



MCAST

Malta College of Arts, Science & Technology

MQF Level 3

Advanced Diploma in IT (Software Development)

IT4-04-19

Course Description

This course is the first step towards becoming a software developer. It will provide the learners with the core software development skills along with the necessary knowledge for the design and development of software applications. The first year of this course will be common for all advanced diploma students. During the second year, students will focus on software development subjects such as: server side and client side scripting; database design and development; and mobile application development

Programme Learning Outcomes

At the end of the programme the learner will be able to:

- 1. Identify the appropriate software infrastructure for a given requirement.*
- 2. Understand the core programming concepts and methodologies.*
- 3. Integrate front-end and back-end systems*
- 4. Rigorously test software application according to a given methodology*

Entry Requirements

MCAST Diploma in IT

or

4 SEC/O-Level/SSC&P (Level 3) passes

Compulsory: Mathematics and one subject from Computer Studies, Physics, BTEC IT Practitioner

Preferred: English Language

Current Approved Programme Structure

Unit Title	ECVET
Database Concepts and Design	6
Computer Systems	6
Fundamentals of Scripting	6
Operating Systems	6
Networking Concepts	6
Website Design	6
Embedded Systems	6
Introduction to Multimedia Design	6
Programming Concepts	6
Introduction to Mobile Applications Development	6
Programming for Computer Games	6
Object Oriented Programming	6
Client Side Scripting	6
Relational Databases	6
Server Side Scripting	6
Project	6
English	6
Mathematics	6
Entrepreneurship	6
Critical Thinking	6
Total ECVET	120

Database Concepts & Design

Unit level (MQF): 4

Credits: 6

Unit Description

Today, in a challenging and fast paced environment, businesses and organizations need to be able to make quick responses in order to remain competitive and meet information demands. Databases are central in supporting core business processes and information systems and therefore need to be as efficient and accurate as possible.

This unit is relevant to learners wishing to develop a sound understanding of the features and functions of databases, and skills in designing and building an efficient database to meet specified requirements and provide accurate information. The unit will introduce the background database concepts and key design methods integral to creating a working database with validity and integrity. No previous competence with a database is assumed.

Learners should develop the underpinning knowledge and understanding through the database design and build process to enable efficiency and accuracy in terms of both structure and data. Learners will design and construct relationships through the process of normalisation, identifying entities and attributes, applying appropriate data types and other properties for implementation within a database application. Database structures will be enhanced by the learner using a variety of software and SQL features that allow for the creation and alteration of tables.

On completion of the unit learners will be familiar with essential database theory and design methods. Learners will be able to implement these within database application software and use a range of SQL techniques to manage the database structure.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the features of a database and a database management system (DBMS).*
2. *Explain and use database design methods to create a relational database structure.*
3. *Implement a relational database design with the use of structured query language.*

Computer Systems

Unit level (MQF): 4

Credits: 6

Unit Description

The purpose of this unit is twofold: to understand the main components of a computer system including the principal aspects and functions of both the hardware and the software components. Secondly it addresses the general skills to recommend the appropriate systems for business purposes which includes the setup, testing and the maintenance of a system.

The unit will start off describing different hardware components and their application of use. It will then go into the different flares of operating systems and illustrate the use of some. Software utilities will be mentioned and a few examples will be given.

Computer Security is an integral part in computer systems and some recommendations will be pointed out.

Learners will be assessed on all of the above and they will also understand the true meaning of computer systems. This involves having the student appreciate the skill set required to be knowledgeable in computer systems and relate to several technical terminologies.

The specific objective of this unit is that the learner undertakes a logical / correct sequence of what computer systems are and be able to recommend different setups to a business environment.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the main components of a computer system.*
2. *Evaluate the scope of operating systems and the different uses.*
3. *Demonstrate different types of software utilities.*
4. *Apply knowledge to recommend, setup and configure systems.*

Fundamentals of Scripting

Unit Level (MQF): 4

Credits : 6

Unit Description

This unit has been designed to teach learners the fundamentals of scripting in the context of procedural paradigm irrespective of framework or delivery platform. The development of procedural code is still at the core of many embedded systems even when it comes to event driven systems and object oriented platforms.

This unit enables learners to become familiar with the underpinning concepts of scripting languages and assumes no prior knowledge of scripting. An introduction is given to the concepts of programming, particularly as contrasted with scripting. A scripting language is introduced and the basic sequence such as variables, conversions, expressions, statements and functions will be covered.

Following these basics, conditionals and iterations will be introduced to cover the basic structure of a procedural programming. For data storage, strings and files will be covered with particular focus on file manipulation - a common task in automation scripts.

Learners will use a structured approach to the design and development of scripting applications, ensuring the solution is well documented and thoroughly tested against the original user requirement.

This unit will set the stepping stone for the Embedded System unit which will guide learners through the basis of common system architectures, Operating Systems (OS) management, I/O interfaces and control.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Understand the features of a scripting language in context of procedural programming paradigm.*
2. *Use the tools and techniques of a scripting language to build console applications.*
3. *Design and develop console applications using a scripting language for a specific use.*

- Demonstrate the use of console applications using a scripting language for a specific use.*

Operating Systems

Unit level (MQF): 4

Credits: 6

Unit Description

The purpose of this unit is to discuss the main structures, functions and operations of the operating system. It will touch various topics and delves into operating system structures, processes and threads, what deadlocks are and how they can be prevented, input / output and the different types of memory. The unit will close off with a basic understanding of virtual machines and why virtualization is important in today's dynamic IT progress.

The learner will also undergo the features and characteristics of different operating systems and learn why some are better than others for certain projects.

Learners will be assessed on all of the above and they will also understand the true meaning of operating systems. This involves having the student appreciate the skillset required to be knowledgeable in operating systems and relate to several technical terminologies.

The specific objective of this unit, is that the learner undertakes a logical / correct sequence of what operating systems are and be able to recommend different setups to a business environment.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the core services of the operating system.*
2. *Evaluate how to protect and secure an operating system.*
3. *Demonstrate the ability to understand key concepts of virtual machines.*
4. *Apply knowledge to recommend, setup and configure operating systems.*

Networking Concepts

Unit level (MQF): 4

Credits: 6

Unit Description

This is a theoretical-based unit during which learners will be exposed to basic concepts on data networking as a foundation to other network-related units.

Learners will appreciate the reasons behind the growth of networks, with a quick look at the origin of PC networks and the Internet, and some of the benefits of networks. The role of network standards is also discussed with an overview of the major standards bodies. The Open

Systems Interconnection Reference model (the OSI model) is then discussed in detail. Learners will be exposed to the concept of protocol layering in order to better understand the functions of the OSI stack. The differences between connection-oriented and connectionless services are explained as part of the discussion of the different levels of network quality-of-service required for different Internet applications (ex. SMTP in Email, VoIP, HTTP etc.)

This unit will also cover TCP/IP fundamentals and the two basic protocols from which it takes its name, Transmission Control Protocol (TCP) and Internet Protocol (IP). Learners will understand the TCP, IP, UDP datagrams and TCP/IP addressing. Address assignment is also covered considering that this is a critical part of network design and deployment. Learners will understand how IP addresses are structured, how name resolution and human-recognizable hostnames are resolved to numeric addresses using DNS. The evolution of IPv4 to IPv6 to cater for more flexibility in IP addressing schemes will also be covered.

The unit will also cover practical aspects of networking concepts. Learners will be able to configure TCP/IP properties and make use of TCP/IP utilities for network troubleshooting. Learners will also make use of applications such as wire-shark in order to inspect data packets.

Throughout the unit, learners will be provided with hands-on experience on selected aspects, and discussions will be facilitated, prompting the learners to brainstorm ideas based on the learning outcomes. On completion of the unit, learners would be able to apply theory into practical applications and have a solid foundation for subsequent units related to data networking.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the Use of Networks, Network Types and Architectures.*
2. *Explain the Role of Network Protocols and Models.*
3. *Familiarise with the Transmission Control Protocol / Internet Protocol (TCP/IP).*
4. *Configure and trouble-shoot TCP/IP.*

Website Design

Unit level (MQF): 4

Credits: 6

Unit Description

Effective website design is central to successful website production. Designers need to present an appropriate image to consumers and maximize opportunities to capture and retain interest. Sites need to be accessible to all and attention also needs to be given to usability issues such as navigation to enable users to access all aspects of a site with ease. Web users will quickly navigate away from poorly designed sites.

This unit follows the development of a website from initial requirements through design, build, test and review.

Learners will develop skills in using design techniques, together with hypertext markup language (HTML) and cascading style sheets (CSS) and build an interactive website using JavaScript. Learners will prepare the site for publication on the internet. This will require learners to be confident in carrying out more advanced techniques and to have the underpinning knowledge and understanding to test functionality, ensuring the site is fully operational in different browser environments and is compliant with copyright and accessibility guidelines

The unit is relevant to learners wishing to learn and develop skills which can be used to provide website solutions in a variety of contexts.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Prepare a website with the latest mark-up language.*
2. *Design a website using the latest styling technology.*
3. *Create interactivity in the website using JavaScript and a JavaScript Framework.*
4. *Upload, test and review created website.*

Embedded Systems

Unit level (MQF): 4

Credits: 6

Unit Description

This unit is a continuation of the unit Fundamentals of Scripting. This unit has been designed to teach learners the knowledge, skills and competence gained from the 'Fundamentals of Scripting' unit and put it into practice by implementing the constructs in an embedded system. This is a skills based unit and will allow learners to demonstrate they have the necessary skills to be able to understand and work with an embedded system.

The unit will guide learners through the basics of common system architectures, Operating Systems (OS) management, I/O interfaces and control. Learners will use the scripting language concepts learned in the 'Fundamentals of Scripting' unit and as a consequence should be able to operate effectively at more than a basic level of competence before commencing this unit.

An introduction is given to the embedded system covering its major hardware components, installation of the Operating System (OS) and basic configurations.

Following these basics, an introduction to scripting commands such as but not limited to: accessing files, processes and permissions will be covered with a particular focus on administration of the Operating System (OS) with command line.

Scripting language specific features are also revisited from the unit 'Fundamentals of Scripting', including the basic constructs, functions and modules. A number of practical tasks can be associated with this module, including programming digital input/ output, blinking LED, face detection and scheduling commands with cron.

During this unit, learners will be able to create small projects such as a cron lamp timer, simple soundboard and photo booth.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Illustrate and develop the fundamental components of an embedded system.*
2. *Produce and describe a simple embedded system proposal for a specific use.*
3. *Prepare and configure hardware and software to manage an embedded system.*
4. *Manipulate and develop a simple embedded system solution for a specific use.*

Introduction to Multimedia Design

Unit level (MQF): 4

Credits: 6

Unit Description

This unit is designed to introduce the learner to the concepts and principles applied to the design and development of simple yet interactive multimedia applications. The unit will appeal to those with an interest in animation, computing, sound or graphic design. Learners will develop a methodology of working which will take them through the stages of development from analysis and planning through to design and finally the implementation and initial testing of a multimedia product to an advanced prototype state. Learners are prepared for this by providing them with the knowledge needed to carry out this type of development. In addition, they will gain an understanding of current terminology and the wide and varied applications of multimedia.

This is a valuable unit for learners since multimedia is used everywhere from educational applications and product advertising, to games and entertainment. Sound, animation, video and graphical art are expected to be components in most applications, therefore it is important to know how and when to apply these components to enhance the user experience. The learner will be introduced to user-orientated design and prototyping and also to Graphical User Interface (GUI) features and design conventions followed to encourage intuitive interaction.

Following planning and design, the learner will go on to develop a small application; they will use storyboards and mood boards to assist the planning and will learn to integrate multimedia components into the final product. The final product will be developed to an advanced prototype standard.

On completion of the Unit learners will understand the processes involved in the design and development of a small interactive multimedia application. They will be able to develop component parts such as audio, animation and graphics. They will learn about interactivity and user-orientated design, and will apply their learning to develop a small and potentially interactive prototype application.

Learning Outcomes

On completion of this unit the student will be able to:

- 1. Plan the multimedia components for a small interactive application.*
- 2. Use appropriate tools and techniques to develop the design of the application.*
- 3. Design the application using a user-orientated approach.*

4. *Build an advanced prototype multimedia application in accordance with the design.*

Programming Concept

Unit level (MQF): 4

Credits: 6

Unit Description

This unit will provide students with a theoretical and practical knowledge of programming concepts, and how easy it can be to transition from developing a program from one programming language to another, with the main difference being the syntax and the tools used.

Through this unit, students will understand what an IDE is, and how to use it. Students will also be able to define different types of variables, such as int, string, double and so on, flow constructs, such as if or switch statements, different types of loops, such as do, while and for loop and give examples of how they can use given a specific business problem.

Through this unit, students will be exposed to practical steps in order to develop a simple windows based software, by going through the various controls available in the toolbox, understand gradually how to structure a code through the various examples to be provided, work with files, and some basic exception handling and debugging the application.

Finally, students will also be able to draw all these concepts together to write a piece of software with a GUI.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Demonstrate knowledge of the basic programming language concepts.*
2. *Explain what is and how to use an Integrated Development Environment (IDE)*
3. *Develop a simple windows application.*
4. *Explain a basic concept of exception handling and debug a simple program.*

Introduction to Mobile Applications Development

Unit level (MQF): 4

Credits: 6

Unit Description

Mobile applications design and production is a complex and challenging skill set. Developers require the ability to select suitable application technology and demonstrate an understanding of the benefits, cost, context, user restrictions, target device and the industry structure when developing web based applications for hand held devices. This unit will give the learner an introduction to the theory and development of web based mobile applications.

This is both a theory and practical based unit and will allow learners to demonstrate they have the necessary knowledge and understanding of mobile applications (web based and target device based) development to be able to identify the features affecting the production of applications. Learners will be given an introduction to the understanding of target device, industry restraints and conditions to gain an understanding of user experience and production requirements in the development of web based mobile device applications.

This Unit is relevant to learners wishing to further develop their knowledge of application design and development for mobile handheld devices such as tablets, smart phones and laptops.

This unit is aimed at; interface designers, graphic designers, visual designers, programmers, interactive designers and information architects.

Learners will carry out introductory evaluations of the effectiveness of mobile applications on a range of target devices and will evaluate their affecting factors, usability and the user experience.

Finally, learners should have the principal knowledge and understanding of development and should feel confident to extend their experience in the design and production for the mobile user experience.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Describe the current technology, features and uses of web based applications on mobile devices.*

2. *Design a web based application for a mobile device.*
3. *Produce a Web Based Application for a mobile device.*

Programming for Computer Games

Unit level (MQF): 4

Credits: 6

Unit Description

This is a skills based unit, and will allow learners to demonstrate that they have the necessary skills to be able to produce computer games in a programming language. Learners will develop an understanding of programming principles as applied to computer game development.

Learners will first demonstrate their knowledge of game programming by selecting an appropriate game engine and programming language for implementation of a particular game design, and justify their choices with regard to factors such as platform compatibility, available features, and so on. At this pre-production stage of the game development process, the learner will also consider the state-driven nature of the game being developed, and design a state machine for implementation.

The learner should understand factors such as the file format, compression, and resolution of the various types of assets used as content in games, such as graphics, (e.g. tiles, sprites and/or sprite sheets, backgrounds, or user interface elements) audio, (e.g. sound effects, ambient sounds, voice, or music) 3d models, fonts, and so on. The learner should also, on completion of this unit, be able to prepare assets which are suitable for the production of a game design, including at least 2d graphics, and sounds.

This unit, however, primarily provides the learner with the opportunity to learn and apply programming skills to a game development project. At this level, a simple 2d game with sound should be suitable. The learner should take into account the capabilities of the target devices, such as resolution, input devices available, and screen orientation / shape.

Finally, learners will be able to complete a post-production phase by deploying, publishing, and sharing their completed game on suitable distribution media for their target platforms.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Select a game engine and programming language for a given task.*
2. *Prepare assets appropriately for the development of a given task.*
3. *Build a simple computer game using 2D graphics, sound, and input devices.*

4. *Deploy, publish and share a simple computer game.*

Object Oriented Programming

Unit level (MQF): 4

Credits: 6

Unit Description

The purpose of this Unit is to enable learners to develop the skills and understanding required to design and develop object oriented applications. Learners will develop a broad knowledge of the concepts, principles and techniques of object oriented software development.

Object oriented programming is an approach to programming which aims to make use of good design practices in order to produce reliable modular and reusable software. The approach is standard in industry for software engineering and should mean shorter development lifecycles and increased productivity and costs, as the task of creating and maintaining complex systems is reduced. The task of creating and maintaining complex applications is simplified by an object oriented approach to programming and this approach maps programming code to the real world.

This unit enables learners to firstly become familiar with concepts of object oriented programming by looking at different features of object oriented programming. Learners will learn how to represent code and data as an object, which has attributes and behaviors. Learners will become familiar with the underlying concepts of an object orientate approach programming such as abstraction, encapsulation, inheritance and polymorphism. Learners will develop particular skills in an object oriented language as they explore tools and techniques used for designing and developing software using this approach. Learners will make use of at least one popular integrated development environment (IDE) to develop these Object Oriented Programming (OOP) solutions. They will be required to demonstrate their proficiency in these skills through the creation of object oriented software solutions to problems.

The aims of this unit is to ensure that learners develop the required knowledge, skills and competences to design, develop, debug and test object oriented solutions using an IDE and an OOP programming language.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Describe the concepts and features of object oriented programming.*
2. *Design an application using an object oriented approach.*
3. *Create an application by implementing object oriented programming.*
4. *Test an application created using an object oriented approach and rectify errors.*

Client Side Scripting

Unit level (MQF): 4

Credits: 6

Unit Description

This unit will allow learners to demonstrate they have the necessary knowledge and ability to create dynamic web based applications. They will become proficient in using client-side scripting techniques combining JavaScript, CSS, HTML 5, and JQuery. Current user expectations are for fast, interactive and responsive web applications, thus the need for skills in client-side scripting techniques is crucial. This is a practical unit with opportunities for the learner to practice the scripting concepts they have learned.

Learners will be able to apply programming concepts such as data-types, selection, iteration, functions and events to scripts. Additionally, they will be exposed to the web document hierarchy such as windows and form elements, and the potential for interactivity that can be applied to those components. Prior knowledge of HTML would be an advantage before commencing this unit; however, the basics can be acquired as the unit progresses. Learners will gain an understanding of Asynchronous JavaScript and XML (AJAX) and the alternative and continually developing JavaScript Object Notation (JSON).

Increasingly web applications are becoming larger and more complex and there is demand for these sites to be accessible via mobile devices; therefore, the need for client-side scripts and AJAX/JSON and JQuery will continue to grow. The Unit is relevant to learners wishing to broaden their web development and programming skills as well as increasing their knowledge of mobile web applications that are responsive and interactive.

On completion of the unit, learners will understand the need for client-side scripts, as well as developing the skills required to produce dynamic, interactive and responsive web content. They will gain an understanding of the current technologies involved with web content on the client, and also the methods of exchanging data between browser and server but the focus will be largely on scripts running on the client and the programming concepts needed to make the data exchange efficient.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the necessity for client-side scripting.*
2. *Demonstrate the use of programming elements associated with client-side scripting languages.*
3. *Use client-side scripting to enhance the functionality of a web application.*

Relational Databases

Unit level (MQF): 4

Credits: 6

Unit Description

Today, every business and organization need to have some form of IT system in order to function efficiently and be able to cope with competition. Databases are therefore a necessity in order to persist the data generated on daily basis. Data retrieval from these data sources is a core component in every type of information system.

Relational Databases is a unit which is relevant to learners wishing to develop the skills required to carry out different database operations through the use of Structured Query Language (SQL). SQL is considered as the official language used by database and information system developers to manage and interrogate the information held in Relational Database Systems. The unit will introduce a number of different querying techniques to add, update, remove and retrieve data. The content of the unit is practical in nature and provides the knowledge and skills to create reliable, efficient and effective SQL commands. The learner should be able to generate reports which output all the information indicated by the user, in order to meet the business requirements.

This unit will not require the learner to have any previous knowledge of SQL. It is designed to be delivered as a continuation of Database Concepts & Design as part of the Extended Diploma in IT (Software Development) although it may also be delivered as a standalone unit.

On completion of this unit, learners will be familiar with the majority of the basic querying concepts. Learners will be able to make use of different querying techniques to handle data stored in a DBMS.

Learning Outcomes

On completion of this unit the student will be able to:

1. *On completion of this unit the student will be able to:*
2. *Create basic queries to manage data held in a relational database management system (RDBMS)*
3. *Use different functions within SQL to meet user requirements*
4. *Use different querying techniques to retrieve more complex user requirements.*

Server Side Scripting

Unit level (MQF): 4

Credits: 6

Unit Description

This unit covers foundation topics on server side programming such as the request-response communication method and state management in web application development. The unit is practical in nature and students will be learning how to combine the basic constructs of programming (sequences, conditions, loops, arrays, functions, etc.) and interaction with HTML components (textboxes, drop-downs, grids, etc.) to create typical web applications.

The unit does not require the use of a particular server-side scripting language, and it is hence up to the instructor or the college to decide on the language most relevant to the learner's studies and industry requirements. Possible languages include, but are not limited to, PHP, JSP, ASP.NET, Python and Ruby.

The unit begins with the theory of client/server communication, with particular attention to how this applies within a web application environment. Focus is given to the stateless nature of the web, as well as HTTP requests and responses. At this stage, these technologies should be covered mostly as an overview, with focus given to the server-side component of web application development.

Following this, learners will be exposed to the syntax and structure of the selected scripting language. This includes an introduction to the sequence, selection and iteration programming structures. Learners will then be introduced to data structures, including arrays and associative arrays or maps, depending on the language chosen. Learners will then be introduced to the object-oriented development paradigm, and shown how to create classes, objects, methods and fields within the selected language.

The learners will then be introduced to the basics of front-end web application development, including the creation of HTML page content with particular attention given to HTML forms and tables. Finally, these skills will be combined with previously learnt server-side programming skills to create fully functional web applications. This also includes a brief introduction to CSS for the styling of these web applications.

By the end of this unit, learners should be able to create fully functional web applications with an HTML/CSS front-end and with a back-end using the language selected for the delivery of the unit.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the client/server architecture employed by the World Wide Web, with particular reference to the stateless nature of the web and how developers work around this architecture.*
2. *Design the layout and formatting of a web application, as well as user-interaction elements such as links, tables and forms using HTML, CSS and JavaScript to given specifications.*
3. *Use a server-side scripting language in conjunction with a front-end web application layout to create a fully functional web application to given specifications.*
4. *Design the structure of a basic database and connect a database to a web application for data storage.*

Project

Unit level (MQF): 4

Credits: 6

Unit Description

This unit is intended to demonstrate the learner's ability to plan, develop and evaluate a small software development project. The unit provides learners with the opportunity to consolidate the knowledge and skills they have mastered in the units that form the basis of the qualification and use their creative and technical abilities to satisfy the requirement of the unit. Learners will be provided with a project brief and follow a specific project management approach to complete each stage of the project. The four stages comprise: providing a detailed analysis of the brief in the analysis stage, documenting and justifying the approach to the project in the planning stage followed by design, implementation and testing in the development stage and finally an evaluation of the product and the management of the project in general. This unit is suitable for any learner undertaking a course in software development or computer games development. It is recommended that the brief is provided to the learner prior to the start of the project in order to allow time for familiarisation with the content and requirements. Learners should be encouraged to produce a professional standard of documentation throughout the project and maintain a record of work carried out.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Analyse a given brief relating to a software development project and produce a requirements analysis.*
2. *Produce a planning report in response to the brief.*
3. *Develop a software solution that meets the brief.*
4. *Evaluate the project to include a personal reflection and an analysis of the extent to which the solution meets the requirements of the brief.*