P&D/í&T").

A park and ride service operates from Dangan car park. Further information and timetable details are available from: [Park & Ride Bus Timetable](#).

Parking at University of Galway is operated by APCOA Ireland. If you have a parking related query please contact: Ireland.permits@apcoa.ie / telephone: 0818 462899.

2.19 Library

The Student ID card also acts as a Library card. Students must have a current card in order to gain entrance to the Library. Details on the services provided by the library are available at [About - University of Galway](#). The Library and IT Service Desk is located on the ground floor of the library and provides advice and support to students on both Library and IT services (e.g., User ID/passwords, book loans, printing Wifi access).

2.20 Module Descriptions

Year 1:

| | 1MF1 | Modules | | Year 1 (60 Credits) |
|----|------|--|----------------|------------------------|
| 1 | Core | CT5117: Research Project | Semester 1 & 2 | Credits: 10 |
| 2 | Core | CT537: Software Engineering 1 | Semester 1 | Credits: 5 |
| 3 | Core | CT870: Internet Programming | Semester 1 | Credits: 5 |
| 4 | Core | CT853: Algorithmics & Logical Methods | Semester 1 | Credits: 5 |
| 5 | Core | CT511: Databases | Semester 1 | Credits: 5 |
| 6 | Core | CT874: Programming I | Semester 1 | Credits: 5 |
| 7 | Core | CT861: Computing Architecture & Operating Systems | Semester 1 | Credits: 5 |
| 8 | Core | CT875: Programming II | Semester 2 | Credits: 10 |
| 9 | Core | CT548: Object Oriented Software Design & Development | Semester 2 | Credits: 5 |
| 10 | Core | CT5127: Computer Networks and Data Communications | Semester 2 | Credits: 5 |

CT5117: Research Project

This module involves completing a research project; this involves reviewing state of the art, preparing a literature review, identifying research questions and hypotheses, developing a prototype and writing a final report of research finding.

CT537: Software Engineering 1

This module is concerned with the methods, tools and procedures of software engineering. It takes a three-pronged approach to the study of the development of software systems: namely process, product and project.

CT870: Internet Programming

Design and implement web pages. Connect a website to a database. Create dynamic web content.

CT853: Algorithmics & Logical Methods

This module is delivered in two distinct halves that each last 6 weeks. Over the first 6 weeks, the module is designed to assist students that are new to programming and initially mirrors many of the concepts covered in Java Programming. Topics include structured programming, pseudocode, algorithmic design and complexity. Sorting algorithms are covered in detail with a significant assignment associated with assessing the ability of students to understand a complex

sorting challenge, design a suitable algorithm and explain the overall complexity and design of their solution. In the second half of the module a range of concepts around searching are covered via a range of practical examples and leveraging core computer science concepts.

CT511: Databases

This module will provide the student with the information and technical know-how to establish, manage and optimally use databases. This will be essential information for those interested in Clinical Research administration.

CT874: Programming I

Introduction to Object Oriented Programming using the Java programming language.

CT861: Computing Architecture & Operating Systems

This module explores basic organisation and types of computer systems.

Important processor architectures. Outlines the basic structure and operation of microprocessors. Key features and operations of digital circuits and memory systems.

Input/output operations and components. Understand and describe the purpose, organisation and main features of an operating system. Research the main requirements and operations of operating systems. Foundational process management (including scheduling and concurrency) Understand memory-, file system-, storage- and I/O device-management. Learn basic security requirements in the context of operating systems.

CT875: Programming II

Understand and describe the architecture and components of Enterprise Java software systems, selected tools, frameworks and concepts for the development of Enterprise Java software systems. Analyse, create and debug Enterprise Java software. Explore advanced Java concepts (such as polymorphism, collections, complex class relations and types, generics, networking and client/server, I/O, concurrency, GUIs) Create and analyse Java programs involving concepts such as polymorphism, collections, complex class relations and types, generics, networking and client/server, I/O, concurrency, GUI frameworks.

CT548: Object Oriented Software Design & Development

Object-oriented programming fundamentals: variables and operators; control structures; objects and classes; methods; inheritance and polymorphism; exception handling; code style and quality.

Data structures and algorithms: stacks, queues, searching and sorting, analysis of algorithms.

CT5127: Computer Networks and Data Communications

This module provides an introduction to computer networks and data communications.

Year 2:

Minor Research Project & Thesis: 45 ECTS

Additional Elective Modules: Totalling 15 ECTS

Note: A maximum of 10 ECTS may be selected from Group 1 only

| | 2MF1 | Core Module | | Year 2 and External Stream (Total 60 Credits) |
|---|------|-------------------------------------|----------------|---|
| 1 | Core | CT5211: Research Project and Thesis | Semester 1 & 2 | Credits: 45 |

Group 1 Elective Modules:

A maximum of 10 ECTS may be selected from Group 1 only

| | 2MF1 | <u>Group 1</u> Elective Modules | | Year 2 and External Stream (Max. 10 Credits) |
|---|----------|---|------------|--|
| 1 | Elective | CT5120: Introduction to Natural Language Processing | Semester 1 | Credits: 5 |
| 2 | Elective | CT4100: Information Retrieval | Semester 1 | Credits: 5 |
| 3 | Elective | CT5132: Program. & Tools for AI | Semester 1 | Credits: 5 |
| 4 | Elective | CT5165: Principles of Machine Learning | Semester 1 | Credits: 5 |
| 5 | Elective | CT5102: Programming for Data Analytics | Semester 1 | Credits: 5 |
| 6 | Elective | CT561: Systems Modelling & Simulation | Semester 1 | Credits: 5 |

Group 2 Elective Modules:

Select 3 modules from Group 2 totalling 15 ECTS OR 2 modules from Group 1 above (total 10 ECTS) and 1 from Group 2 (5 ECTS)

| | 2MF1 | <u>Group 2</u> Elective Modules | | Year 2 and External Stream (15 Credits) |
|---|----------|---|------------|---|
| 1 | Elective | CT5189: Introduction to Cybersecurity | Semester 1 | Credits: 5 |
| 2 | Elective | CT5191: Network Security & Cryptography | Semester 1 | Credits: 5 |
| 3 | Elective | CT5197: Interaction Design | Semester 1 | Credits: 5 |
| 4 | Elective | CT404: Graphics & Image Process | Semester 1 | Credits: 5 |
| 5 | Elective | CT3536: Games Programming | Semester 1 | Credits: 5 |

CT5211: Research Project and Thesis

This module will provide students with experience of conducting hands-on scientific research and communicating it via oral presentation and written dissertation. This module involves reviewing the state of the art, preparing a literature review, identifying research questions and hypotheses, developing a prototype and writing a final report of research findings.

CT5120: Introduction to Natural Language Processing

Introduction to natural language processing, including foundations in linguistics, statistical analysis, and applications.

CT4100: Information Retrieval

The course introduces some of the main theories and techniques in information retrieval. The main models and their strengths and limitations are covered. Approaches to designing and analysing weighting schemes are studied. Practical approaches to design algorithms for efficient retrieval are covered. Several sub-areas are covered: web search, recommender systems, relevance feedback, clustering, and learning approaches are also included.

CT5132: Program. & Tools for AI

This module is about programming and computational tools required for artificial intelligence. It uses the Python language as the main vehicle, but focusses on conceptual material rather than just the language itself. It moves fast through introductory Python workings. It covers several important Python libraries in detail. It discusses approaches to building re-usable, high quality code but not on software engineering. It also visits some extra topics such as version control and an introduction to the R language for statistics. The module is core for the University of Galway MSc in Artificial Intelligence (MSc AI) Part-time (online) and Full-time (classroom). The syllabus and assessment will be the same for both. We will use a hybrid of lecture-style and lab-style delivery. The lecture-style delivery will be via video (for the part-time/online version) or classroom (for the full-time version). Practical exercises will be interleaved with the lecture-style delivery.

CT5165: Principles of Machine Learning

Definitions of Machine Learning, Data Mining and the relationship between them; the CRISP Data Mining process model; major tasks including classification, regression, clustering, association learning, feature selection, and reinforcement learning; algorithms for these tasks that may include decision tree learning, instance-based learning, probabilistic learning, support vector machines, linear and logistic regression, and Q-learning; open-source software tools for data mining; practical applications such as sensor data analysis, healthcare data analysis, and text mining to identify spam email; ethical issues and emerging trends in data mining and machine learning.

CT5102: Programming for Data Analytics

This module will introduce programming for data analytics using open-source programming tools. It will focus on the R programming language and its associated powerful frameworks for data manipulation, analysis and visualisation such as *caret* and *ggplot*. Topics will include R programming fundamentals, Data Loading, Data cleaning transformation and merging, Exploratory Data analysis and visualisation, use of machine learning libraries for regression, time series and classification operations.

CT561: Systems Modelling & Simulation

Simulation is a quantitative method used to support decision making and predicting system behaviour over time. This course focuses the system dynamics approach. The course covers the fundamentals of simulation, and describes how to design and build mathematical models. Case studies used include: software project management, public health policy planning, and capacity planning.

CT5189: Introduction to Cybersecurity

The introductory module covers the importance of cybersecurity by considering the comprehensive overview of all cybersecurity categories. It will provide learners with a foundation of advanced topics in cybersecurity through the theoretical and practical aspects of Cybersecurity. Learners will develop a strong understanding of the current cybersecurity landscape and best practices for protecting against cyber-attacks. It will also cover the importance of risk management and incident response. By the end of this module, learners will have the knowledge and skills to design and implement secure information systems, assess the security of existing systems, and respond to security incidents.

CT5191: Network Security & Cryptography

The module is designed to provide learners with a comprehensive understanding of the principles and practices of securing networks and data through firewalls, VPNs, secure communication protocols, and cryptography. Throughout the module, learners will have the opportunity to apply their knowledge through hands-on exercises and projects, such as configuring firewall rules, implementing encryption, and simulating security breaches in network security.

CT5197: Interaction Design

This module is an introductory interaction design course. It is concerned with the design of effective interactions between people and computers. Students will complete the course armed with understandings of the principles and methods required to create excellent interfaces to digital technologies.

CT404: Graphics & Image Process

Computer graphics and digital image processing, from a technical engineering perspective with application. The graphics content focuses on the fundamentals of how modern computer graphics are rendered, and includes classic rendering algorithms, hidden surface and lighting algorithms, and interactivity. There is an emphasis on practical application in a modern programming language. The image processing content focuses on classic and modern scientific algorithms for image analysis, with an emphasis on practical application in a modern programming language.

CT3536: Games Programming

An introduction to games programming. Assumes reasonable prior competency in a C-like language, e.g. Java, Javascript, C#, C. The module uses a modern game engine, and equips already-competent programmers with the skills and knowledge to create fully-featured games and other interactive media. The module engages with topics such as game engine architecture, physics engines, lighting and materials, and modern real-time programming patterns for games.