UNIVERSITY of York

Department of Electronic Engineering : Programme Specification

MSc : Digital Systems Engineering

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UNIVERSITY OF YORK
POSTGRADUATE PROGRAMME SPECIFICATION

This document applies to students who commence the following programme:
Awarding & Teaching institution: **University of York**
Department: **Electronics**
Award and programme title: **MSc in Digital Systems Engineering**
Level of qualification: **Level 7 (Masters)**
Awards available only as interim awards:
Postgraduate Diploma in Digital Systems Engineering (exit point only for 120cu)
Postgraduate Certificate in Electronics (exit point only for 60cu)
Admissions criteria
Applicants are expected to hold an appropriate honours degree with at least an upper second class honours

or the equivalent from a university recognised by the University of York. This degree should have a significant electronics and/or computing content.

For non-English native speakers English language skills at the standard university requirement of at least IELTS 6.0 or the equivalent are expected.

Length and status of the programme and mode of study

Programme	Length (years) and status (full-time/part-time)	Start dates/months	Mode		
			Face-to-face, campus-based	Distance learning	Other
MSc in Digital Systems Engineering	1 year full-time	September	Yes	No	N/A

Language of study: English

Programme accreditation by Professional, Statutory or Regulatory Bodies

IET (Institute of Engineering Technology)

Educational aims of the programme

For the Masters, Diploma and Certificate:
The programme aims to provide a broad-based introduction to the integration of modern digital system design suitable for students with a bachelor's degree in electronics, computer science or an allied subject, and to provide a solid grounding in theory and techniques suitable for students wishing to pursue a career or higher research degree in the field of digital engineering.

Additionally for the Masters:
There is a major Independent Study Module in the form of a Group Project, enabling students to obtain realistic technical experience, and develop interpersonal skills, much in the way that this development is undertaken in industry.

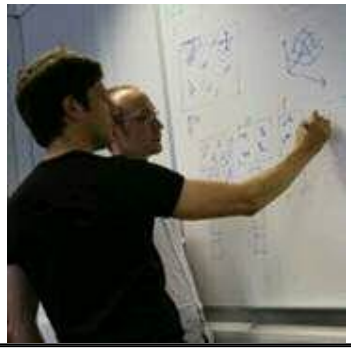
Diagrammatic representation of the programme structure by stage, showing the distribution and credit value of core and option modules

Autumn Term	Spring Term	Summer Term	Summer Vacation
Digital Design [ELE00067M] 20 CU, Level 7	**Embedded Systems for Field-Programmable Gate Array** [ELE00013M] 10 CU, Level 7	**Design Exercise** [ELE00084M] 20 CU, Level 7	
Integrated Circuit Design and Simulation [ELE00089M] 20 CU, Level 7	**Data Communication Techniques** [ELE00040M] 10 CU, Level 7		
C Programming for MSc [ELE00107M]	**Advanced Digital Design** [ELE00044M]		

10 CU, Level 7	10 CU, Level 7	
	Systems Programming for Embedded Devices [ELE00063M] 10 CU, Level 7	
	Computer Operating Systems for MSc [ELE00106M] 10 CU, Level 7	

Intended learning outcomes for the programme – and how the programme enables students to achieve and demonstrate the intended learning outcomes

A: Knowledge and understanding

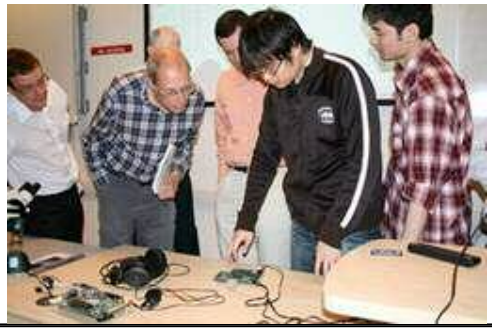


After having successfully completed this programme, students will have a solid knowledge of, and developed skills in, the theory, design and implementation of digital systems. This knowledge and related skills will provide students with appropriate grounding for careers in the digital and computing industries and/or research.
Most teaching will be undertaken through conventional lectures, laboratory sessions and workshops, and will be assessed through closed-book examinations and/or continuous assessment.

Knowledge & Understanding	Module	Delivery & Assessment
Microelectronic design techniques with a focus on CMOS transistor level design, simulation and test. Stochastic variations in modern semiconductor fabrication technologies, counter measures and statistical simulation.	**Nanoscale Integrated Circuits (IC) Design and Simulation**	Lectures, Practicals. Closed-book examination & lab report.
Design a FPGA-based development board, and suitable embedded firmware for communicating with peripherals and debugging the board once it has been constructed.	**Design Exercise**	Lectures, Practicals. Continuous assessment.
Concepts of software design and the techniques of computer programming. Study the C programming language to allow for the understanding of basic programming principles.	**C Programming for MSc**	Lectures, Computer Practicals. Programming Exercise.
Systems programming and how it differs from application programming. Device drivers and operating systems. Processes, shared memory, semaphores and deadlock.	**Systems Programming for Embedded Devices**	Lectures, Practicals. Continuous assessment.
Advanced digital design methods and techniques. How computation can be mapped on hardware through custom processing units. VHDL for the	**Digital Design**	Lectures, Laboratories. Practical assessment

synthesis of digital circuits.		and lab report.
Characteristics, functioning and limitations of a number of prominent computer operating systems for both conventional and Internet and mobile computing devices.	**Computer Operating Systems for MSc**	Lectures, Practicals & Workshops. Coursework & Presentation.
Communication systems and techniques that underpin digital technologies, especially with embedded systems.	**Data Communication Techniques**	Lectures. Closed-book examination.
Complete design flow (synthesis, place and route, floorplanning, timing analysis, etc.) required to implement complex designs. Differences in FPGA architectures and how these affect circuit design.	**Advanced Digital Design**	Lectures & Computer Practicals. Continuous Assessment.
Embedded microcontroller-based systems through implementation of various embedded systems using FPGA platforms. Varying options and constraints	**Embedded Systems for FPGA**	Lectures & Computer Practicals. Continuous Assessment & presentation.

B: (i) Skills: Discipline-related

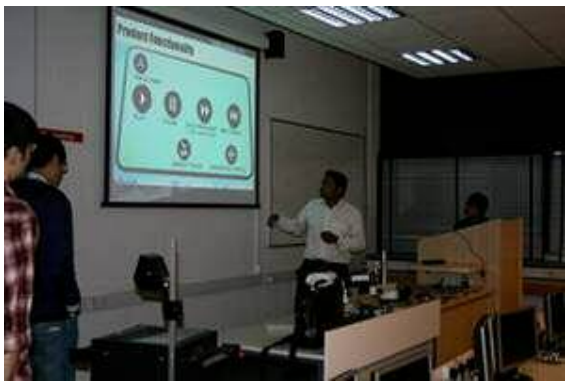


A number of the modules will provide skills specific to digital system design – notable examples are Digital Design, Advanced Digital Design, Embedded Systems using FPGA & C Programming . These will enable students to design and implement software and hardware devices to industry standards, paying special regard to quality assurance and other professional requirements. The laboratories will also enable students to develop skills in the underlying technologies.

Discipline-related Skills	Module	Delivery & Assessment
Design CMOS transistor circuits using schematic entry, transistor devices/models and SPICE simulation within the framework of industry standard design tools (e.g. Cadence, Mentor).	**Nanoscale Integrated Circuits (IC) Design and Simulation**	Lectures, Practicals. Closed-book examination & lab report.
Understand issues relating to off-the-shelf components, budgeting, write firmware IP & design a multi-layer PCB for an FPGA with a BGA footprint.	**Design Exercise**	Lectures, Practicals. Continuous assessment.
Programming: assignment including design, implementation and testing, carried out during laboratories.	**C Programming for MSc**	Computer Laboratories. Programming Exercise.
Systems programming and how it differs from application programming. Device drivers and operating systems. Processes, shared memory, semaphores and deadlock.	**Systems Programming for Embedded Devices**	Practical Exercise and Lab Report, Continuous assessment.
Physical implementation in hardware of a small dedicated processor. implement complex designs (e.g. a simple processor) from gate level using VHDL.	**Digital Design**	Lectures, Laboratories. Practical assessment and lab report.
Demonstrate understanding of distributed computing environments and the need for security.	**Computer Operating Systems for MSc**	Practicals & Workshops. Coursework & Presentation.
Understand practical digital communications	**Data**	Lectures. Closed-book

techniques such as clock embedding and recovery, line coding, DC balancing, serialisation and de-serialisation, buffering and buffer control.	**Communication Techniques**	examination.
Producing advanced digital designs using a VHDL-based design flow. Use post and pre route simulation to verify designs in the presence of faults.	**Advanced Digital Design**	Lectures & Computer Practicals. Continuous Assessment.
Design custom peripherals for embedded microprocessors, and connect off-the-shelf peripheral components to an FPGA-based system.	**Embedded Systems for FPGA**	Lectures & Computer Practicals. Continuous Assessment & presentation.
Investigation of a specified problem in Digital Systems Engineering.	**MSc Project**	Project supervisions. Staged reports, viva, presentation, demonstration, performance review.

B: (ii) Skills: Transferable



The 60 credit unit Group Project provides an excellent opportunity to gain experience working in a group, much in the way development is undertaken in industry.

Groups of several students working together in a coordinated environment is an ideal way in which software and hardware integrated systems can be developed.

In addition to attaining technical experience, experience in interpersonal skills is also gained.

Our experience with students on all our taught MSc's has demonstrated how much students can benefit from this aspect of the programme, especially if they have aspirations to work in multinational companies.

Transferable skills of project management, presentation and technical writing are taught as part of the Group Project. In addition to skills developed through academic programmes, the University's York Award can help students to plan and reflect on their experience and gain certification for many extra-curricular activities.

Transferable Skills	Module(s)	Delivery & Assessment
Group working. Interpersonal skills. Time management. Delegation & risk management. Placing individual work in a larger context, as in real-life companies.	**MSc Project**	Initial report. Final report. Viva examination. Performance review.

C: Experiences of the MSc in Digital Systems Engineering

Students on the MSc in Digital Systems Engineering benefit from a wide-ranging programme covering the theoretical background and solid hands-on experience of the techniques used in modern digital systems design. The course delivers a balanced picture of state-of-the-art digital systems design methods; a sound theoretical and practical knowledge of digital devices, tools, data networks and operating systems; and hands-on experience of the different stages of the design of a modern digital system, which will culminate

in the construction of a complex device (for example, an FPGA-based MP3 player).
Students gain experience with industry-standard software tools in laboratory sessions, and participate in a group project designed to simulate a typical experience in industry. To support this project, they receive training in planning team projects, assigning roles, preparing agendas, chairing meetings and taking minutes, and managing a small team. Modules are taught by internationally leading experts in their fields, with the teaching quality widely praised by students.

Student Profile 1: Experience of the Course - Zheng Shen
Zheng completed a Postgraduate course in Computer Science and decided to take a second Masters course. She writes here of her experience at York on the MSc in Digital Systems Engineering.

"The University of York has been ranked in the top 10 universities in the UK in recent years. It is a perfect university from the academic teaching, research performance through to the support facilities. York's high reputation is what caught my attention in the beginning.
The Digital Systems Engineering course provides students with a lot of lectures to learn the theoretical background in digital systems such as VHDL, Embedded Computer Systems and Digital Design Techniques. It also supports enough hands-on experience on digital design such as Advanced Digital Design and Embedded Systems using FPGAs. I have also learned how to work as part of a group and developed management skills and accumulated experience in presentation skills and lab reports.
During my 9 months at York, I have enjoyed staying and studying here, though it is not an easy job to study an electronic master course since many lectures and assignments are compressed into this year. I have found my own way to relax - I like walking along York's city walls to view this city's beauty, talking with the lovely people here and feeding the ducks in the university's lake."

Student Profile 2: Valuable engineering skills - Rosh Mendis

"The Digital Systems Engineering course brings together valuable skills needed in the electronics industry. Not only will you gain hands-on experience in designing hardware and software, but the course also introduces you to networking, security and digital communication aspects in the modern world. What attracted me most were the comprehensive technical modules centred around FPGA and Embedded Systems design. One important difference between this masters course and similar courses offered by other universities is, that it introduces valuable transferable skills every engineer should have - such as team work, project management and quality assurance. The final main project is group based, and is challenging but at the same time an exciting experience, by showing us what it feels like to work in a real company. The academic staff in the University of York are very friendly and are experts in their field, always willing to provide guidance and support to students.
The warm amicable nature of the locals, the beautiful scenery and history, makes York one of the best places in the UK to live and study. The University with its reputation for student satisfaction and top ranking in the league tables made it an excellent choice for my postgraduate education"

Relevant Quality Assurance Agency benchmark statement and other relevant external reference points

Here we summarise the main characteristics of MSc students, taken from:
Framework for Higher Education Qualifications in England, Wales and Northern Ireland – August 2008
QAA Subject Benchmark Statements on Engineering (2006)
http://www.qaa.ac.uk/Publications/InformationandGuidance/Documents/FHEQ08.pdf

MSc students will be able to:

- deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences
- demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level

- continue to advance their knowledge and understanding, and to develop new skills to a high level.

And will have the qualities and transferable skills necessary for employment requiring:

- the exercise of initiative and personal responsibility
- decision-making in complex and unpredictable situations
- the independent learning ability required for continuing professional development.

University award regulations

To be eligible for an award of the University of York a student must undertake an approved programme of study, obtain a specified number of credits (at a specified level(s)), and meet any other requirements of the award as specified in the award requirements and programme regulations, and other University regulations (e.g. payment of fees). Credit will be awarded upon passing a module's assessment(s) but some credit may be awarded where failure has been compensated by achievement in other modules. The University's award and assessment regulations specify the University's marking scheme, and rules governing progression (including rules for compensation), reassessment and award requirements. The award and assessment regulations apply to all programmes: any exceptions that relate to this programme are approved by University Teaching Committee and are recorded at the end of this document.

Departmental policies on assessment and feedback

Detailed information on **assessment** (including grade descriptors, marking procedures, word counts etc.) is available in the written statement of assessment which applies to this programme and the relevant module descriptions. These are available in the student handbook and on the Department's website: https://www.elec.york.ac.uk/internal_web/Docs/Handbooks/MSc/5_Statement_of_Assessment.html

Information on formative and summative feedback to students on their work is available in the written statement on feedback to students which applies to this programmes and the relevant module descriptions. These are available in the student handbook and on the Department's website: https://www.elec.york.ac.uk/internal_web/

Overview of modules by stage

Core module table

Module Title	Module Code	Credit Level[1]	Credit Value[2]	Terms Taught	Pre-requisites	Assessment Rules[3]	Timing and format of main assessment[4]
Advanced Digital Design	ELE00044M	7/M	10	SpT	Digital Design (Autumn Term)		SpT Coursework
C Programming for MSc	ELE00107M	7/M	10	AuT	Department of Electronic Engineering standard MSc entrance requirements or equivalent.		SpT Coursework
Computer Operating Systems for MSc	ELE00106M	7/M	10	SpT	Department of Electronic Engineering standard MSc entrance requirements or equivalent		SpT Coursework
Data Communication Techniques	ELE00040M	7/M	10	SpT	N/A		SuT week 1 Examinations
Design Exercise	ELE00084M	7/M	20	SuT	Advanced Digital Design Embedded Systems using FPGA		SuT Coursework
Digital Design	ELE00067M	7/M	20	AuT	None		AuT, SpT & SuT

							Coursework
Embedded Systems for Field-Programmable Gate Array	ELE00013M	7/M	10	SpT	Core for UG Computing students and optional for all other UG students except Business students. Core for MSc DSE and MSc DSP. UG students: All Stage 3 core modules and Stage 3 Digital Engineering module. MSc students: None.		SpT & SuT Coursework
Integrated Circuit Design and Simulation	ELE00089M	7/M	20	AuT			SpT week 1 Examinations
Systems Programming for Embedded Devices	ELE00063M	7/M	10	SpT	Core for MSc DSE, IWC & Autonomous Robotics. MSc students: None.		SuT Coursework

Option modules

Module Title	Module Code	Credit Level[1]	Credit Value[2]	Terms Taught	Pre-requisites	Assessment Rules[3]	Timing and format of main assessment[4]
MSc Digital Systems Engineering Project	ELE00048M	7/M	60	SuV	DSE Taught modules		SuV Coursework

[1] The **Credit Level** is an indication of the module's relative intellectual demand, complexity and depth of learning and of learner autonomy (Level 4/Certificate, Level 5/Intermediate, Level 6/Honours, Level 7/Masters).

[2] The **Credit Value** gives the notional workload for the module, where 1 credit corresponds to a notional workload of 10 hours (including contact hours, private study and assessment).

[3] **Assessment rules**

P/F = the module marked on a pass/fail basis (NB pass/fail modules cannot be compensated).
NC = the module cannot be compensated.
NR = there is no reassessment opportunity for this module. It must be passed at the first attempt.

[4] **Timing and format of main assessment**

AuT = Autumn Term.
SpT = Spring Term.
SuT = Summer Term.
SuV = Summer Vacation.

Transfers out of or into the programme

N/A

Quality and Standards

The University has a framework in place to ensure that the standards of its programmes are maintained, and the quality of the learning experience is enhanced.

Quality assurance and enhancement processes include:

- The academic oversight of programmes within departments by a Board of Studies, which includes student representation
- The oversight of programmes by external examiners, who ensure that standards at the University of York are comparable with those elsewhere in the sector
- Annual monitoring and periodic review of programmes
- The acquisition of feedback from students by departments.

More information can be obtained from the Academic Support Office:
https://www.york.ac.uk/about/departments/support-and-admin/academic-support/staff/#quality

Date on which this programme information was updated:	12/08/2017 TH
Departmental web page:	https://www.elec.york.ac.uk/

Please note

The information above provides a concise summary of the main features of the programme and learning outcomes that a typical students might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the leaning opportunities that are provided.

Detailed information on learning outcomes, content, delivery and assessment of modules can be found in module descriptions.

The University reserves the right to modify this overview in unforeseen circumstances, or where processes of academic development, based on feedback from staff, students, external examiners or professional bodies, requires a change to be made. Students will be notified of any substantive changes at the first available opportunity.

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