

# School of Computer Science and Informatics Modules for Erasmus and International Exchange 2018 – 2019

# **FACULTY OF TECHNOLOGY ERASMUS MODULE OPTIONS 2018-19**

# School of Computer Science and Informatics (Modules CTEC and IMAT)

- **Business Information Systems** •
- Computing
- **Computer Science** •
- Computer Games Programming •
- - Information and Communication Technology
  - Mathematics
- Please choose modules to match the number of ECTS credits required by your Learning Agreement. (V)
- Please choose reserve modules to the value of 30 credits, indicating these with R.

Module code	Module title	DMU Credit Size	Semester	Please tick or R
CTEC3110	Secure Web Application Development	15	1	
CTEC3423	Digital Investigations	15	1	
CTEC3426	Telematics	15	1	
CTEC3605	Multi-service Networks 1	15	1	
CTEC3753	Emerging Topics in Security	15	1	
CTEC3905	Front-end Web Development	15	1	
IMAT3103	Research Methods	15	1	
IMAT3223	Statistical Modelling I (Maths p.13-)	15	1	
IMAT3225	Multicriteria Analysis (Maths p.13-)	15	1	
IMAT3227	Modelling Ordinary Differential Equations (Maths p.13-)	15	1	
IMAT3406	Fuzzy Logic and Knowledge Based Systems	15	1	
IMAT3423	Systems Building: Methods	15	1	
IMAT3427	IT Services Foundations	15	1	
IMAT3611	Popular Technology Ethics	15	1	
IMAT3613	Data Mining	15	1	
IMAT3904	Game Engine Architecture	15	1	
IMAT3906	Shader Programming	15	1	
IMAT3908	Advanced Statistics for Business	15	1	

NAME	
CONTACT EMAIL	
DATE	

#### DMU module sizes mapped to indicative ECTS credits

DMU Module Size	Semester Y Exchange	Semester 1 Exchange	Semester 2 Exchange
	(Year Long)	(Sept - Dec)	
60	30 ECTS credits	15 ECTS credits	Not supported *
45	22.5 ECTS credits	11.25 ECTS credits	
30	15 ECTS credits	7.5 ECTS credits	
15	7.5 ECTS credits	3.75 ECTS credits	

- When choosing modules, please check that your choice will provide the number of ECTS credits required by your learning agreement.
- The list of modules is indicative only and covers study at level 6. For study at level 5, please enquire.
- All module choices are subject to the approval of the programme leader for the area of study, and will be confirmed in the Learning Agreement.
- Modules offered for study in Semester 1 Are listed above. We regret that exchanges in Semester 2 only are not currently supported. If you wish to complete a year-long exchange, please enquire for year-long and Semester 2 options.
- All module choices are subject to Timetabling constraints. If a Timetabling clash is advised, we will ask you to make another choice and for a revised Learning Agreement to be approved.

Module Title:	Secure Web Ap	oplication Deve	lopment	
Module Code:	CTEC3110	Credit Value:	15.00	DMU Credit Level: 3
Faculty:	Faculty of Tech	nology		
Academic Period:	2019			
Module Leader:	<b>Clinton Ingram</b>	S		
Module Pre-requisites commercial experienc	CTEC270 e of web develo	)1 Multi-tier W opment, prefer	eb Applicatio ably in the P	ns, or equivalent significant HP web development language.

Many modern computer services are now accessed via the ubiquitous web-browser, and users have come to expect instant and secure access to information on a wide range of platforms. Underpinning these web systems is usually a web application, providing a channel to data stored in databases. However, increasingly the web-site has also become a point of entry for unauthorised access to stored data. This is often the result of poor web application design and/or implementation.

The module considers how a web application may be designed and implemented in such a way as to reduce the likelihood of unauthorised access to information. This also requires an understanding of the more common forms of browser-based attacks and the coding techniques that can be used to defend against these.

The module also considers how information can be accessed and presented from remote sources via web-service protocols.

The most commonly used web development language, and therefore the language of choice for the module, is PHP, although this could be replaced by other web development languages such as Scala, Ruby or Python.

Module Title:	Digital Investigations		
Module Code:	CTEC3423 Credit Value: 15.		15.00
Faculty:	Faculty of Tech	nology	
Academic Period:	2019		
Module Leader:	Helge Janicke		

DMU Credit Level: 3

#### Module description (including outline content)

This module will present and explore the tools and techniques of investigation for two different types of digital artefact. Typically, the types of investigation will cover a mixture of 'dead-box' forensics as well a mobile phone technologies. The module will culminate in a scenario of a realistic incident which will emphasise the technologies studied throughout. The scenario will focus on the use of tools for data preservation and analysis as well as managing the integrity of the evidence whilst the findings will be presented to a lay audience.

Indicative topics may include:

- Search and seizure.
- File system forensics.
- Live system forensics.

- Mobile phone forensics.
- Memory forensics.

Module Title:	Telematics		
Module Code:	CTEC3426		
Credit Value:	15.00	DMU Credit Level:	3
Faculty:	Faculty of Tech	nology	
Academic Period:	2019		
Module Leader:	Mario Gongora	1	

Telemetry is the use of a transmission system to monitor and control remote and distributed systems. The transmission medium may be wired, such as a CAN network as used in most modern vehicles. Or it may be wireless, employing GSM (mobile phone) technology, Bluetooth and similar RF based data communications media. This module provides an understanding how distributed telematic systems are designed and implemented. This will include a detailed study of a range of telematic standards and protocols. Students will gain the skills to develop telemetry software for use in the automotive sector, and as part of a wider pervasive network of intelligent distributed computers that are linked by wireless technology.

#### Outline content:

1. CAN Networking, with emphasis on vehicle telematic systems using the J1939 protocol, and knowledge of industrial protocols such as DeviceNet.

2. Application of GSM technology for remote monitoring and control. Specific emphasis will be the use of SMS (PDU and Text mode), GPRS and dial-up connections to transfer data.

3. Application of BlueTooth technology for wireless monitoring and control. Specific emphasis will be placed on gaining an understanding of the BASIC HCI protocol that underpins BlueTooth, and some higher level applications.

Module Title:	Multi-Service Networks 1		
Module Code:	CTEC3605 Credit Value: 15.00		
Faculty:	Faculty of Tech	nnology	
Academic Period:	2019		
Module Leader:	Ali Al-Bayati		

DMU Credit Level: 3

#### Module description (including outline content)

When you click on an audio link in a Web page, how does the plug-in get started and the sound start playing? When you send an email, how does it get delivered? How can you tell who an email really comes from? How can these diverse application services be delivered over the same network? This module aims to answer these, and other questions relating to networks. It introduces the major concepts that underpin the communication between remote hosts and demonstrates how these are implemented in a TCP/IP stack.

The module provides a comprehensive analysis of problems and solutions found in modern networks and covers the communication stack (Physical, Data-link and Network layers). The module

concentrates largely on the TCP/IP networks while the subnet covers recent and emerging developments in LANs, MANs and WANs, for both fixed and wireless network technologies. The Internet will be used as the driving vehicle to deliver the module. Familiarity is assumed with the basic concepts, but not necessarily the detail of data communications and the mechanisms by which a communications subnet transfers data segments between remote machines. Typically, these will have been studied in Year 2 modules but this is not a pre-requisite. The module does have a strong software & algorithms orientation.

Outline Content:

1. Consolidation of existing Skills & Knowledge: Introductory material, Cyclic Redundancy Check (CRC), Sliding Window Mechanism;

2. Subnet Delivery Issues: Addressing, Routing, IPv4 Switching & IPv6, MAC switching and Address Resolution Protocol (ARP);

3. End-to-End Delivery Issues: Delivery & Delay, The network reliability, Interpretation & Transparency;

4. Modern Subnet Technologies: WANs, MANs, LANs;

Module Title:	Emerging Topics in Security			
Module Code:	CTEC3753	Credit Value: 15.0	00	DMU Credit Level: 3
Faculty:	Faculty of Tech	nnology		
Academic Period:	2019			
Module Leader:	Eerke Boiten			

#### Module description (including outline content)

Cyber security is emerging and fast changing subject area in which practitioners require regular updating of knowledge and skills. This module is designed teach the recent advances in knowledge in the cyber domain, in particular skills for analysing recent threats and discovered vulnerabilities as well as tools in which to analyse them and to recover from attacks. The taught programme will change year on year and focus entirely on emerging research in the domain and may cover technical, business or law considerations. The module will be organised as a series of lectures devoted to principles of discovering new knowledge related to recent attacks, as well as student led research seminars in which learners will investigate and present most advanced security topics and recent incidents analysis.

Indicative topics may include:

- Technical considerations, e.g. recently important Industrial Control Systems (ICSs) security, supervisory control and data acquisition (SCADA) security, and Internet of Things (IoT) security or
- Business considerations, e.g. security investments and controls selection or
- Law considerations

Module Title:	Front-End W	eb Development
Module Code:	CTEC3905	Credit Value: 15.00
Faculty:	Faculty of Te	chnology
Academic Period:	2019	
Module Leader:	David Everit	:

DMU Credit Level: 3

#### Module description (including outline content)

This module provides a thorough grounding in the rapidly-evolving area of front-end web technologies and interface design, covering:

- 1. crucial design principles;
- 2. Information Architecture;
- 3. Usability and accessibility.

This exciting field has been driven by recent advances in the three main technologies:

- markup languages, with current and forthcoming changes in HTML5 and CSS3;
- browser manufacturers and developers driving standards forward;
- widening scope of Javascript into development frameworks.

Web application logic has moved from the 'database-driven website' towards `app-like' front ends that communicate seamlessly with data-driven back-ends across desktop, mobile and tablet environments.

#### Outline Content

- 1. Design principles and user experience
- 2. Information Architecture
- 3. Usability, accessibility and WAIS
- 4. HTML5, CSS3
- 5. Javascript and Javascript frameworks
- 6. Web languages for mobile development
- 7. JSON as a data format
- 8. Version control

Module Title:	Research Methods		
Module Code:	IMAT3103	Credit Value: 15.00	DMU Credit Level: 3
Faculty:	Faculty of Technology		
Academic Period:	2019		
Module Leader:	Catherine Flig	ck	

Module description (including outline content)

This is a companion module offered to students who have completed IMAT2704 Introduction to Research and Ethics and who have typically decided to undertake a Research project in their final year.

Contemporary organisations rely more than ever on the collection and interpretation of large volumes of data - about customers, about employees, about the business environment and more. While other modules teach technical aspects of storing, processing and interpreting such data, this module concentrates on its collection, analysis, and interpretation. Many examples of practical situations where data is collected are subject to ethical debate and controversy, for example personal data collected online, CCTV footage and bio-security information.

The module provides the student with a grounding in the essentials of research methods and methodologies, for example the different characteristics and aims of quantitative versus qualitative research. It develops the student's ability to consider the stages of research, in line with a Final Year Project; pilot different methodologies such as questionnaires and interviews, and gain the skills to apply these to their own original research. It develops skills in data collection, interpretation and evaluation from a variety of perspectives, including a public engagement view and a theoretical/academic view. In addition, the module builds on the introduction of some of the key concepts of computer ethics in IMAT2704 and considers key ethical issues in relation to information

Module Title:	Fuzzy Logic and Knowledge Based Systems			
Module Code:	IMAT3406	Credit Value: 15.00	DMU Credit Level: 3	
Faculty:	Faculty of Technology			
Academic Period:	2019			
Module Leader:	Archie Khum	an		

### Module description (including outline content)

This module deals with, arguably, the two most successful techniques in the area of artificial intelligence.

Fuzzy logic is a technique for modelling uncertainty and imprecision and appears in many applications for example in consumer products such as washing machines and camcorders. The ideas behind fuzzy logic use the notion that the world is not precise and that the ability to model words like hot, tall and expensive is very difficult using conventional mathematical techniques. The student will gain an understanding of fuzzy sets and how these are used in systems that contain fuzzy if-then rules for decision making.

Knowledge Based Systems (KBS - also known as expert systems) are the most commercially successful technique in AI. These systems are analogous to data base systems except instead of storing data the use knowledge from an expert(s) to make decisions. Students will learn about the history of KBS as well as the various aspects of KBS development such as knowledge acquisition, inferencing, knowledge representation and system development. In summary, this module exposes the students to two highly successful methods for modelling expertise in decision-making environments

# Introduction to fuzzy logic

The concepts of uncertainty and imprecision The notion of a fuzzy set Basic operations on fuzzy sets Intersection Union Complement

#### **Fuzzy Systems**

Mamdani Sugeno

### **Fuzzy Logic Applications**

Use of Matlab for developing Fuzzy Systems Introduction to Knowledge Based Systems (KBS)

The nature of expertise basic components of a KBS History of KBS

- Knowledge Representation e.g. semantic nets, frames, production rules
- Inferencing
- Knowledge Acquisition
- KBS applications
- A comparison between a conventional KBS and Fuzzy System

Module Title:	Systems Buil		
Module Code:	IMAT3423	Credit Value: 15.00	DMU Credit Level: 3
Faculty:	Faculty of Te	chnology	
Academic Period:	2019		

# Module description (including outline content)

This module covers two important aspects of Information Systems Development (ISD)- the selection and evaluation of methodologies and the management of the Systems Development process.

A variety of ISD paradigms and methodologies will be considered, including 'hard' approaches, both Object-Oriented and Structured, 'soft' and participative approaches, and 'heavyweight' and 'agile' methodologies. A framework will be developed to compare and evaluate methodologies to help determine their applicability to particular development projects and environments. The way in which methodologies are used in practice will be considered.

To successfully deliver a computer-based Information System to a customer, whether internal or external, requires proper planning- an analysis of the project, its potential as an investment, the benefits and risk. The manager should be convinced that the project will succeed, is controllable, that resources will be forthcoming and should carry out planning (as detailed as possible) before accepting the brief. The importance of being able to balance the key project requirements of timescale, budget, quality and delivered functionality makes the project manager's role challenging and satisfying.

The success of a project depends on more than just technical issues; commitment from the users, 'ownership' of the system, effective communications, clear identification of benefits and managing

the delivery of these - these and other 'softer' issues are often the key factors in determining success.

Various project management approaches will be examined and critically evaluated in the context of the methodological approach (e.g. SSADM/PRINCE, agile development).

Staffing issues (e.g. recruitment, training, motivation, team-building, leadership style) have major implications for project success and will be placed in the context of ISD.

Module Title:	IT Services Foundations		
Module Code:	IMAT3427	Credit Value: 15.00	DMU Credit Level: 3
Faculty:	Faculty of Te	chnology	
Academic Period:	2019		
Module Leader:	Neil McBride	2	

#### Module description (including outline content)

IT Service Management involves a wide range of activities and disciplines. This module explores the entire problem space around the management of IT in organisation. It is divided into two sections. The first tackles fundamentals, starting with the use of CATWOE and stakeholder analysis frameworks in order to set the context. ITIL is outlines in two lectures. This provides an overview for students who have not come across ITIL before and revision for those who are ITIL-competent having done ITIL in the Level 5 IT Service Management modules. The focus at Level 6 moves to critically appraising the shortcomings of ITIL and recognising how frameworks such as SIAM, IT4IT and DevOps are stepping in to fill the gaps and deal with the inadequacies of ITIL. Part One also involves the study of standards and developing an understanding of IT Service Governance.

Module Title:	Popular Technology Ethics		
Module Code:	IMAT3611	Credit Value: 15.00	DMU Credit Level: 3
Faculty: Academic Period:	Faculty of Tech 2019	nology	

#### Module description (including outline content)

As a powerful and influential change agent, the computer professional has responsibility and obligations to society, to employers, to colleagues and to the profession itself. Recognition of a need to address ethical issues and encourage professionals to operate within a moral code is increasing. The aim of this module is to provide an opportunity for the student to explore the concepts of ethics in the context of IT, IS, Business Information Systems and other related disciplines. The module addresses the ethical and social responsibility issues surrounding advances in ICT. Responsible research and innovation (RRI) is introduced, which is an umbrella term that balances commercial and other goals with those concerned with ethics and wider wellbeing. RRI provides an approach that enables research and innovation to be conducted that builds-in ethics from the outset.

The module's approach considers in detail how a technology business might encompass computer ethics and RRI. The value of professional codes of conduct is also included to inform ethical policy

making and promote ethical behaviour. Ethical concepts and consideration of computer ethics as a discipline provide a necessary philosophical foundation for this module.

Therefore, the aims of the module are; to increase awareness of ethical dilemmas that surface every day within the work of the information systems professional, to reflect on and sharpen the process which is used to make choices within the business computing context and increase understanding of that process; and to understand the theoretical and applied frameworks for ethical practice within the computing profession

The module draws heavily upon the research activity of the Centre for Computing and Social Responsibility.

Module Title:	Data Mining			
Module Code:	IMAT3613	Credit Value: 15.00	DMU Credit Level: 3	
Faculty:	Faculty of Te	chnology		
Academic Period:	2019			
Module Leader:	Anthony Wil	liams		

#### Module description (including outline content)

Data is collected and stored in all different types of organisations - commercial, governmental, educational. Every day hundreds of terabytes of data are circulated via the Internet. Extraction of meaningful information and hidden patterns from data is critical for many business applications including marketing and security and many new areas of knowledge, including bio-informatics. Data mining involves extracting meaningful information and knowledge from vast quantities of data, to help us to make informed decisions.

Although data mining is still largely a new, evolving field, it has already found numerous applications. In direct marketing, data mining is used for targeting people who are most likely to buy certain products and services. In trend analysis, it is used to identify trends in the marketplace by, for example, modelling the stock market. In fraud detection, data mining is used to identify insurance claims, cellular phone calls and credit card purchases that are most likely to be fraudulent.

Data mining is fast becoming essential to the modern competitive business world. This module aims to review the methods available for uncovering important information from large data sets; to discuss the techniques and when and how to use them effectively.

The module uses the data mining tool SAS Enterprise Miner. SAS is a comprehensive data management software package that combines data entry and manipulation capabilities with report production, graphical display and statistical modelling.

Module Title:	Game Engine Architecture		
Module Code:	IMAT3904	Credit Value: 15.00	DMU Credit Level: 3
Faculty:	Faculty of Te	chnology	
Academic Period:	2019		
Module Leader:	Stephen Ack	land	
Module Pre-requisite	s: CSCI14	101 or Object oriented pro	ogramming/design experience

Computer games development is a growing industry and increasingly requires competent programmers (mainly in C++) with skills and a good knowledge of the use of graphics libraries and game engines programmatically. This module brings together previous knowledge and skills from other modules on programming, graphics, mathematical modelling and AI and binds them with advanced programming techniques to create a basic prototype of a game engine.

Upon completion of the module, students will have a good understanding of the concept of a game engine and its design and will learn how to use some of the libraries for creating interactive applications in 3D. To encourage collaborative team-based development, relevant tools to support and improve coordination of development activities such as revision control systems and project management tools will be introduced and used. This module assumes previous knowledge of the C++ programming language with good experience in using object oriented concepts, AI techniques and understanding of the nature of the multimedia components. The assessment will involve specification, design and implementation of a game with group and individual activities.

- Windows programming
- Open GL
- Game engine architecture
- Game elements and building blocks
- Artificial Intelligence techniques for game programming
- Game design and implementation

Module Title:	Shader Programming		
Module Code:	IMAT3906	Credit Value: 15.00	DMU
Faculty:	Faculty of Te	chnology	
Academic Period:	2019		
Module Leader:	Hossein Male	ekmohamadi	

Module description (including outline content)

This module will provide further background in computer graphics. The aim of the module is to give detailed technical competence relevant to graphics programming. An outline of the content is:

- Review of Transformations, projection, cameras
- Quaternions for rotations
- Hidden surface removal
- Culling and clipping

Credit Level: 3

- Consolidation and extension of knowledge of: lighting and shading; texturing and perspective-correct texturing; rasterisation; terrain generation; animation.
- Vertex and pixel shaders
- Shader languages
- Shadows and real-time shadows
- Spatial subdivision
- Scene graphs

Module Title:	Advanced Statistics for Business			
Module Code:	IMAT3908 Credit Value: 15.00 DMU Credit Level: 3			
Faculty:	Faculty of Te	Faculty of Technology		
Academic Period:	2019			
Module Leader:	Bharti Patel			

This module further develops the quantitative modelling and decision making techniques used routinely in business and industry. It seeks to formulate and solve problems of supply and demand, cash-flow, logistics and uncertainty in the realms of banking, accountancy, marketing and manufacturing. The emphasis is on forecasting, optimization and the information to be found by the categorization of data into discrete groupings with similar properties. The module intends to integrate the underlying theory with a thorough practical grounding using modern laboratory software.

# Mathematics modules: Semester 1

Module Title:	Statistical	Modelling I	
Module Code: IMAT	3223		
Credit Value:	15.00	DMU Credit Level:	3
Faculty:	Faculty of	Technology	
Academic Period:	2019		
Module Leader:	Joanne Ba	con	

Module description (including outline content)

Taking a practical approach, advanced statistical techniques will be introduced and students will use real problems and data to stimulate statistical models and their interpretation. Typical application areas considered in this module include:

- medicine, e.g. clinical trials (using hypothesis testing), the analysis of lifetimes (using survival analysis),

- business (using principal component analysis and factor analysis),

e.g.examining company data to uncover what factors relate to their success. Financial data such as ratios, accounting information, annual report details, etc. are often highly correlated with one another. A factor analysis might show that the majority of the original variables are heavily 'loaded' on 3 factors such as profitability, size and type of industry.

- marketing (using cluster analysis).

What makes this type of analysis different from regression analysis is the absence of a dependent variable - the attributes are only related to themselves. Cluster analysis is a way of grouping records according to similar characteristics so a proper marketing campaign may be developed for each group.

- crime, e.g.) football arrests (using poisson and negative binomial distributions).

crime and unemployment (investigating relationships)

Other application areas such as government e.g.) election turnout and poll-leads, education e.g.) performance indicators and sport e.g.) statistically modelling the winners, will also be discussed. Open source software, such as R, will be introduced in this module, in addition to using the previously met software: Minitab and SAS.

Module Title:	Multicrite	ia Analysis	
Module Code: IMAT	3225		
Credit Value:	15.00	DMU Credit Level:	3
Faculty:	Faculty of	Technology	
Academic Period:	2019		
Module Leader:	Iryna Yevs	eyeva	

# Characteristics

This module examines the types of problems that can be investigated using discrete-event simulation. A standard software package, e.g. MATLAB, Solver, Octave, Gurobi used to build and run simulation models. Basic statistical techniques are applied to simulation output. It will also provide students with model-building skills in mathematical programming.

# Indicative Content

# Simulation

- Discrete-event simulation. Waiting line models.
- Generation of random numbers and random values from different distributions. Statistical analysis of simulation results
- Discrete-event simulation language, e.g. MATLAB. Basic modelling concepts. Intermediate modelling concepts.

# Using the input and output processors

- Applications to commercial and industrial problems
- Running a simulation project.

# Advanced Linear Programming formulations

# Multi-criteria analysis and optimisation

- Transportation, Trans-shipment and Assignment problems.
- Revenue Management, Portfolio models and asset allocation.
- Nonlinear optimisation models: Markowitz Portfolio model.
- Integer Programming.

- Data Envelopment Analysis
- Introduction to Goal Programming. Scoring models.
- Dynamic Programming. Illustration of the DP approach to problem formulation and solution by considering a range of DP models.

Module Title:	Modelling Ordinary Differential Equations			
Module Code:	IMAT3227	Credit Value: 15.00	DMU Credit Level: 3	
Faculty:	Faculty of Te	chnology		
Academic Period:	2019			
Module Leader:	Tony Croft			
Module Pre-requisit	tes: IMAT2	202		
Term/Semester in v	which the modul	e can run: Semester	1	

In this module students will experience some of the ways in which ordinary differential equations (odes) and partial differential equations (pdes) are used by mathematicians, engineers and scientists to model, explain and predict the behaviour of physical and biological systems. Some problems can alternatively be formulated as variational principles through which a definite integral must be maximised or minimised. This module will draw upon a wide range of applications to demonstrate the modelling processing and solution using differential equations and variational principles.

Outline content:

- Modelling with ordinary differential equations. Typical application areas considered in this part include: the study of one dimensional oscillations such as those that occur when a mass attached to a spring oscillates; motion due to the tension in the spring and a gravitational force; simple harmonic motion; forced motion, resonance; motion under the action of a central force including the study of planetary motion; the study of electrical circuit - the first and second order odes that arise in the modelling of circuits containing resistors, capacitors and inductors; population growth models.
- Modelling with partial differential equations. Typical application areas considered in this part include: the wave, heat and Laplace equations. Solution by separation of variables in rectangular Cartesian and polar coordinates. Application of Fourier series to the solution of pdes.
- Introduction to variational principles. Calculus of variations; typical variational problems, functionals, first variation, Euler-Lagrange equations. Second variation and Legendre test. Classical applications such as the brachistochrone problem.