Birmingham City University
Technology Innovation Centre

Undergraduate Programme

Programme Specification
including Student Guide and Employer Guide

BEng (Hons) Electronic Engineering

Date of Course Approval/Review	Version Number	Version Date
24 March 2005	2.04	22 June 2006

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Definitive Documents and Version Control

This document has a version number and reference date in the footer. Documents originating from the 1999 scheme follow the sequence 1.01, 1.02, 1.03 etc. Documents originating from the 2004 scheme begin with 2.01 as the first released version and follow the same sequence.

The process leading to introduction of new courses, and major changes to courses follows ***tic*** procedure QA 1 and culminates in approval by the University's Senate.

The process leading to introduction of minor changes to modules and courses follows ***tic*** procedure QA 5 and culminates in approval by the Dean.

The reference date will be that of the validation event, minor changes board, or other meeting at which formal consideration was given.

Further details about the course and document development may be obtained from minutes of the validation, or minor changes board. A history of the document is summarised in the table below and further information relating to past versions can be obtained from the ***tic*** Registry.

BEng Electronic Engineering Programme Specification, Student and Employer Guides			
Version	**Event**	**Date of event**	**Authorised by**
2.01	Review & Re-Approval	24 March 2005	Dean of Faculty
2.02	Review & Re-Approval - conditions	24 March 2005	Panel Chair
2.03	Notification of IIE (now IET) accreditation	7 Sept 2005	Dean of Faculty
2.04	Special BoS - Desemesterisation	22 June 2006	Dean of Faculty

BEng (Hons) Electronic Engineering

PROGRAMME SPECIFICATION

NOTE: This specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes advantage of the learning opportunities that are provided. More detail on the specific learning outcomes, indicative content and the teaching, learning and assessment methods of each module can be found (1) at https://web.tic.ac.uk, (2) in the Module Specification Handbook, and (3) in the Student Handbook. The accuracy of the information contained in this document is reviewed by the University and may be checked within independent review processes undertaken by the Quality Assurance Agency.

The information from this specification may be selectively extracted and included in documents that are more appropriate for students, intending students and employers.

1	**Awarding Institution / Body:**	**Birmingham City University**
2	**Teaching Institution:**	**Birmingham City University / TIC**
3	**Programme accredited by:**	**Institution of Engineering and Technology * see note below**
4	**Final Award:**	**BEng (Hons)**
5	**Programme Title:**	**Electronic Engineering**
6	**UCAS Code:**	**H610**
7	**QAA Benchmarking Group:**	**Engineering**

*** Application to Institution of Engineering and Technology for re-accreditation pending (May 2008).**

8 Aims of the programme

The programme aims to provide learners with:

1. A broadly-based and stimulating curriculum which combines study of hardware, communications and software programming relevant to the design and development of electronic systems;

2. A curriculum which provides a range of subjects to facilitate the development of abilities, pursuit of interests and promotion of wide career choice;

3. A course of study that develops the students' intellectual and creative abilities by combining technical knowledge with appropriate practical design, business and management skills relevant to the electronics industry;

4. An understanding of the broad nature of electronic engineering through a themed approach encompassing analogue electronics, digital electronics, communications, embedded systems and business;

5. Analytical and modelling techniques to specify, design and build electronic systems;

6. An understanding of legal, ethical and environmental factors associated with electronic systems and products;

7. A range of transferable and marketable skills and knowledge leading to employment opportunities in a variety of roles within the field of electronics and associated industries;

9. An opportunity to acquire some of the skills necessary for lifelong learning;

10. A qualification that satisfies accreditation requirements of relevant professional bodies.

9 Intended learning outcomes and the means by which they are achieved and demonstrated: the programme provides learners with opportunities to develop and demonstrate knowledge and understanding, skills and other attributes as follows:

Knowledge and understanding

Knowledge and understanding of:	**Teaching, learning and assessment methods used:**
1. The principal features and operations of electronic and microelectronic components and systems. 2. Fundamental concepts, principles and theories that underpin analogue electronics, digital electronics, network and high frequency radio communications and embedded systems. 3. Analytical and mathematical modelling techniques used to solve problems in electronic circuit design. 4. General tools and techniques for the specification, design and verification of software for embedded systems. 5. The practical skills necessary in the specification, design implementation and test of electronic and microelectronic systems. 6. Commercial, social and business factors, which influence the choice of solutions to engineering problems. 7. The organisational, teamwork and practical management approaches required by professional engineers.	Knowledge and understanding are acquired through formal lectures, laboratory experiments, team working, problem solving and experimentation, report writing and other directed and independent learning activities at all stages. Knowledge is assessed, formatively and summatively, by a number of methods, including, coursework, examinations (seen and unseen, open- and closed- book), presentations, and practical work. A range of assessment methods is employed, the criteria for each module being published within each specified module guide and assessment brief.

Skills and other attributes

Intellectual / cognitive skills:	**Teaching, learning and assessment methods used:**
1. Analyse and evaluate information from a variety of sources and in various formats. 2. Argue rationally and draw independent conclusions based on a rigorous, analytical and critical approach. 3. Transfer learning study skills to new field of the programme discipline. 4. Recognise and apply appropriate managerial, creative, analytical and practical techniques to solve engineering problems. 5. Make critical judgements about the merits of differing points of view and perspectives. 6. Evaluate electronic components, products, processes and systems; expose the strengths and weaknesses, and make reasoned choice between them and offer alternatives. 7. Demonstrate an understanding of the use of technical, business and creative operations applied to engineering practice and products.	Intellectual skills are developed through formal lectures, tutorials, laboratory experiments, team working, problem solving and experimentation, report writing and other directed and independent learning activities. Analytical and problem solving skills are further developed using a range of appropriate 'real' and 'theoretical' case-studies and problem/task-based learning scenarios. Assessment includes practical work, individual and group presentations, written coursework, laboratory experimentation, examinations (seen and unseen, open- and closed- book).

Skills and other attributes (cont.)

Practical, research and independent learning skills:	**Teaching, learning and assessment methods used:**
1. Use electronic design automation (EDA) tools for applications related to the electronic, microelectronic and embedded systems, paying attention to the underpinning theory, research and design methodology. 2. Plan and undertake tasks, work to deadlines, and accept accountability for learning decisions. 3. Apply appropriate methodologies to the realisation of a major project, using primary and secondary, print and electronic sources. 4. Collect relevant information, assimilate knowledge, marshal a coherent and rational argument, and relate theory and practice. 5. Draw independent conclusions based on a rigorous, analytical and critical assessment of argument, opinion and data. 6. Use appropriate laboratory and workshop equipment to execute safely a series of applied experiments and to generate transferable data.	The acquisition of appropriate and transferable practical skills is central to the learning strategy of the programme. Initiative and independence are fostered throughout, and develop as the course progresses. Emphasis is placed on guided, self-directed and student-centred learning, with increasing independence of approach, thought and process. Learners are encouraged to plan their own work schedules and are required to meet strict deadlines. Diaries / logbooks are required to be kept in some modules. Learners undertake a major individual practical / research project and complete a related dissertation.

Transferable / key skills:	**Teaching, learning and assessment methods used:**
1. Work with, and relate effectively to, others. 2. Manage time and prioritise workloads. 3. Make effective oral and written presentations. 4. Access and make appropriate use of relevant numerical and statistical information. 5. Make effective use of information and communications technologies, including word and data processing packages, the internet, email and electronic information retrieval systems. 6. Formulate ideas and seek to develop innovative solutions. 7. Understand career opportunities and begin to plan a career path. 8. Show confidence and self-awareness, reflect on own learning, and be self-reliant and constructively self-critical.	Transferable/key skills are core to the learning strategy of the programme. They are pervasive, and are incorporated into modules and assessments as appropriate, eg team-working skills are fostered via group, task-based practical projects. Reflection and self awareness are fostered by keeping logbooks and the opportunity for submitting self assessment documentation in support of personal performance. Assessment methods include practical projects, presentations, coursework, peer- and self-assessment.

10 Programme structure and requirements, levels, modules, credits and awards

The BEng (Hons) programme is normally studied over three years full-time or five years part-time, and students may if they wish move between full and part-time modes of attendance. The academic year runs from September to June. The course is divided into study units called modules, each of 24 credits. Students complete 120 credits at levels 4, 5 and 6 (corresponding to years 1, 2 and 3 of the full-time programme). Each 24 credit module represents 240 hours of student learning and assessment.

The Faculty's BEng (Hons) degrees can be studied in sandwich mode. Students who, in addition to satisfying requirements for an honours degree, successfully complete an approved industrial placement between levels 5 and 6 (full time year 2 and 3) obtain the award of a sandwich honours degree.

The structure of the course, the modules, levels and credit ratings, and the awards which can be gained are shown below.

Level 4/Stage 1

Module number	Module name	Credit
	Computer Network Basics D1 LAN/WAN terminology, OSI, media, devices, standards, TCP/IP and addressing. Router configuration, routing protocols, access control lists, TCP/IP and Router operating systems.	24
	Maths Analysis D1 Algebra, calculus, complex numbers, vectors, statistics, computer packages. Matrices, partial differentiation, differential equations, Laplace transforms, computer packages.	24
	Electrical Principles D1 Basic DC and AC theory, network analysis, characteristics of non-sinusoidal waveforms, introduction to ECAD. Analysis of AC circuits using j notation. Fourier analysis. Transmission line theory. Electromagnetic theory. Motors and generators. Transformers.	24
	Computer Systems and Programming D1 Software development, system concepts, programming, software documentation. Structured programming techniques, software document writing, quality.	24
	Electronics D1 Combinational logic circuits, discrete electronic devices, transistor switching circuits, operational amplifiers. Discrete semiconductor devices. Operational amplifier circuits: integrator, differentiator, rectifier. Active filters, combinational and sequential logic, oscillators.	24

Award: Cert HE (120 credits)

Level 5/Stage 2

Module number	Module name	Credit
	Market-led Business for Engineers D2 Market-led business analysis and planning: Marketing; Finance; Strategy and Change; General Management Principles; Business Applications of ICT; Professional Development; Communications.	24
	Communication Systems D2 The communications channel, baseband transmission, digital modulation, transmission impairments. Radio wave propagation. Aerial design. Radio frequency signal generation and detection. Transmitter and receiver circuits. Satellite communications. Digital radio systems.	24
	Analogue Electronics D2 Operation of discrete devices (e.g. BJT, FET, SCR etc.). Diode and transistor modelling, introduction to feedback analysis and stability. Small signal modelling of transistors and amplifiers. Linear power amplifiers. Further operational amplifier applications.	24
	Digital Electronics D2 Formal design methods for sequential systems, design and applications of Finite State Machines, ECAD tools, ADC and DAC circuits. Use of VHDL, applications of combinational and sequential circuits, microprocessor architecture and design and implementation using gate arrays.	24
	Embedded Systems D2 Concepts of software engineering applied to real-time systems, systems analysis and design. Introduction to hardware and software requirements used in monitoring/control applications, basic computer architecture, digital and analogue interfacing, transducers, open loop and on/off control applications and interrupts.	24

Award: Dip HE (240 credits)

Level 6/Stage 2

Module number	Module name	Credit
	Individual Project D3 To provide opportunity to develop in-depth knowledge and skills in an area relevant to the course and ability to manage actives and resources and to generate, implement and report on solutions to meet project objectives.	24
	Analogue Electronics D3 Implementation of active and switched-capacitor filters. Design of linear power supplies and operation of switched-mode power supplies, power amplifier design. Further feedback analysis, high frequency modelling of transistors, programmable analogue IC devices and applications, noise.	24
	Microelectronic System Design and Test V Computer architecture and organisation, Finite state machine design methodology. Use of VHDL for system design and simulation. Design implementation using ASIC, PLD and FPGA devices. Digital system testing. Design for test in complex systems. Professional and legal responsibilities (EMC, WEE).	24
	Embedded Systems D3 Application and use of Real Time Operating Systems, closed loop control systems, further sensor/actuator interfacing, development of autonomous guided vehicle.	24
	Digital Signal Processing D3 Analogue and digital signal processing, Analysis of digital signals, FFT, Z-Transforms, design of FIR and IIR filters, advanced digital signal processing.	24

Award: BEng (Hons) (360 credits)

Course Structure – BEng (Hons) Electronic Engineering (FC0152)

Level 6

Individual Project D3 FM6020	Analogue Electronics D3	Digital Signal Processing D3	Microelect-ronic System Design and Test D3 FM6025	Embedded Systems D3 FM6017

Level 5

Market –led Business for Engineers D2 FM5056	Analogue Electronics D2 FM5028	Digital Electronics D2 FM5047	Communicati on Systems D2 FM5037	Embedded Systems D2 FM5051

Level 4

Mathematical Analysis D1 FM4037	Electrical Principles D1 FM4024	Electronics D1 FM4026	Computer Network Basics D1 FM4045	Computer Systems and Programming D1 FM4019
Project & Business Theme	***Analogue Electronics Theme***	***Digital Electronics Theme***	***Communi-cations Theme***	***Embedded Systems Theme***

BEng (Hons) Electronic Engineering (FC0152)

Part-time (day release) study mode

Year				Semester
P/t yr5 **F/t yr3**	Individual Project D3	Digital Signal Processing D3	Microelectronic System Design and Test D3	**10** **9**
P/t yr4 **F/t yr2**	Analogue Electronics D3	Embedded Systems D3	Digital Electronics D2	**8** **7**
P/t yr3 **F/t yr 2**	Analogue Electronics D2	Embedded Systems D2	Communication Systems D2	**6** **5**
Normal entry point for holders of a relevant HNC or equivalent				
P/t yr2 **F/t yr 1**	Market –led Business for Engineers D2	Computer Systems and Programming D1	Maths Analysis D1	**4** **3**
P/t yr1 **F/t yr1**	Electronics D1	Electrical Principles D1	Computer Network Basics D1	**2** **1**

Typical Exemptions for entry with relevant qualifications

11 Support for Learning

Students are encouraged to identify and, with guidance, to reflect on their own learning needs and are offered the following support as appropriate to those needs:

An induction programme dealing with orientation and the dissemination of essential information.

A dedicated Learning Centre with open access learning materials, resources and full-time staff specialising in a variety of support areas.

Access to the services of the Learning Centre and IT support staff.

A Student Handbook, containing information relating to the University, Faculty, course and modules.

Access to administrative staff and to academic staff, including the Tutors, Course Director and Head of Division, at reasonable times.

Support staff to advise on pastoral and academic issues, and to offer support and assistance with the keeping of Students' Progress Files.

Access to Faculty resources, including the Faculty Resource Centre, and a range of supported IT equipment.

Access to the University's Student Services, including those offered by the careers service, financial advisers, medical centre, disability service, crèche, counselling service and chaplaincy.

12 Criteria for admission

Entry requirements are in accordance with section D of the University's Academic Regulations and Practices.

All applicants must have GCSE (grade C or above) in Physics (or Science which includes a study of physics) and English Language or equivalent. In addition, applicants should have one of the following, for which the typical tariff offer is 220 points for Curriculum 2000, or equivalent for other qualifications. Actual tariff offers may vary from 220 points.

Qualification	**Requirements**
Curriculum 2000, A Levels	Five GCSEs/GCEs including at least two subjects at A2 level. Points tariff can include AS level. A minimum of AS level grade C in Mathematics must be offered.
Curriculum 2000, AVC.	Two 6-unit or one 12-unit AVCE.
Irish Leaving Certificate	Passes in six subjects at the higher grade including Mathematics.
Scottish Certificate of Education	Passes in five subjects at the higher grade including Mathematics.
International Baccalaureate or European Baccalaureate	Including higher level Mathematics.
BTEC/Edexcel National Certificate/National Diploma	In an appropriate subject.
A pass in a recognised Access or Foundation Year for BEng course	
An appropriate Advanced General National Vocational Qualification	
A professional qualification of an appropriate standard	
A qualification deemed equivalent to one of the above	

Other learning and experience may be considered for entry to the programme. A student may be allowed entry to a course if he or she does not have the standard entry qualifications but can provide evidence of necessary knowledge and skills to successfully enter and complete the course.

Applicants with a Higher National Certificate or Higher National Diploma, including Merits, in an appropriate subject, or an equivalent qualification, may be offered entry with advanced standing.

UCAS applicants are invited to visit the **tic** during open days held through the academic year. Open day programmes include a tour of facilities and an introduction to the **tic**'s courses and activities. Meetings are arranged between course tutors and prospective students to ensure opportunity is provided for individual questions and clarification of the course content.

13 Evaluation and improvement of quality and standards

Committees:	**Mechanisms for review and evaluation:**
Course Committee Board of Studies Examination Board Learning Management Committee Faculty Board Learning Quality Committee	Review and validation events Accreditation by professional bodies Annual Monitoring Report Student feedback questionnaires Annual staff appraisal External Examiners' Reports Course team meetings

14 Regulation of assessment

Details of the mechanisms and criteria for assessment in individual modules, and the means of determining final degree classifications, are published widely. Students are able to access the University's Standard Undergraduate Assessment Regulations on the Intranet and individual and collective guidance is given by academic staff on their operation at appropriate times throughout the course.

To qualify for an Honours degree a student must successfully complete all required modules and obtain 360 credits (each module has a 24 credit value). Only assessments at levels 5 and 6 (that is second and third year modules on the 3-year full-time programme) are used to calculate the degree classification. The pass-mark in all modules is 40%.

Degree classifications are determined, after successful completion of all the course modules from whichever is the best of:

1. The average of the marks for the level 5 and level 6 modules, or

2. The average of the marks for the five level 6 modules, or

3. The average of the final year Individual Project module mark plus the best three from the remaining four level 6 modules.

The highest average is used to obtain the degree classification according to the following bands:

First class honours	aggregate mark of 70% or above
Upper second class honours	aggregate mark of 60%-69%
Lower second class honours	aggregate mark of 50%-59%
Third class honours	aggregate mark of 40%-49%

External Examiners are appointed. Their work includes:

- Reviewing coursework assignments and assessment criteria
- Approving examination papers
- Monitoring standards through moderation of completed assessments
- Attending Examination Boards
- Participating in the course review processes.

BEng (Hons) Electronic Engineering

Student Guide

Background

Electronic Engineering is continuing to experience rapid technological advance. People rely on sophisticated electronic technology in applications ranging from mobile telephones to life-saving medical science. The need for electronic knowledge and skills continues to grow in a multitude of areas and this trend is not expected to diminish.

The BEng (Hons) Electronic Engineering degree combines a study of the enabling technologies of electronics and communications with applications relating to design and development of real systems. Our graduates will be versatile, adaptable, technically literate, creative and acquire practical design skills relevant to the specification, design, simulation and test of electronic and microelectronic systems.

Is the course accredited?

The BEng (Hons) Electronics Engineering is accredited by the Institution of Engineering and Technology as satisfying partial academic requirements towards CEng. Holders of BEng (Hons) awards are required to complete Further Learning in order to meet the full requirements for CEng. (Subject to confirmation of re-accreditation)

Facilities / Partnerships

Students following the programme have access to well renowned computing and laboratory facilities within the Technology Innovation Centre.

CISCO Systems is a multinational organisation specialising in the supply of communications network technology products and infrastructure. The ***tic*** became the first CISCO Regional Network Academy in the UK and is now a CISCO Academy Training Centre. Students studying on the BEng Electronics Engineering course will study the first part of the CCNA (CISCO Certified Network Associate) curriculum as part of the course study programme.

What does the industry want?

To remain competitive in the world market place there is a constant demand for well-qualified graduate engineers. Industry requires electronic engineering

graduates who are versatile, adaptable and possess technical knowledge, analytical capability and practical skills in design, test and implementation of electronic systems coupled with business and commercial awareness. These qualities will provide the foundation for a successful and rewarding career.

What type of work will I do?

The programme combines a number of key themes: Analogue Electronics, Digital Electronics, Embedded Systems, Communication systems and Business. There is also a final year project.

Assignments include: Technical specification, design, prototype and test as well as final integration and implementation of a mobile embedded platform.

Are there Sandwich Placements and Opportunities?

Yes. The Technology Innovation Centre has a placements officer who manages a scheme designed to give students an opportunity to work in industry as a part of their studies. Industry placements offer students stimulating challenges and the chance to further develop practical expertise, to take on real responsibility and gain valuable experience of commercial life in a variety of organisations.

Project Opportunities Supporting Research Programmes

- Embedded microcontroller for motor / drive control
- Smart keyless access for vehicles
- Data acquisition and control over the Internet
- Home energy monitoring systems
- Computer network traffic analysis
- Embedded multi-function instruments
- Micromouse competition

Employment prospects?

As well as more general management and applications opportunities, possible employment areas include:

- Hardware embedded system designer; Software Embedded system engineer
- Technical appointments in Automobile, Aviation Engineering, Computer systems integration companies and the Communications industry etc;
- Analogue/ digital design engineer. VHDL / ASIC design engineer
- ATE methodology technologist
- DSP design engineers

How do I apply?

University: **Faculty:**	Birmingham City University Technology Innovation Centre Millennium Point, Curzon Street, Digbeth Birmingham B4 7XG Telephone: (+44) (0)121 331 5400 http://www.tic.ac.uk
Applications:	UCAS Rosehill New Barn Lane Cheltenham Gloucestershire GL52 3LZ Telephone (+44) (0)1242 223707 http://www.ucas.ac.uk/
UCAS code:	H610
Course Length:	3 years full-time 4 years sandwich 3 years part-time for stage 2 entry with appropriate HNC or equivalent, 5 years if no exemptions apply
Location:	Millennium Point, Birmingham
Enquiries:	Information Officer (at the above address) Telephone: (+44) (0)121 331 5400 Email: enquiries@tic.ac.uk

BEng (Hons) Electronic Engineering

Employers Guide

Introduction

The Technology Innovation Centre (***tic***), part of Birmingham City University, offers a portfolio of engineering and technology focused programmes that share the common philosophy of combining the enabling technologies of computing, communications and electronics.

Electronic engineering is continuing to experience rapid technological advance. People rely on sophisticated electronic technology in applications ranging from mobile telephones to medical science where lives are saved. The need for electronic knowledge and skills continues to grow in a multitude of areas and this trend is not expected to diminish.

The BEng (Hons) Electronic Engineering combines a study of electronics and communications with their creative applications relating to design and development of electronic systems.

Our graduates will be versatile, adaptable, technically literate, creative and acquire practical design skills relevant to the specification, design, simulation and test of electronic and microelectronic systems.

Facilities / Partnerships

Students following the programme have access to the Technology Innovation Centre's state of the art computing and laboratory facilities.

CISCO Systems is a multinational organisation specialising in the supply of communications network technology products and infrastructure. The ***tic*** became the first CISCO Regional Network Academy in the UK and is now a CISCO Academy Training Centre. Students studying on the BEng Electronics Engineering course will study the first part of the CCNA (CISCO Certified Network Associate) curriculum as part of the course study programme.

The Curriculum

The content and structure of the course is designed to produce graduates with a broadly based but technologically orientated education. There are five themes on the course:

- Digital Electronics & DSP
- Embedded Systems
- Analogue Electronics
- Communications
- Mathematics, Business and Project

Programme Aims

The course aims to produce engineers who are versatile, adaptable and possess technical knowledge, analytical capability and practical design skills relevant to the specification, design and test of electronic and microelectronic systems.

Expected Outcomes

Graduates can be expected to have acquired extensive knowledge and hands-on practical experience of the organisational, business management, creative practice and technical operations that are inherent in a diverse range of electronic processes and products.

A typical graduate will have knowledge and understanding of:

- The principal features and operations of electronic and microelectronic components and systems.
- Fundamental concepts, principles and theories that underpin analogue electronics, digital electronics, communication (both radio and network) and embedded systems.
- Relevant analytical and mathematical modelling techniques used to solve problems in electronic circuit design.
- General tools and techniques for the specification, design and verification of software for embedded systems.
- Practical skills necessary for the specification, design implementation and testing of electronic and microelectronic systems.
- Digital signal processing techniques applied to electronics and communication systems.
- Commercial, social and business factors that influence the choice of solution to engineering problems.
- The organisational, teamwork and practical management

approaches required by professional engineers.

Accreditation

The BEng (Hons) Electronics Engineering is accredited by the Institution of Engineering and Technology as satisfying partial academic requirements towards CEng. Holders of BEng (Hons) awards are required to complete Further Learning in order to meet the full requirements for CEng. (Subject to confirmation of re-accreditation)