Computing, Information and Communications Technology

Short Courses & Training Programmes

J M Blackledge

Faculty of Engineering
Dublin Institute of technology

http://eleceng.dit.ie/blackledge

School of
Electrical Engineering Systems

School of Electrical Engineering Systems http://eleceng.dit.ie

The School of Electrical Engineering at Dublin Institute of Technology is located at the Dublin Institute of Technology Kevin Street site. We are one of the longest established Schools of Electrical Engineering in Ireland. Courses in technical engineering commenced at Kevin Street in 1887. The School's four year honours degree programme is accredited by Engineers Ireland and the Washington Accord. We cater for education in electrical engineering from levels 6 to 10 (Apprentice to PhD) of the National Qualifications Authority of Ireland.

The School is one of five Schools within the Faculty of Engineering http://www.dit.ie/faculties/engineering and is comprised of three departments:

Control Engineering;

Electrical Engineering;

Electrical Services Engineering.

The School offers programmes ranging from and inclusive of Phase 4 and Phase 6 Electrical Apprenticeship, Higher Certificate, Diploma, Ordinary Degree, Honours Degree, Master of Engineering by taught modules and minor dissertation, Master of Engineering (MPhil) and Doctor of Engineering (PhD) by research.

Many of our programmes run in both part-time and full-time mode, with in excess of 1,500 students.

The School has Professional Associations including:

IET
Engineers Ireland
Enterprise Ireland
Enable Ireland
CIBSE
FAS
SEI
SFI

CONTENTS **Page #**

Programming for Beginners 3 days

ABOUT THE COURSE

This is a basic course in programming, taking delegates from writing their first, simple programs to the stage where they can write code to solve real problems using C or C++. The course is aimed at those with no previous experience in programming, and provides an introduction to program design techniques, basic algorithms and the C/C++ programming language. A number of simple applications are used as examples. Supervised practical programming workshop sessions, where delegates work at their own pace through programming exercises, form a central component of the course.

DELEGATES WILL LEARN TO

- Write programs in the industry standard languages C and C++
- Work from a problem to a solution in the form of a program
- Write, debug and unit test programmes efficiently
- Use procedural and structured programming styles
- Use a programming language with other software tools

COURSE CONTENT

- Algorithms and programs
- A first program in C
- Input and output
- Variables
- Recursion and iteration
- Structured program design
- Functions and modular programming
- Some basic algorithms
- Programming design techniques

Principles of Software Engineering 3 days

ABOUT THE COURSE

Understanding and applying the principles of software engineering are fundamental to the design, development and functionality of all software applications and packages. Although software engineering is a discipline that is ideally independent of a programming language or operating system, using a programming approach significantly helps to reinforce the ideas and concepts which is the basis for this course. Delegates are therefore expected to have a working knowledge of the C/C++ programming language which is used throughout the course. The course starts by reviewing the history of software engineering giving a number of case studies and illustrates how and why specific approaches have been introduced to aid the 'art' of software development. It explores the role of procedural and object oriented design methods with a specific focus on the management of large scale projects using state-of-the-art CASE (Computer Aided Software Engineering) tools.

DELEGATES WILL LEARN TO

- Understand the principles of modern software engineering methodologies
- Appreciate the relationship between systems design and modern programming practices
- Develop a working knowledge of how to manage the various stages associated with software development projects

COURSE CONTENT

Data structures and data streams
The software lifecycle
Top-down design
Hybrid design methods
Procedural design techniques
Functions, modules and object libraries
Complexity
Style and presentation
Systems design and management
CASE tools
Software maintenance
Processes and procedures
Programming languages
Bottom-up design
Data-flow design methods
Structured programming
Testing strategies
Object-oriented design
Software specification
Optimization methods
Formal methods
Grid computing

The C Programming Language 4 days

ABOUT THE COURSE

This is a hands-on course, which starts from fundamental concepts and builds through numerous practical exercises to cover the advanced features of the C programming language. Aimed at programmers with some experience of a high level language, this course provides an ideal introduction to the C programming language.

DELEGATES WILL LEARN TO

- Write, compile and execute ANSI C programs
- Write programs using standard C libraries
- Understand the concepts and principles of structured program design.

COURSE CONTENT

- Introduction to C, history and evolution, key characteristics
- Program structure, declaring variables, variable types, storage classes
- Operators and expressions, arithmetic, logical and conditional operators, precedence, associativity and equivalence
- Program loops, while, do and for loops, Boolean expressions
- Control flow, if, else, switch and jump statements
- Functions and program structure, function prototypes, calls and definitions, separate compilation and linkage
- Structured data types, array notation, multi-dimensional arrays, structures, unions, pointers and arrays, pointers and address arithmetic
- Dynamic memory allocation and memory management
- The C pre-processor, passing values to the compiler, conditional compilation, tokens and macros
- Standard C libraries, input/output, file management, string manipulation, command line arguments, math functions

Object Oriented Programming in C++ 4 days

ABOUT THE COURSE

This is a hands-on course, which starts from fundamental concepts and builds through numerous practical exercises to cover the features of the C++ programming language using a true object-oriented approach to software development which is emphasized throughout.

DELEGATES WILL LEARN TO

- Write programs in C++
- Debug C++ programs
- Appreciate the benefits of an object-oriented approach to software development in C++

COURSE CONTENT

- Introduction to object-oriented development
- First steps in C++ programming
- Implementing statistic behaviour
- Instantiating and deleting objects
- Implementing behaviours
- Components of object behaviours; statements, expressions, derived data types, arrays, pointers, structures
- Ad hoc polymorphism; class defined conversions, overloading and function selection, friend functions, unary operator overloading, binary operator overloading
- Dynamic memory management; dynamic storage allocation, variable sized objects, storage management in C++, destructors, aliases and dynamic allocation, dynamic member allocation, assignment, copy constructor
- Inheritance and multiple inheritance
- Polymorphism, virtual functions, templates, class templates, function templates, C++ standard library
- Exception handling; handler functions, exceptions, try, catch and throw
- Stream I/O; C++ I/O operators, I/O status and error functions, opening, closing, deleting and renaming files, stream formatting, unformatted I/O, overloading, the << and >> operators

Programming in Java 4 days

ABOUT THE COURSE

This is a hands-on introduction to Java programming, aimed at delegates with some background in programming (e.g. C, Cobol), although experience with object orientation is not required. A basic grounding in Java programming skills and object-oriented concepts is taught, using short presentations which alternate between intensive practical sessions.

DELEGATES WILL LEARN TO

- Become familiar with the fundamental concepts of object orientation
- Understand the foundations of programming in Java
- Implement small Java applications and applets

COURSE CONTENT

- Basic Java syntax
- Simple Java programs
- Core libraries
- Classes and objects
- Encapsulation syntax
- Methods and attributes
- Constructors
- Client-supplier programming
- Further libraries
- Strings
- Collection structures
- Abstract window toolkit
- Inheritance
- Polymorphism
- Clientship verses derivation
- Abstract classes and interfaces
- Further windows programming
- Applications and applets
- Configuring Web pages

Programming in LaTeX 3 days

ABOUT THE COURSE

LaTeX is the principal standard type setting package for the production of papers, reports, books and high quality documents and publications in general. This course is designed to instruct delegates on the principles of using LaTeX to design their own documents for a wide range of purposes. It is a hands-on course that covers those aspects of LaTeX required for delegates to be acquainted with the system to the degree necessary for them to produce their own documents and publications. All the software used in the course (apart from the Windows operating system) is freely available on the internet which will be down loaded as part of the course.

DELEGATES WILL LEARN TO

- Understand the terminology and jargon of LaTeX
- Appreciate related systems such as PlainTeX, AMSTeX and MikTeX
- Write, edit and compile in LateX
- Use GUIs developed for LaTeX
- Understand the characteristics and facilities of LaTeX

COURSE CONTENT

- Jargon-busting
- Basic facilities
- Definitions and macros
- Mathematical notation
- Designing Tables
- Generating graphics
- Importing graphics
- Referencing and indexing
- Trouble shooting
- Compiling documents with LaTeX
- Complying with standards.
- Internet resources

Introduction to MATLAB 4 days

ABOUT THE COURSE

MATLAB is one of the most popular computational modelling tools, with wide ranging applications in science, engineering and commerce. This hands-on course is intended for those who have some previous computing experience but wish to gain an insight into the capabilities of MATLAB and develop their basic knowledge, competence and confidence to use this comprehensive computing environment for analysis, visualization and development. The course is designed to provide an introduction to MATLAB so that delegates will be in a position to select, assimilate and implement the parts relevant to their needs, enabling them to develop applications much more quickly.

DELEGATES WILL LEARN TO

- Input commands for performing basic calculations
- Use the editing and help facilities
- Handle vectors and matrices and appreciate the benefits obtained by 'vectorizing' computations
- Utilize graphics facilities
- Use inbuilt MATLAB functions for specialised tasks
- Write MATLAB code to produce new MATLAB functions (m-files)
- Write MATLAB application programmes
- Use MATLAB toolboxes and incorporate m-files from these toolboxes into their own applications

COURSE CONTENT

- The MATLAB environment
- Introduction to the MATLAB language
- Basic calculations and graphical facilities
- Exporting graphics
- Matrix and array operations
- m-files: what are they and how to use them
- Programming in MATLAB: Syntax, commands, I/O, loops and control
- Use of toolboxes
- 3D graphics
- Symbolic algebra and the Symbolic Math toolbox
- Application examples (numerical analysis, statistics & financial analysis)

Computer Simulation 4 days

ABOUT THE COURSE

This is an introductory course concerned with numerical methods for solving systems of ordinary and partial differential equations which form the basis for a wide range of computer simulations in science and engineering. The course assumes that delegates have a background in graduate level mathematics and some programming experience. The course considers the range of numerical methods for solving different types of differential equations and how these methods can be used to design specific algorithms and converted into suitable code for execution and analysis on a digital computer using a MATLAB environment.

DELEGATES WILL LEARN TO

- Appreciate the use of differential equations for modelling in science and engineering
- Use methods of numerical analysis to formulate an appropriate solution to a differential equation
- Design and execute computer algorithms based on a specific numerical approach
- Analyse and visualize the output of the numerical field generated by a particular numerical solution

COURSE CONTENT

- The concept of simulation
- Discretization methods
- The finite difference method
- The finite element method
- Initial value problems
- Boundary value problems
- Explicit and implicit methods
- Solution to first order ODEs for initial value problems
- Solution to second order ODEs for boundary value problems
- Types of partial differential equations and their origin
- Solution to elliptic equations
- Solution to parabolic equations
- Solution to hyperbolic equations
- Numerical dissipation

Design and Publication on the WWW 3 days

ABOUT THE COURSE

The course is designed to instruct delegates on the design, creation and publication of Web pages for public access over the world-wide web. A hands-on approach is considered throughout the course and hands-on practical sessions are used to help delegates design and build their own web pages.

DELEGATES WILL LEARN TO

- Understand the terminology and jargon of the worldwide web and the basic structure of web sites
- Write and edit web pages
- Include hyperlinks, tables, images, videos and other components in web pages
- Get the most out of search engines to advertise their website
- Understand the characteristics and facilities of different web tools and packages

COURSE CONTENT

- Jargon-busting and the basics of the worldwide web: the internet, servers, browsers, http and HTML
- A basic web page – hyperlinks
- Publishing a web page and checking it
- Web authoring tools
- Images and movies
- Colours and fonts
- Lists, paragraphs, spans and tables
- Trouble shooting
- Complying with standards
- Programming for the Web – Javascript
- Hosts and domain names
- Popularising a website – keywords, search engines and crawler pages

Digital Signal Processing 4 days

ABOUT THE COURSE

This course has been designed to provide a hands-on C programming approach to Digital Signal Processing (DSP) and its practical implementation using MATLAB and in particular, MATLAB's DSP toolbox as a rapid prototyping environment. It is assumed that delegates have some knowledge of the C programming language. Emphasis is placed on the design of specific algorithms and their application to processing digital signals using a structured and procedural programming approach. This is achieved by instructing delegates on the following: (i) specifying and defining the problem in terms of an appropriate mathematical model for a signal; (ii) analysis of and solution(s) to the problem; (iii) application of appropriate numerical recipe(s); (iv) designing a suitable algorithm; (v) software implementation of the algorithm; (iv) unit testing procedures. The course includes a DSP object library (with C source code) which has been specifically deigned for training in this area. A number of case studies are given including the applications of DSP to Radar, speech recognition, seismic imaging, telecommunications and financial analysis.

DELEGATES WILL LEARN TO

Develop numerical algorithms for DSP; write, compile and execute their own C functions; use their own DSP library to write applications; test their applications and investigate the results.

COURSE CONTENT

Mathematical Background

Complex analysis revisited
The Fourier series
The Fourier transform
The Laplace transform
The sampling theorem
The Hilbert transform
The wavelet transform
Other integral transforms

Computational Background

Sampling and aliasing
The Discrete Fourier transform
The Fast Fourier transform (FFT)
Computing with the FFT
Leakage and windowing
The FIR flter
The IIR filter
The least squares method

Processing Techniques

The inverse filter
The Wiener filter
The matched filter
Bayesian estimation methods
The maximum entropy method
Constrained deconvolution
The Kalman filter
Spectral extrapolation
Time domain filtering
Random signals and systems
Random fractal signals
Chaotic signals

Digital Imaging Processing 4 days

ABOUT THE COURSE

The course provides a hands-on programming approach to imaging and Digital Image Processing (DIP) using MATLAB and C/C++ and it is expected that delegates have some knowledge of the C/C++ programming language. The course begins by considering some of the physical models used to describe the formation of an image and the way in which these models help to define a mathematical model for an imaging system and define specific problems in DIP. The numerical solutions to such 'problems' are then addressed and implemented on a digital computer. This approach has been designed to provide delegates with an understanding of the relationship between the principles of image formation theory, DIP algorithms and the interpretation of digital images and the information that they convey.

DELEGATES WILL LEARN TO

Understand the physical basis of imaging systems; comprehend the design of DIP algorithms; write, compile and execute their own DIP programs; test and investigate their 'software solutions' using a range of digital images.

COURSE CONTENT

Background to Imaging
Waves and the wave equation
The fundamental imaging equation
Coherent and incoherent images
Image acquisition and modeling

Computational Background
The Discrete Fourier Transform
The Fast Fourier transform (FFT)
The Finite Impulse Response filter
Displaying digital images

Restoration and Reconstruction
Inverse problems and deconvolution
Constrained deconvolution
Bayesian estimation methods
Maximum entropy estimation
Reconstruction from bandlimited data
Reconstruction from projections

Image Enhancement
Simple transformations
Histogram equalization
Homomorphic filtering
High emphasis filtering
Fourier space filters
Moving window filtering

Segmentation and Pattern Recognition
Thresholding and binarization
First and second order edge detection
The Marr-Hildreth algorithm
Statistical segmentation methods
The Hough transform
Feature vector analysis
Neural computing methods

Supplementary Topics
Image file formats
Image compression methods
JPEG and MPEG standards
Fractal images
Fractal image segmentation
Wavelets and image processing
Digital watermarking

Introduction to Cryptography 4 days

ABOUT THE COURSE

This course has been designed for delegates who require a hands-on introduction to modern techniques of cryptography with applications to area such as computer network security, digital communications and e-banking. Delegates should have a reasonable grasp of basic mathematics and some experience of computer programming but no prior knowledge of cryptography is required. The course begins with a brief history of cryptography, looks at the principal developments of the subject over the past fifty years and instructs delegates on the principal algorithms, standards and products that form the basis of modern encryption technology. Some of the theoretical aspects of the subject are discussed, but the aim of the course is to provide a hands-on approach to the subject. Delegates will benefit from understanding the relationship between the theoretical principles of an approach to encrypting data and its practical application in terms of developing software to implement a single and/or set of computer algorithms. The programming environment used throughout is C/C++.

DELEGATES WILL LEARN TO

Understand the underlying concepts of cryptography in a unified and complete way; understand the basis upon which standard (and some non-standard) algorithms are constructed; design computer algorithms to investigate the encryption of different data fields; apply their knowledge to design encryption systems for specific problems.

COURSE CONTENT

Introduction

Brief history of cryptography
Basic cypher systems
Substitution cyphers
Transposition cyphers
Strength of a cypher
Unconditionally secure algorithms
Computationally secure algorithms
Terminology and jargon

Mathematical Background

Fundamental models
Prime numbers
Modular arithmetic
Diffusion and confusion
Stochastic fields
Random number generators
Information measures and entropy
Geometry and cryptography

Computational Background

Iteration, seeds and keys
Computation of prime numbers
Computing random numbers
Discrete stochastic fields
Frequency analysis
Statistical analysis
Data coding
Hash functions

Algorithms and Standards

Symmetric and asymmetric methods
Private and public keys
Algorithms for symmetric encryption
The Digital Encryption Standard
Algorithms for asymmetric encryption
The RSA algorithm
Key exchange algorithms
Advanced Encryption Standard

Computer Network Security 3 days

ABOUT THE COURSE

The course is designed to provide delegates with a hands-on working knowledge and understanding of the methodologies and software solutions to issues concerned with security of data within a computer network. This will include instruction on the principles of cryptography and on the principal algorithms used to design symmetric and asymmetric encryption systems including DES (Data Encryption Standard), DES3, AES (Advanced Encryption System) and RSA (Rivest, Shamir and Adleman) together with methods of key exchange, digital signatures, verification and authentication. Applications discussed will include LAN security, Web security, e-commerce and e-banking security and security issues and methods associated with database management and mobile communication systems including digital watermarking and self-authentication techniques.

DELEGATES WILL LEARN TO

- Understand the technical specifications associated with modern information security algorithms and the systems to which they are applied
- Relate to the common issues, problems and solutions associated with securing an information network
- Develop a working knowledge of how to develop a security procedure for different types of networks taking into account known attack strategies.

COURSE CONTENT

- Basic cypher systems
- Important historical ciphers
- The strength of security systems
- Data encryption standards
- The DES algorithm and DES3
- Key exchange algorithms
- Public key cryptography
- The RSA algorithm
- The AES algorithm
- Digital signatures
- Using encryption in computer networks
- Mobile communications security
- E-commerce applications

Digital Rights Management 3 days

ABOUT THE COURSE

With the growth of digital information and communications technology, the need to protect and manage the exchange of digital data is becoming increasingly important. Hence the technologies associated with Digital Rights Management or DRM is of growing importance. This course is designed to provide delegates with a working knowledge and understanding of the methodologies and software solutions used for DRM. It includes the range of systems currently available now and in the near future and introduces delegates to the fundamental principles upon which these technologies are based. These include the use of digital watermarking and information hiding, digital seals, verification, authentication and self-authentication. Applications include digital audio and voice authentication, digital image watermarking, video stream authentication and secure database management.

DELEGATES WILL LEARN TO

- Understand the technical issues associated with DRM
- Consider the environment in which DRM is necessary and can be applied
- Develop a working knowledge of how DRM algorithms are designed
- Obtain hands-on skills to applying and developing DRM software

COURSE CONTENT

- Digital data, signals and images
- Information hiding
- Digital transformations
- Watermarking methods for digital signals
- Watermarking techniques for digital images
- E-to-e watermarking schemes
- E-to-print watermarking methods
- Digital seals
- Digital signatures
- Digital compression
- Applications to digital media: CD, DVD, Memory Sticks
- Protective downloading
- E-commerce security

Information

The short courses and training programmes described in this brochure have been designed and are delivered by Professor J M Blackledge – http://eleceng.dit.ie/blackledge. They are hands-on programmes with delegates having ample opportunity to develop the practical application of the skills being developed.

FEES
Fees will be quoted upon enquiry and are payable prior to the commencement of the course. The fees quoted for each course include all course materials (lecture notes, software and supplementary materials), buffet lunch and refreshments and a course completion certificate.

TIMINGS
All course days are 8:30am to 4:30pm unless notified otherwise.

LOCATION
All courses are normally held at one of the training centres at Dublin Institute of Technology.

MATERIALS
All short courses and training programmes include formal presentations, practical workshops and problem solving, a complete set of training notes and supplementary learning materials.

CUSTERMISED TRAINING
Short courses can also be tailored to a company's particular needs as bespoke training programmes, which can be held either on location at Dublin Institute of Technology, externally at the client's site or in a location of mutual convenience.

TERMS AND CONDITIONS

In booking on the course you accept the terms and conditions detailed below.

1. Course bookings will only be confirmed after a completed booking form has been received together with any of the stated payment methods.
2. Where full payment is required prior to the course, we reserve the right to refuse admission to any delegate whose fees have not been paid in full prior to the commencement of the course.
3. If you cancel your booking, subject to clause 4, refunds will be made as follows: (i) If the cancellation is made at least 12 weeks prior to the commencement of the course, the refund will be 50% of the total course fee; (ii) If the cancellation is made at least 4 weeks but less than 12 weeks prior to the commencement of the course the refund will be 20% of the total course fee; (iii) If the cancellation is made less than 4 weeks prior to the commencement of the course no refund will be made.
4. For closed courses only, a further change may be made, if you cancel an event, to cover expenses incurred by us to third parties to the extent that these are not covered by the fees retained in accordance with clause 3 above. Our reasonable estimate of these expenses will be final and binding.
5. You may substitute one delegate for another at any time without charge.
6. The right is reserved to make alterations to the programme without notice.
7. If we cancel the course, then we will endeavour to give you as much notice as is reasonably possible. In this situation, we shall have no liability to you other than to refund your course fees in full. In particular, we shall have no liability for any costs, claims, damages or expenses arising out of any tortuous act or omission or any breach of contract calculated by reference to profits, income, production or by reference to accrual of such costs, claims, damages or expenses on a time basis.
8. Value added tax is due on course fees at the prevailing rate which is included in the fee.
9. These terms and conditions apply to the exclusion of any other terms and conditions contained or referred to in any communication sent by you.
10. All copyright in the course materials is reserved and may not be copied or distributed or made available to any other person.
11. Notwithstanding any provisions of these conditions, we shall not be responsible or liable for any delay in performance arising from acts or events beyond our control which will include but shall not be limited to acts of God, third party lock outs or other industrial disputes or action, riots, acts of war, epidemics, emergencies, acts of omissions of government or other government authorities, fire, postal or delivery failures or delays or natural disasters.
12. Unless otherwise indicated by you on the booking form, we may use personal data about you for the purpose of customer administration, marketing and selling, public relations and external affairs, management of agents and intermediaries and other third parties.
13. These conditions embody the entire agreement between us and supersede all previous communications and agreements with respect to its subject matter.
14. You acknowledge that you have not entered into the booking in reliance upon any representation by us.
15. No modification shall be binding on us unless made in writing and signed by an authorised representative of DIT.
16. Our failure to insist upon exact performance of any provisions of these conditions shall not be construed as the waver of any subsequent default of a similar nature.
17. Any legality or invalidity of any parts of these conditions shall not affect the legality or the validity of the remainder.
18. This agreement shall be interpreted in accordance with the law of the EU and shall be subject to the exclusive jurisdiction of EU courts.

Contact Details for Further Information

For further information about the courses and training programmes available contact:

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