WJEC
CBAC

GCSE TEACHERS' GUIDE

New Specifications:
for teaching from September 2009

Electronics

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GCSE in Electronics
Teachers' Guide

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1. INTRODUCTION

The WJEC GCSE Electronics specification has been modified and updated for delivery from September 2009. The first unit awards will be made in Summer 2010 and the first GCSE awards in summer 2011. For the first availability of units, see page 2 of the specification. The specification can be delivered and assessed in centres throughout the UK.

There are no national criteria specifically for GCSE Electronics content. The skills and other general aspects of the GCSE Science criteria are applicable.

This Guide is one of a number of ways in which WJEC provides assistance to teachers delivering the new specification. Also essential to its introduction are the Specimen Assessment Materials (question papers and marking schemes) and professional development (INSET) conferences.

Other provision, which you will find useful are:

- Examiners' reports on each examinations series
- Free access to past question papers via the WJEC website
- Easy access to specification and other key documents on main website
- Student notes available for free download from the WJEC website*
- Regular INSET delivered by Chief Examiners
- Easy access to both the Subject Officer and to administrative sections

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* Student notes introduced progressively from May 2009 starting with section 1 of unit E1. From the homepage www.wjec.co.uk select (subject) Electronics and (level) GCSE and click on "Go"; look for the link to the student notes.

1.1 Rationale

The candidate who works through this course will be taught to identify problems which are susceptible to electronic solutions and to design and test solutions to such problems. A systems approach to the solution of problems is encouraged.

An electronics system is conceived of as a set of interconnected blocks, each with its own function. These blocks are considered on two levels:

1. how they combine to function as components of the whole system;

2. how they are constructed from individual circuit components.

The course is conceived of as practically based. Students should be encouraged to employ their growing understanding to the design of practical circuits from the earliest part of the course.

1.2 Overview of the Specification

The course consists of 3 units.

Unit 1: Discovering Electronics

For candidates taking GCSE Electronics as a 2-year course, this unit is designed to be taught in the first year alongside appropriate preparation for unit 3, the internally-assessed unit.

1.1	**Electronic Systems**	The concept of Electronic Systems, as consisting of Input, Processing and Outputs is introduced.
1.2	**Electronic Sub-Systems**	A variety of Input, Output and Processing subsystems is introduced.
1.3	**Circuit Concepts**	The behaviour of electronic components and their behaviour in circuits are considered – including current/voltage characteristics, resistance combinations, power and the use of SI multipliers.
1.4	**Sensing Circuits**	How components are connected into sensing circuits.
1.5	**Designing Sensing Circuits**	Using the results of 1.4 to design their own circuits.
1.6	**Output Circuits**	Consideration of appropriate output devices and circuitry.
1.7	**Switching Circuits**	Includes npn transistors, n-channel mosfets, thyristors and voltage comparators.
1.8	**Applications of Diodes**	Includes forward voltage drop across silicon diodes and their use to protect motor and solenoid driver circuits.
1.9	**Combinational Logic**	Truth tables AND, OR, NOT, NAND and NOR gates, Boolean notation and NAND-gate implementation.

Unit 2: Applications of Electronics

2.1	**Timing Circuits**	Includes R-C circuits, monostables and bistables, calculation of time delay and frequency.
2.2	**Sequential Systems**	D-type flip-flops, binary, BCD and decade counters.
2.3	**Interface circuits**	Transistors and Schmitt inverters, including the use of the latter for signal conditioning.
2.4	**Analogue Communications**	General amplifier systems: gain, bandwidth, frequency response and clipping; non-inverting and inverting op-amp-based amplifier circuits; mixers/summing amplifiers.
2.5	**Programmable Control Systems**	Sequence controllers; memory ICs Software control systems; flowcharts N.B. The knowledge and skills gained in this part of the qualification provide an alternative route to the system design in unit 3. Centres are advised to contact the examining team for advice on this.

Unit 3: Electronics System Design & Realisation (Controlled Assessment)

In consultation with their teachers, students define a problem, draw up a specification for an electronic solution, explore solutions and select an appropriate one, design build and test the system using a subsystems approach. The students document their work and it is marked according to criteria in the specification and on the website.

The full details of controlled assessment, see pages 24-30 of the GCSE Electronics specification.

1.3 Changes to the specification for teaching from September 2009

The content of the specification is largely unchanged from the previous specification. Minor changes have been made to the content statements with the aims of:

- clarifying content requirements;
- removing content which proved difficult to assess.

The major change is to the number of units, their aggregation and method of assessment. These changes are:

1.3.1 Unit Structure

The previous specification consisted of 4 units including a terminal unit. The 3 externally assessed units were tiered and the terminal paper included content from the first two units.
This specification has 3 units all of which are independent and all of which are untiered.

1.3.2 Aggregation

The results of the units are reported on a Uniform Mark Scale. The unit weightings and UMS maximum marks are:

Unit	External / Internal	Weighting	Maximum UMS
E1	External	35%	70
E2	External	40%	80
E3	Internal	25%	50
Overall subject			200

The relationship between the UMS scores and the grades is as follows:

Unit	UMS max	A*	A	B	C	D	E	F	G
E1	70	63	56	49	42	35	28	21	14
E2	80	72	64	56	48	40	32	24	16
E3	50	45	40	35	30	25	20	15	10
Total	200	180	160	140	120	100	80	60	40

Ofqual/DCELLS GCSE criteria require that at least 40% of the assessment take place at the end of the course on aggregation. On initial aggregation, this is unlikely to present difficulties but it means that, if a candidate wishes to retake units and re-aggregate, he/she may need to take more than one unit.

1.3.3 Method of Assessment

The external units, E1 and E2, will be assessed by on-screen electronic assessment. This represents a major change. The assessments will have 60 raw marks in two sections, A and B. Section A will consist of questions accessible to candidates across the ability range; section B will consist of questions designed to discriminate between high ability candidates. Candidates will be able to obtain a C-grade by correct answers to section A only.

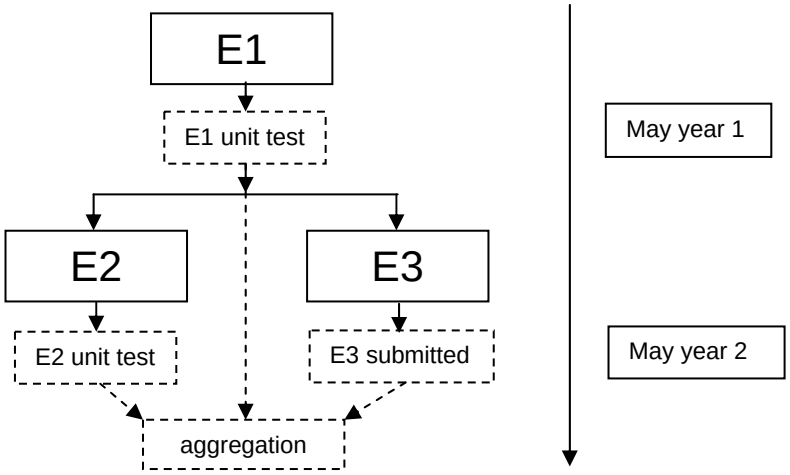
2. DELIVERING THE SPECIFICATION

The specification is designed to be delivered in approximately 150 hours of contact or directed study. This equates to a two year course with approximately 10% of curricular time or a one year course with 20%. The course is designed to be approached in a practical manner; from the earliest part of the course, candidates should be encouraged to apply their knowledge to the design of electronic systems, from the identification of subsystem blocks to the design of the block circuits and whole systems.

2.1 Pathways through the specification

The specification can be approached in either a linear or modular manner, i.e. the unitised nature of the assessment can be taken advantage of or ignored. The division of the specification into units E1, E2 and E3 should not be taken to imply that the work must be undertaken in this order; the same comment can be made about the subdivisions in units E1 and E2. On the other hand, the externally assessed units were written with an eye to progression and it is the opinion of the examining team that the section sequence in each of these units represents a reasonable teaching sequence and that E1 provides a good introduction to the course.

Unit E1 provides the necessary basis for the techniques required for the design of circuits in the Controlled Assessment, unit E3. The experience of the examining team is that the vast majority of candidates benefit from undertaking a project based upon the digital techniques covered in the E1. Because of these considerations, the following pathway is likely to be beneficial to candidates undertaking the course over two years:



This pathway makes good use of the post-E1 time at the end of the first year of the course to introduce the project, thus saving time in the second year.

It is possible to use a PIC approach to the Electronic System Design and Realisation (E3). In this case, the appropriate part of unit E2 (2.5) needs to be covered first.

3. SUPPORT FOR TEACHERS

In the absence of an appropriate textbook for the course, WJEC is developing a set of student notes for free download. These should start appearing on the WJEC website from late May 2009. Teachers can obtain an early idea of the nature of these notes by looking at the GCE Electronics section of the website. To navigate to these notes:

On the WJEC homepage – **www.wjec.co.uk** – choose (subject) Electronics and (level) (GCE A/AS/AEA) and click on "Go". This will take you to the GCE Electronics page. In the central section, select "view full list of documents" and this will take you to the first of about 6 pages of documents. The student notes are to be found under the heading "Teacher Guidance Notes".

WJEC runs a consultative moderation service. This is to enable centres which are new to the specification or newly appointed teachers to approach WJEC for advice on assessing coursework. The service is normally provided by the Chief Examiner, who may also be approached for guidance on other issues such as task setting (for E3) and level of treatment. The subject officer or subject support officer should be contacted in the first instance: see page 2 of this Guide for contact details.

3.1 National Grid for Learning - Cymru

National Grid for Learning Cymru - http://www.ngfl-cymru.org.uk/ - is developing resources for teaching and learning across a wide range of subjects at GCSE and GCE. Currently there are no resources for Electronics but it is likely that, in the near future, the student notes will be transferred to the NGfL. In this case, a link will appear on the Electronics pages of the WJEC website.

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