

University of Hertfordshire
School of Computer Science
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Online Modular Masters Programme for September 2007 start

Module Descriptions – Preliminary Version

Summary

Module Title	Module Code	Credit Points	Page No.
Advanced Database (online)	MCOM0162	30	2
Distributed Systems Security (online)	MCOM0163	30	3
Measures & Models for Software Engineering (online)	MCOM0166	30	4
Multimedia Specification, Design & Production (online)	MCOM0170	30	5
Software Engineering Practice & Experience (online)	MCOM0174	30	6
Web Services (online)	MCOM0175	30	7
Human Computer Interaction: Selecting Usable Systems (online)	MCOM0164	15	8
Human Computer Interaction: Developing Usable Systems (online)	MCOM0165	15	9
Mobile Standards, Interfaces & Applications (online)	MCOM0167	15	10
Multicast and Multimedia Networking (online)	MCOM0168	15	11
Secure Systems Programming (online)	MCOM0172	15	12
Wireless, Mobile and Ad-hoc Networking (online)	MCOM0176	15	13
Professional Issues (online)	MCOM0171	15	14
Software Development Tools And Methods (online)	MCOM0173	15	15
Object-oriented Programming (online)	3COM0162	15	16
Introduction To Programming (online)	2COM0083	15	17

About this Document

Every reasonable effort has been made to ensure that the information contained in this document was accurate at the time of publication. However please note it is subject to change.

This document is published as a guide for current and prospective students to help with module and course selection. It is derived from the Definitive Module Descriptions (DMDs) published by the University. In the event of any discrepancy between the two, the DMD, as its name suggests, is definitive and takes precedence over this document.

For full details of this programme, including more recent information, consult the University website at <http://www.herts.ac.uk/>.

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The availability of any particular module in any one year depends on demand and timetabling feasibility.

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Module (DMD) Code	MCOM0162
Full Title	Advanced Database (online)
Module Description 1	<p>The aim of the module is to enhance your understanding and knowledge of selected current and emerging database issues. The study is grounded in sound understanding of relevant theory, practice and principles, and made concrete by practical work using (among others) an enterprise scale DBMS such as Oracle. Thus you will acquire a practical understanding and critical awareness of the selected issues.</p> <p>This module is designed for those with existing database experience.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> selected current and emerging issues in the database field and their practical implementation, based on sound understanding of underlying theory and principles; a range of data modelling paradigms appropriate to the above. <p>You will develop skills:</p> <ul style="list-style-type: none"> to analyse, design, implement and evaluate local and distributed databases in selected current and emerging system contexts; to evaluate and to communicate selected database concepts, techniques and technologies from appropriate sources, including primary sources.
	<p>The module covers database topics such as:</p> <ul style="list-style-type: none"> database essentials (relational model, SQL, transactions, normalisation, security, database literature); decision support systems such as data warehousing and data mining, including appropriate data models, logical and physical design issues; distributed database systems, including heterogeneous distributed database systems and mobile database systems, including both logical and physical design issues (including for example the grid), update policies; object oriented and object relational databases systems, including appropriate data models and extensions to SQL; the extent to which all of the above are (or are not) supported by modern database management systems such as Oracle; selected topics of research interest such as temporal or spatiotemporal databases, or literature of historical interest such as Codd's seminal papers.
Level	M
Credit Points	30
DMD Version	1
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Module (DMD) Code	MCOM0163
Full Title	Distributed Systems Security (online)
Module Description 1	<p>This module covers the theoretical and practical techniques used to provide security and protection to networked and distributed systems. It examines how the issues and concerns of operating systems design are modified when extended in this context.</p> <p>Case studies will be used throughout. Some themes apply throughout the module: viz models, design, standards, protocols, and performance.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> • requirements for security services, such as authentication, non-repudiation and access control, and the need for security policies • features of distributed systems that make security and integrity problematic, including consideration of social, legal and ethical issues. • You will develop skills: <ul style="list-style-type: none"> • to identify and evaluate threats to the security and integrity of distributed systems • to select and to deploy context-appropriate countermeasures, which may include, but are not limited to, the use of specific cryptographic technology.
Module Description 3	<p>The module covers topics such as:</p> <ul style="list-style-type: none"> • Security services, Threats and Countermeasures • Symmetric and Asymmetric Cryptography • Tamper Evidence • Security Protocols • Key Distribution and Management • Trust and Accountability • Security Policies and Infrastructure
Level	M
Credit Points	30
DMD Version	1
Date of Last Update	13-Jul-07

Module (DMD) Code	MCOM0166
Full Title	Measures and Models for Software Engineering (online)
Module Description 1	<p>In this module you will explore the state-of-the-art for both research and practice in software engineering.</p> <p>The range of software engineering products (user requirements, design documents, code etc.) and processes (testing, de-bugging etc.) making up a software project are measured and modelled. The module shows you how the modelling and measuring of such products and processes enable quantified decision-making to be carried out during software development.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> o the range of individual products and processes that exist within a complex software engineering project. o the selection of appropriate models and measures that can be applied to software engineering products and processes. <p>You will develop skills:</p> <ul style="list-style-type: none"> o to apply a range of measurement based techniques to typical software engineering problems. o to apply a range of modelling techniques to typical software engineering problems.
Module Description 3	<p>The module covers research and practice relating to evaluating, modelling and improving the software engineering process, products and practices. Topics typically include:</p> <ul style="list-style-type: none"> • Measurement theory fundamentals • Collecting, analysing and representing software measurement data. • Measuring software process attributes, e.g., testing effectiveness, de-bugging efficiency, developer productivity • Measuring product attributes, e.g., system reliability, code maintainability, system usability • The application of Evidence Based Software Engineering (EBSE) • Process modelling approaches, e.g. notation-based approaches such as Spearmint • Process modelling techniques, e.g. System dynamics modelling, BBNs • Process assessment models, e.g. SEI models such as CMMi
Level	M
Credit Points	30
DMD Version	1
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Module (DMD) Code	MCOM0170
Full Title	Multimedia Specification, Design and Production (online)
Module Description 1	<p>In this module you will gain an advanced understanding of the stages in the development of interactive, multimedia computer applications. This includes the analysis, design, implementation and evaluation of the software as well as the design and development of its component media.</p> <p>There is a large practical element. You will develop advanced skills in a particular multimedia programming tool such as Macromedia Flash, which you will use in conjunction with the theoretical principles gained on the module to develop an interactive multimedia application.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> • how a range of techniques from several disciplines, including traditional software engineering, is applied to multimedia system design • how a multimedia system is developed, including advanced topics in the analysis, design, implementation and evaluation • how multimedia is authored and rendered, including the data representation of audio, video, animation, text and graphics, and the associated standards employed <p>You will develop skills:</p> <ul style="list-style-type: none"> • to use the advanced features of a multimedia software development tool • to apply systematic methodologies to the production and evaluation of multimedia
Module Description 3	<p>The development of multimedia systems calls on diverse disciplines and practices. The module will build on your existing expertise to develop advanced knowledge and skills in these areas, including:</p> <ul style="list-style-type: none"> • aspects of systems development, computer programming • production of images, animation, video and sound • management of large projects • judgement on the industry standards to adopt based on the target output devices and a sophisticated understanding of the representation of multimedia data • advanced features of a multimedia programming tool or language such as Macromedia Director, Flash MX or Visual Basic.
Level	M
Credit Points	30
DMD Version	1
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Module (DMD) Code	MCOM0174
Full Title	Software Engineering Practice & Experience (online)
Module Description 1	<p>In this module you develop advanced knowledge and skills in software engineering, readily transferable to professional practice.</p> <p>The module covers each element of the software engineering process. It explores the use of overarching development approaches such as eXtreme Programming and Component Based Software Engineering. Leading edge practices are introduced, such as using program slicing to find code faults. Specialised software development approaches are investigated such as those required for safety critical systems. Industrially-relevant process models, such as one of the SEI models, are evaluated.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> • a variety of popular software engineering process models • a range of leading edge software engineering practices <p>You will develop skills:</p> <ul style="list-style-type: none"> • to select and to apply an appropriate software process model to the development and evolution of software. • to deploy a variety of software engineering approaches to the development and evolution of software
Module Description 3	<p>This module is practically oriented. The topics covered are practised within the context of the development and evolution of one or two large-scale pieces of software, typically existing open source systems. Java or another modern, industrially relevant 3GL are used.</p> <p>The module covers topics such as:</p> <ul style="list-style-type: none"> • Software engineering process models. e.g. CMMi, P-CMM, ISO. • Software engineering methodologies. e.g. Agile, CBSE, Spiral. • Technical engineering practices. e.g. version control tools, configuration management tools, code analysis (such as program slicing), fault detection, verification techniques (i.e. advanced testing). • Quality engineering practices. e.g. design reviews, code inspections, post mortems. <p>You will carry out practical software development and evolution work, gaining hands-on experience of each of the above topics.</p>
Level	M
Credit Points	30
DMD Version	1
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Module (DMD) Code	MCOM0175
Full Title	Web Services (online)
Module Description 1	<p>Web services are the building blocks of “service oriented architectures” (SOA) and Web 2.0 “mash-ups”. They enable information sharing and integration of functionality from different applications in a decentralised network environment such as the Internet.</p> <p>In this module you will learn about the fundamentals of web services and their underlying protocols and standards, from basic technologies through to architectural issues and evaluation. You will study real world examples such as e-commerce, and information retrieval.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> the distinctive features of web service architecture and the issues they address in the development of distributed data intensive systems; different approaches for implementing any one component (including data modelling, messaging, and service description) within a SOA and their relationships to other development techniques on-going developments in web service standards, technologies and applications. <p>You will develop skills:</p> <ul style="list-style-type: none"> to evaluate the applicability of web services for a particular enterprise to create web services and implement selected components using appropriate standards and technologies.
Module Description 3	<p>The module covers topics such as:</p> <ul style="list-style-type: none"> definition, features and benefits of service oriented architectures the component layers that make up a web service structuring data using standards such as XML, XML Schemas, RSS and other XML-based ontologies presentation and manipulation of data using techniques such as CSS, XSLT messaging using protocols such as SOAP or XML requests over HTTP specification and brokering using standards such as WSDL and UDDI application case studies, for example Google and Amazon. tools to support web service development, e.g. AJAX and Java standards development processes and organisations, e.g. W3C, WSI comparisons with preceding technologies (e.g. EDI, Corba), and on-going developments in standards and applications (e.g. the semantic web).
Level	M
Credit Points	30
DMD Version	1
Date of Last Update	13-Jul-07

Module (DMD) Code	MCOM0164
Full Title	Human Computer Interaction: Selecting Usable Systems (online)
Module Description 1	<p>Human Computer Interaction (HCI) is the study of the interaction between computers and people. It provides evidence-based direction and guidance for ensuring the interface with the user meets goals such as ease of use, efficiency and learnability.</p> <p>This module introduces you to the concepts, tools, techniques, standards and guidelines that are needed to produce and to evaluate interactive systems. You will examine systems in a variety of contemporary domains and will undertake practical evaluation projects.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> the factors that contribute to an effective design the tools and techniques for capturing requirements and evaluating interactive systems within a range of domains <p>You will develop skills:</p> <ul style="list-style-type: none"> to evaluate interactive systems in specified domains taking into account relevant guidelines and legislation.
Module Description 3	<p>All of the areas studied will be examined through in-depth analysis of a representative range of practical case studies relating to requirements gathering and evaluation for usability, accessibility and adherence to the specification.</p> <p>The module covers topics such as:</p> <ul style="list-style-type: none"> Interactive systems in contemporary domains, with conventional and non-conventional interaction devices, e.g. Internet, e-commerce, information systems, portals; mobile and ubiquitous systems; location-based interactions; e-Learning Understanding users: cognition; motivation Identifying needs and establishing requirements: Identifying stakeholders; Establishing the domain; Gathering requirements; Task analysis; Scenarios and use-cases; Requirements specification Evaluation: Evaluation approaches and techniques: Expert evaluation; Heuristics; Inspections; Walkthroughs; Observational evaluation; Surveys Guidelines and Standards: Legislation and Guidelines for Accessibility e.g. W3C.
Level	M
Credit Points	15
DMD Version	1
Date of Last Update	06-Jul-07

Module (DMD) Code	MCOM0165
Full Title	Human Computer Interaction: Developing Usable Systems (online)
Module Description 1	<p>Human Computer Interaction (HCI) is the study of the interaction between computers and people. It provides evidence-based direction and guidance for ensuring the interface with the user meets goals such as ease of use, efficiency and learnability.</p> <p>This module introduces you to the concepts, tools, techniques, standards and guidelines that are needed to build interactive systems. You will study systems in a variety of contemporary domains and will undertake practical design projects.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> the complex factors that contribute to an effective design the tools and techniques for creating interactive systems, the range of domains in which interactive systems operate, and the impact of the domain on the design process <p>You will develop skills:</p> <ul style="list-style-type: none"> to make an informed choice amongst the concepts tools and techniques available for the evaluation and design of interactive systems to design interactive systems in specified domains taking into account relevant standards, guidelines and legislation.
Module Description 3	<p>All of the areas studied will be examined through in-depth analysis of a representative range of practical case studies relating to the complete development process.</p> <p>The module covers topics such as:</p> <ul style="list-style-type: none"> Developing interactive systems in contemporary domains, with conventional and non-conventional interaction devices, e.g. Internet and e-commerce, public information systems, portals; Ubiquitous systems; Location-based interactions; e-Learning Understanding users: Cognition; Motivation Design approaches: Prototyping and storyboarding; Conceptual design; Incremental and evolutionary design Evaluation: Managing the evaluation process; Evaluation approaches and techniques; Model-based approaches Guidelines and Standards: Manufacturers guidelines, e.g. Windows; Design guidelines e.g. ISO 9241 ISO 13407;
Level	M
Credit Points	15
DMD Version	1
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Module (DMD) Code	MCOM0167
Full Title	Mobile Standards, Interfaces & Applications (online)
Module Description 1	<p>Mobile and pervasive computing is rapidly evolving and so, in this module, there is an emphasis on close reading of the most up-to-date research, with associated seminars and lectures. Themes covered typically include pervasive computing, mobile HCI, privacy and security, location and context awareness, mobile development platforms, networking and data standards.</p> <p>Alongside this, you will follow a practical course in programming for mobile devices based on an industry-standard development platform. Finally you will work in a project to create a substantial mobile application.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> • the principles behind a range of current mobile network technologies • likely future directions in the area of mobile and pervasive computing • the major technical standards in the field, as well as the principles behind the major development platforms <p>You will develop skills:</p> <ul style="list-style-type: none"> • to commission, design and specify mobile applications • to code, implement and evaluate mobile applications, using at least one of the major development platforms.
Module Description 3	<p>The module has three elements.</p> <p>1. Conceptual:</p> <ul style="list-style-type: none"> • readings of important research papers in mobile and pervasive computing, with associated assignments • taught material in topics such as fundamental network, programming and XML paradigms. <p>2. Practical sessions, using a major development platforms such as J2ME or Windows CE, focussing on specific challenges in mobile computing, for instance:</p> <ul style="list-style-type: none"> • user interface restrictions on small devices, • contextual awareness through Bluetooth and wireless network sniffing, • control of elements such as the camera, infra-red, • communication protocols such as SMS, MMS. <p>3. A group project, in which you will specify and design a mobile application:</p> <ul style="list-style-type: none"> • write a document establishing a market case for a new application • specify and design the application • developing the application on current technology or through simulation.
Level	M
Credit Points	15
DMD Version	1
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Module (DMD) Code	MCOM0168
Full Title	Multicast and Multimedia Networking (online)
Module Description 1	<p>This module addresses the issues that must be solved to integrate diverse network applications onto a single network infrastructure:</p> <ul style="list-style-type: none"> • how to deal efficiently with applications that have to send the same data to many different destinations • how to mix applications with very different quality of service requirements.
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> ○ the problems and issues arising when applying high-speed network technology to applications with diverse quality of service requirements <p>You will develop skills:</p> <ul style="list-style-type: none"> ○ to design, test and evaluate protocols intended to solve some of the issues that arise in multicast and multimedia networking.
Module Description 3	<p>The module covers topics such as</p> <ul style="list-style-type: none"> ○ Service models. ○ Multicast routing. ○ Multicast applications. ○ QoS issues, IntServ, DiffServ, RSVP and other mechanisms. ○ Real time continuous media applications and their QoS requirements. <p>The practical work is based on:</p> <ul style="list-style-type: none"> ○ Java network programming ○ NS2 network simulation
Level	M
Credit Points	15
DMD Version	1
Date of Last Update	04-Jul-07

Module (DMD) Code	MCOM0172
Full Title	Secure Systems Programming (online)
Module Description 1	The variety and proliferation of malicious attacks made against users of networks and distributed systems has led to a need for pro-active defence mechanisms against such attackers. For individuals and enterprises, the impact ranges from extreme frustration to significant cost and damage to their reputation. This module will be both theoretical and practical, exploring concepts and applications from the fields of computer systems and their security weaknesses.
Module Description 2	You will gain knowledge and understanding of: <ul style="list-style-type: none"> • security requirements, threats and countermeasures • tools and techniques which may be used to enhance or break system security • the relative strengths and weaknesses of a range of programming language features from a security perspective You will develop skills: <ul style="list-style-type: none"> • to identify and evaluate a selection of key concepts and methods employed by adversaries to break into insecure systems • to select and deploy appropriate techniques to write more secure code, both in theory and practice.
Module Description 3	The module will include major developments relating to system security and specific research interests. It covers a range of topics selected from: <ul style="list-style-type: none"> • Types of Language: C++, Java, .Net; their relative strengths and weaknesses from a security perspective • Vulnerabilities: Input validation, Overflows, SQL injection; Social engineering, password and configuration issues • Malicious Software: Viruses, Trapdoors, Logic bombs, trapdoors and related threats; countermeasures • Techniques and Tools: Firewalls, Intrusion Prevention and Detection, Current software tools
Level	M
Credit Points	15
DMD Version	1
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Module (DMD) Code	MCOM0176
Full Title	Wireless, Mobile and Ad-hoc Networking (online)
Module Description 1	This module examines a range of wireless communication technologies and addresses the issues of mobile ad-hoc and wireless networks: <ul style="list-style-type: none"> • how to handle users and computers that move from place to place and yet wish to remain in contact with the net
Module Description 2	You will gain knowledge and understanding of: <ul style="list-style-type: none"> ○ the problems and issues arising when mobility occurs in networks You will develop skills: <ul style="list-style-type: none"> ○ to design, test and evaluate protocols intended to solve some of the issues that arise in mobile networking.
Module Description 3	The module covers topics such as <ul style="list-style-type: none"> ○ Mobile IP, agent discovery, registration, tunnelling. ○ MAC protocols for wireless networks. The practical work is based on: <ul style="list-style-type: none"> ○ Java network programming ○ NS2 network simulation
Level	M
Credit Points	15
DMD Version	1
Date of Last Update	04-Jul-07

Module (DMD) Code	MCOM0171
Full Title	Professional Issues (online)
Module Description 1	<p>This module provides a broad understanding of information systems (IS) project management. It examines the various IS development methodologies and project control techniques including: estimation of development resources, risk management, systems quality assurance and human resource management.</p> <p>This module also covers the relationship between technological change, society and the law. This includes those legal aspects relevant to IS management, illustrated by UK laws, and the ethical concepts and dilemmas of importance to computer professionals.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> the tools, models and techniques for the management of software development projects. professional, social and ethical issues related to contemporary software development practice. <p>You will develop skills:</p> <ul style="list-style-type: none"> to deal with complex managerial issues in software development, both systematically and creatively.
Module Description 3	<p>The module covers topics such as:</p> <ul style="list-style-type: none"> Ethics; Ownership; Privacy; Security; Reliability; Accuracy; Accessibility; Usability; Information overload; Computers and employment; Computers and learning; Computers and crime Relevant laws and ethical guidelines, for example: Data Protection Act; Computer Misuse Act; Intellectual Property Rights; Computer contracts; Professional codes of conduct such as those of the BCS (UK) and the ACM (USA). Responsibilities of organisations to society at large and to their employees when designing, implementing and using Information Systems. Information Systems Project Management (following the PRINCE2 methodology): the role of the Project Manager, project planning, network diagrams; the processes of resource planning and estimation, costings and budgets; team work and organisation; control systems and project reviews.
Level	M
Credit Points	15
DMD Version	1
Date of Last Update	04-Jul-07

Module (DMD) Code	MCOM0173
Full Title	Software Development Tools And Methods (online)
Module Description 1	<p>This module introduces you to industry standard and current best practice tools and techniques for the development of software systems. The Unified Modelling Language (UML) is used to produce models of the system at various stages in a software project, from analysis through to design, implementation and deployment.</p> <p>You will explore patterns and frameworks that occur across a range of problems and applications and be introduced to alternative models of the process of software development.</p> <p>This is a practical module with an emphasis on the use of standard software tools.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> • current and emerging technologies in software development • techniques applicable to current software development, including some which are at the forefront of current practice • tools, models and methods used to design software • models of the software development process itself <p>You will develop skills:</p> <ul style="list-style-type: none"> • to deal with complex technical issues in software development, both systematically and creatively • to use suitable tools and techniques productively in the development of software
Module Description 3	<p>Module content typically is drawn from the following areas, with most of the practical activity based around UML modelling.</p> <ul style="list-style-type: none"> • Models of the software development process and their suitability for different systems e.g - waterfall, agile methodologies, object-oriented approaches such as Rational Unified Process; • Models of system structure and dynamics using UML (Unified Modeling Language) and OCL (Object Constraint Language); Model-Driven Architecture. • Models of persistent data and of data "on-the-move": relational data modelling, XML. • Patterns as a means of capturing expertise and professional good practice: analysis patterns; design patterns (e.g. "GoF" patterns); architectural patterns, e.g: client-server, multi-tier. transaction-processing, message-oriented, service-oriented.
Level	M
Credit Points	15
DMD Version	1
Date of Last Update	04-Jul-07

Module (DMD) Code	3COM0162
Full Title	Object-oriented Programming (online)
Module Description 1	<p>This module explores the use of object-oriented methods and tools in the design and implementation of software systems, particularly the appropriate use of inheritance to support code reuse and to promote flexible designs.</p> <p>In the practical work, you will develop programs to exploit inheritance and other advanced features of modern programming languages such as graphical user interfaces, threads, and generic library classes.</p> <p>The module assumes some prior programming experience and an understanding of basic object-oriented concepts.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> advanced technologies used in contemporary software development the features of a typical object-oriented programming language, particularly the details of its inheritance mechanisms the use of inheritance to produce flexible and extensible program structures strategies for evaluating object-oriented software designs and architectures according to established quality criteria <p>You will develop skills:</p> <ul style="list-style-type: none"> to use object-oriented tools, techniques, notations and methods in the design, implementation and testing of computer-based solutions to identify situations in which the use of inheritance is appropriate, and make sensible decisions concerning its use.
Module Description 3	<p>The module covers topics such as:</p> <ul style="list-style-type: none"> Simple techniques for identifying and classifying objects. Designing simple class interfaces according to information hiding principles. Inheritance and specialisation; class hierarchies; abstract classes and interfaces; representing simple class and object structures in UML. Polymorphism and dynamic binding. Using a collections framework; generic (template) classes and instantiation. Approaches to error handling; assertions and "programming by contract"; robust/defensive programming and the role of exceptions. Program correctness and verification - by reasoning about the implementation, by black box and white box testing; debugging. Input/output using streams. Approaches to persistence. Programming graphical user-interfaces. An introduction to programming concurrency (threads) Internal design quality, and factors influencing it. Simple programming idioms and design patterns.
Level	3
Credit Points	15
DMD Version	1
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Module (DMD) Code	2COM0083
Full Title	Introduction To Programming (online)
Module Description 1	<p>This module introduces the basic facilities in imperative and object-oriented programming languages. You will develop the skills needed to use such languages to build and verify high quality programs to solve clearly-specified problems.</p> <p>It assumes no previous programming experience and follows a practical approach, using up-to-date tools such as Java and the BlueJ environment, to explore modern approaches to program development.</p>
Module Description 2	<p>You will gain knowledge and understanding of:</p> <ul style="list-style-type: none"> • the basic concepts underlying procedural programming • the facilities offered by a modern object-oriented programming language • the importance of abstraction and modularization in promoting software quality <p>You will develop skills:</p> <ul style="list-style-type: none"> • to design and implement classes and to use existing library classes in programming solutions to clearly-specified problems • to develop and test software in a realistic production environment, such that it meets accepted quality criteria • to use a variety of tools effectively in the software development process.
Module Description 3	<p>Currently this module uses Java and the BlueJ IDE. It covers topics such as:</p> <ul style="list-style-type: none"> • Imperative and object-oriented paradigms for programming. • Structure of a program. Introduction to the programming environment. • Lexical issues. Style conventions (naming, layout, comments) • Basic predefined types, operators and expressions. Instructions/Commands - assignment. • Input/output of values of simple types using library facilities. • Control Instructions - sequence, selection, iteration. • 'Stepwise refinement' as a problem solving technique for algorithm design. • Structured types (character strings and arrays). • Procedures and Functions - declaration and invocation. Scope of variables, parameter passing semantics. • Structure of simple object oriented systems. Classes, objects, attributes and methods. • Object declaration and creation. 'Use' (client/supplier) relations between objects. Reference semantics. • Visibility modifiers and information hiding. • Use of library classes. • Basic principles of unit and system testing.
Level	2
Credit Points	15
DMD Version	1
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