Oxford Cambridge and RSA Examinations

OCR AS GCE in Information and Communication Technology   (3838)

OCR Advanced GCE in Information and Communication Technology (7838)

Approved Specifications – Revised Edition

First Advanced Subsidiary GCE certification was 2001   QAN (3872) 100/0082/3

First Advanced GCE certification was 2002   QAN (7872) 100/0081/1

Foreword to the Revised Edition

This Revised Edition has been produced to consolidate earlier revisions to these specifications and any changes contained within have previously been detailed in notices to centres. **There is no change to the structure of the specification, and most differences are minor content changes or cosmetic**. Sidelining will be used to indicate any **significant** changes throughout this document.

The main changes are:

Synoptic Assessment – it is no longer a requirement to take synoptic units at the end of the course**.**

Re-sits of Units - The restrictions on re-sitting units have been removed, enabling candidates to re-take units more than once (see page 17 for details).

© OCR 2005

2 **Foreword** (continued)

This booklet contains OCR's Advanced Subsidiary (AS) and Advanced GCE (A level) ICT specifications for teaching from September 2005.

The AS GCE is assessed at a standard appropriate for candidates who have completed the first year of study of a two year Advanced GCE course, i.e. between GCSE and Advanced GCE. It forms the first half of the Advanced GCE course in terms of teaching time and content. When combined with the second half of the Advanced GCE course, known as 'A2', the AS forms 50% of the assessment of the total Advanced GCE. However, the AS can be taken as a 'stand-alone' qualification. A2 is weighted at 50% of the total assessment of the Advanced GCE.

In these specifications the term **module** is used to describe specific teaching and learning requirements. The term **unit** describes a unit of assessment.

Each teaching and learning module is assessed by its associated unit of assessment.

These specifications meet the requirements of the Common Criteria (Qualifications and Curriculum Authority, 1999), the GCE AS and Advanced Level Qualification-Specific Criteria (QCA, 1999) and the relevant Subject Criteria (QCA, 1999).

Contents

Specification Summary

Outline

The overall aim of these Advanced Subsidiary GCE and Advanced GCE specifications is to encourage candidates to develop an understanding of the principles of problem solving using ICT and of the range of applications of ICT and the effects of their use, and to apply this understanding when developing ICT solutions to problems. Candidates develop an understanding of systems analysis and design, and methods of implementation, testing and documentation.

Rationale

In today's world, individuals will increasingly need technological and information literacy skills that include the ability to gather, process, and manipulate data. These skills are now as essential as the traditional skills of numeracy and literacy.

The impact of ICT on society is enormous and as the percentage of businesses and households connected to communication networks such as the Internet grows, so does the need for individuals who can master and manipulate these new technologies. As well as the rapid development of new technologies that gather, organise, and share information, familiar technologies like television, telephone, and computers are evolving and being expanded by digitised information, causing a convergence of technologies.

ICT provides new opportunities for learning as well as changing the way in which we work. Traditional unskilled jobs are disappearing, while new areas of economic activity, such as multimedia production, are growing rapidly. Also, how and where we work continues to evolve as technology impacts on the workplace.

Broad Aims

These specifications are designed to develop an understanding of the fundamentals of ICT and to provide the knowledge and skills suitable for participation in an evolving information-based society. Students need to have a firm grounding in ICT for their careers, for lifelong learning, and for recreation. The intention is therefore to provide the opportunity for the student to learn the analytical, interpersonal, and technical skills they require to be active participants in an exciting and dynamic world.

To be responsible members of society, students must be aware of the ever-growing impacts of ICT. They need to reflect critically on ICT's role in society and consider its positive and negative effects. These specifications reflect this need to develop skills and attitudes that increase students' abilities to address the social and ethical issues of technological advancements.

Progression opportunities

In today's workplace, those with the knowledge and skills to use ICT creatively have the opportunity to pursue new and exciting careers, with whole industries emerging around the ICT revolution.

To meet these career challenges, students must be self-reliant as well as good communicators and problem solvers. They require interpersonal, academic, and technical skills, and must demonstrate an ability to work independently and as part of a team. They also need to develop an ethical approach to the use of information. These specifications provide a focus to develop these skills while ensuring that students acquire a sound knowledge of ICT.

Recommended prior learning

No previous knowledge of ICT is assumed, although the specifications develop the aims of GCSE specifications in Information and Communication Technology by enhancing and broadening the range and the understanding of the capabilities of applications and information systems studied. The use of a range of tools and techniques is required, to solve more extensive and more complex problems.

Specification Content

The content covers the principles of problem solving using ICT and a range of applications, and the effects of their use. The content goes on to cover communications technology, user interfaces, distributed systems, systems analysis and design and methods of implementation, testing and documentation.

Scheme of Assessment

The Advanced Subsidiary GCE forms 50% of the assessment weighting of the full Advanced GCE. Advanced Subsidiary GCE is assessed at a standard between GCSE and Advanced GCE and can be taken as a stand-alone qualification or as the first part of the full Advanced GCE course.

Assessment is by means of **three Units of Assessment** for Advanced Subsidiary GCE and **six Units of Assessment** for Advanced GCE.

AS GCE   Candidates take Units 2512, 2513 and 2514.

Advanced GCE   Candidates take Units 2512, 2513, 2514, 2515, 2516 and 2517.

Units of Assessment

Unit	Level	Name	Mode of Assessment	Duration	Weighting	
					AS	Advanced GCE
2512	AS	Information, Systems and Communications	Written Examination	1 hour 30 mins	30%	15%
2513	AS	Structured Practical ICT Tasks	Coursework	-	40%	20%
2514	AS	Practical Applications of ICT using Standard/Generic Applications Software	Written Examination	1 hour 30 mins	30%	15%
2515	A2	Communications Technology and its Application	Written Examination	1 hour 30 mins	-	15%
2516	A2	ICT Project	Coursework	-	-	20%
2517	A2	ICT Systems and Systems Management	Written Examination	1 hour 30 mins	-	15%

Question Paper Requirements

AS

Unit 2512: Information, Systems and Communications: a written paper of 1 hour 30 minutes duration, containing 10-15 structured contextualised questions requiring short answers.

Unit 2514: Practical Applications of ICT using Standard/Generic Applications Software: a written paper of 1 hour 30 minutes duration, containing 4-6 questions based on a short scenario.

A2

Unit 2515: Communications Technology and its Application: a written paper of 1 hour 30 minutes duration, containing 4-6 structured questions.

Unit 2517: ICT Systems and Systems Management: a written paper of 1 hour 30 minutes duration, containing 4-6 structured questions.

Coursework Requirements

AS

Unit 2513: Structured Practical ICT Tasks: the pre-released OCR-set tasks are presented to candidates, requiring them to find a solution to a given problem and to demonstrate competence in the skills of design, testing, implementation and documentation. The candidate's work is marked by the teacher and externally moderated by OCR.

A2

Unit 2516: ICT Project: this unit requires candidates to develop an ICT solution to a real-life problem. The problem should be formulated through negotiation between the candidate and the teacher and involves the skills of analysis, design, testing, implementation and evaluation. The candidate's work is marked by the teacher and externally moderated by OCR.

Overlap with VCE

Overlap with VCE specifications is detailed in Appendix C.

1   Introduction

ICT is at the heart of the majority of commercial, industrial, service sector and scientific organisations. It has a continual and profound effect on the daily lives of everyone in society. These specifications allow candidates to understand and evaluate this effect and to develop a flexible approach as hardware and software continues to develop.

These specifications are designed to allow Advanced Subsidiary GCE and Advanced GCE candidates the opportunity to develop their understanding of how ICT is used to assist in the processing of data in a range of organisations and situations. They offer candidates opportunities to develop a sound understanding of the ways in which software packages may be used and tailored to meet the needs of users in these organisations, including development of a tailored and appropriately designed interface using prototyping or other appropriate design techniques. Candidates are expected to adopt a systematic approach to the analysis, design and production of such tailored solutions.

The specifications require all candidates to do coursework. In AS, this is a series of OCR-set structured practical ICT tasks; at A2, this is a single substantial project. The acquisition of the knowledge and understanding of ICT systems and tools is complemented by the skills of analysis, design, implementation, documentation, testing and evaluation.

1.1   Certification Title

These qualifications are shown on a certificate as:

- OCR Advanced Subsidiary GCE in ICT.

- OCR Advanced GCE in ICT.

1.2   Language

These specifications and associated assessment materials are in English only.

1.3   Overlap with VCE

Overlap with VCE specifications in Information and Communication Technology is detailed in Appendix C.

1.4   Exclusions

Candidates who enter for this Advanced Subsidiary GCE specification may not also enter for any other Advanced Subsidiary GCE specification with the certification title Information and Communication Technology, Information Technology or Computing in the same examination session.

Candidates who enter for this Advanced GCE specification may not also enter for any other Advanced GCE specification with the certification title Information and Communication Technology, Information Technology or Computing in the same examination session.

Every specification is assigned to a national classification code indicating the subject area to which it belongs.

Centres should be aware that candidates who enter for more than one GCE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Performance Tables.

The classification code for these specifications is 2650.

1.5   Code of Practice Requirements

These specifications will comply in all respects with the revise Code of Practice requirements for courses starting from September 2000.

2   Specification Aims

The aims of these Advanced Subsidiary GCE and Advanced GCE specifications are to encourage candidates:

- to develop an understanding of the use of ICT in processing data in a variety of organisations and situations;

- to develop an understanding of the effects of the use of ICT on the data processing and communications systems within and between organisations and individuals;

- to develop an understanding of the range of hardware and software tools that may be used to create an effective ICT system;

- to develop an understanding of the principles of human-computer communication and computer-computer communications which result in advanced systems;

- to acquire the skills necessary to tailor applications software to meet the needs of given situations and users.

In addition the Advanced GCE specification encourages candidates:

- to develop skills of analysis and design when faced with new problems that may yield to an ICT solution;

- to be systematic in the production of solutions with testing, evaluation and documentation that is appropriate both to the users of the system and those who have to maintain it;

- to develop their capacity to apply knowledge learnt to different contexts;

- to develop project and time management skills and communication skills when producing solutions for a third party.

2.1   Spiritual, Moral, Ethical, Social, Legal and Cultural Issues

These specifications encourage candidates to explore the spiritual, moral, ethical, social, legal and cultural aspects of the introduction of ICT solutions to problems through a study of the effects of ICT on society.

Through candidates' study of sections 5.1.6 and 5.4.3, they have an opportunity to develop their understanding of spiritual, moral, ethical, social, legal and cultural issues. These sections consider issues such as changing leisure patterns and work practices, privacy and confidentiality of data held in systems, opportunities for access to information and environmental issues.

Section 5.4.3 introduces a global dimension with the study of electronic communications, for example, the Internet.

2.2 Environmental Education, the European Dimension and Health and Safety Issues

These areas are covered in Module 2512 (see section 5.1.6).

2.3 Avoidance of Bias

OCR has taken great care in the preparation of these specifications and assessment materials to avoid bias of any kind.

3   Assessment Objectives

Advanced Subsidiary and Advanced GCE Information and Communication Technology have the same assessment objectives. In the Advanced GCE specification, the assessment objectives related to the skills of analysing, designing, implementing, testing and evaluating systems are given a higher weighting because of the increased emphasis on candidates developing their own ICT based solutions to real-life problems.

Candidates should meet the following assessment objectives in the context of the learning outcomes specified in sections 5.1 - 5.6.

AO1 Knowledge and understanding

Candidates should be able to:

- describe a wide range of uses of ICT in the home and in the work place;

- comment critically on the impact of ICT with respect to legal, moral, social, health,safety and environmental issues;

- describe the components of a networked Management Information System (MIS) and explain how it is managed;

- describe the factors influencing user interface design and comment critically on the necessity to meet the needs of the user specifically;

- describe the features of standard generic application software and explain how to select and use them for tasks, configuring/tailoring them to meet users needs;

- describe and explain the need for, and the use of, various forms of data organisation and processing to support the information requirements of a particular application;

- describe and explain the systematic development of effective solutions to problems, and the techniques appropriate for implementing such solutions;

- describe and explain the management of change, organisational functions and how integrated office systems software supports MIS in organisations;

- communicate in writing:

- select and use a form and style of writing appropriate to purpose and complex subject matter;

- organise relevant information clearly and coherently using specialist vocabulary where appropriate;

- ensure text is legible, and spelling, punctuation and grammar are accurate, so that meaning is clear.

AO2 Skills

Candidates should be able to:

- define, investigate and analyse a problem situation, identifying user requirements and preparing a specification;

- design a solution to meet a specification;

- select and tailor appropriate application software necessary to carry out successful implementation of a design;

- specify procedures for security, maintenance and installation of a system;

- prepare detailed user documentation and evaluate a system.

The assessment objectives are weighted as follows:

	Advanced Subsidiary GCE	A2	Advanced GCE
AO1	58%	34%	46%
AO2	42%	66%	54%

3.1 Specification Grid

The relationship between the assessment objectives and the units of assessment is shown in the specification grid below.

Unit	Level	Percentage of Advanced GCE		
		AO1	AO2	Total
2512	AS	12	3	15
2513	AS	5	15	20
2514	AS	12	3	15
2515	A2	8	7	15
2516	A2	2	18	20
2517	A2	7	8	15
Total		46	54	100

3.2   Quality of Written Communication

The Quality of Written Communication is assessed in respect of each of the units assessed through the written papers (that is, in Units 2512, 2514, 2515 and 2517). The question paper rubric provides information to candidates as to which questions include marks for the Quality of Written Communication.

Assessment Objective 1 includes the assessment of Written Communication and candidates are required to:

- select and use a form and style of writing appropriate to purpose and complex subject matter;

- organise relevant information clearly and coherently, using specialist vocabulary when appropriate;

- ensure text is legible, and spelling, grammar and punctuation are accurate, so that meaning is clear.

4   Scheme of Assessment

Candidates take three units for Advanced Subsidiary GCE, followed by a further three units at A2 if they are seeking an Advanced GCE award.

Units of Assessment

Unit	Level	Name	Mode of Assessment	Duration	Weighting	
					AS	Advanced GCE
2512	AS	Information, Systems and Communications	Written Examination	1 hour 30 mins	30%	15%
2513	AS	Structured Practical ICT Tasks	Coursework	-	40%	20%
2514	AS	Practical Applications of ICT using Standard/Generic Applications Software	Written Examination	1 hour 30 mins	30%	15%
2515	A2	Communications Technology and its Application	Written Examination	1 hour 30 mins	-	15%
2516	A2	ICT Project	Coursework	-	-	20%
2517	A2	ICT Systems and Systems Management	Written Examination	1 hour 30 mins	-	15%

Rules of Combination

Candidates must take the following combination of units.

Advanced Subsidiary GCE   Units 2512, 2513 and 2514

Advanced GCE   Units 2512, 2513, 2514, 2515, 2516 and 2517

Unit availability

There are two unit sessions each year, in January and June.

The availability of units is shown in the following table.

Unit	Level	Unit Title	Jan 2003	June 2003
2512	AS	Information, Systems and Communications	✓	✓
2513	AS	Structured Practical ICT Tasks	-	✓
2514	AS	Practical Applications of ICT using Standard/Generic Applications Software	✓	✓
2515	A2	Communications Technology and its Application	✓	✓
2516	A2	ICT Project	✓	✓
2517	A2	ICT Systems and Systems Management	✓	✓

The availability shown for 2003 will be the same in subsequent years.

Sequence of Units

The normal sequence in which the units could be taken is Units 2512, 2514 and 2513 in the first year of a course of study, leading to the Advanced Subsidiary GCE award, then Units 2515, 2516 and 2517 in the second year leading to the Advanced GCE award. However, the units may be taken in other sequences.

Alternatively, candidates may take all units at the end of their Advanced Subsidiary GCE or Advanced GCE course in a 'linear' manner, if desired.

Synoptic Assessment

Synoptic assessment tests candidates' understanding of the connections between the different elements of the subject. It accounts for at least 20% of the total Advanced GCE marks and appears particularly in Unit 2517 (15%) and also in the ICT Project (Unit 2516), in the sections on analysis and evaluation (5%).

As synoptic units contain assessment that expects candidates to draw on other units in the course, it is not advisable that they take these units until they have covered all the units. However, this is not a requirement.

Aggregation

Candidates may enter for:

- Advanced Subsidiary GCE aggregation;

- Advanced Subsidiary GCE aggregation, bank the result, and complete the A2 assessment at a later date;

- Advanced GCE aggregation.

Candidates must enter all six Advanced Subsidiary and A2 units to qualify for the full Advanced GCE award.

Shelf-life of Units

Individual unit results, prior to certification of the qualification, have a shelf-life limited only by that of the qualification.

Re-sits of Units

The restrictions on re-sitting units have been removed enabling candidates to re-take units more than once. Upon making an entry for certification, the best attempt will be counted towards the final award. This change applies to all candidates, including those who have already been entered for any units or full qualifications.

Re-sits of Advanced Subsidiary GCE and Advanced GCE

Candidates may still enter for the full qualification an unlimited number of times.

4.1   Question Papers

Units 2512, 2514, 2515 and 2517 are assessed by a written examination. All question papers for these four units are of 1 hour 30 minutes duration. For all four units there is a maximum of 90 marks of which 4 marks are allocated to the assessment of the Quality of Written Communication.

4.1.1 Advanced Subsidiary

Unit 2512: Information, Systems and Communications   **(90 marks)**

Assessment is by a written examination of 1 hour 30 minutes duration, containing 10-15 structured contextualised questions requiring short answers.

Unit 2514: Practical Applications of ICT using Standard/Generic Applications Software

(90 marks)

Assessment is by a written examination of 1 hour 30 minutes duration, with 4-6 structured questions based on a short scenario.

4.1.2   A2

Unit 2515: Communications Technology and its Application   **(90 marks)**

Assessment is by a written examination of 1 hour 30 minutes duration, containing 4-6 structured questions.

Candidates will be expected to have a general knowledge of information applications and to be able to apply such knowledge to specific examples.

Unit 2517: ICT Systems and Systems Management   **(90 marks)**

Assessment is by written examination of 1 hour 30 minutes duration, containing 4-6 structured questions.

4.2   Coursework

4.2.1   *Advanced Subsidiary*

Unit 2513: Structured Practical ICT Tasks   **(120 marks)**

The Structured Practical ICT Tasks unit examines knowledge and understanding as well as skills applied in a practical way. The tasks are intended to allow candidates to demonstrate their competence in the different phases of development of an ICT system using the skills of design, testing and implementation (3-5 tasks). Candidates are asked to find a solution to a given problem (see Section 5.2).   The Structured Practical ICT Tasks are set by OCR. Candidates' work is marked by the teacher and externally moderated by OCR.

For those candidates who go on to A2, the tasks prepare them for the ICT Project (Unit 2516), where the integration of these skills is required in response to an identified need.

One or more tasks will require the use of an ICT system in their solution, based on the use of applications software.

4.2.2   *A2*

Unit 2516: ICT Project   **(120 marks)**

This unit assesses candidates' ability to develop an ICT solution to a real-life problem. Candidates should formulate the task in negotiation with their teacher. The project should

identify a well-defined user-driven problem involving a third-party user, and be designed to generate a solution. This should be done using tools chosen by the candidate, which involve appropriate applications software or other software. Opportunity is provided to gain feedback on the appropriate nature of the tasks from OCR.

4.2.3 Assessment and Moderation

All coursework is marked by the teacher and internally standardised by the centre. Marks are then submitted to OCR, after which postal moderation takes place in accordance with OCR procedures. The purpose of moderation is to ensure that the standard for the award of marks in coursework is the same for each centre, and that each teacher has applied the standards appropriately across the range of candidates within the centre.

4.2.4 Minimum Coursework Requirements

If a candidate submits no work for a coursework unit, then the candidate should be indicated as being absent from that unit on the coursework mark sheets submitted to OCR. If a candidate completes any work for the coursework unit then the work should be assessed according to the criteria and marking instructions, and the appropriate mark award, which may be 0 (zero).

4.2.5 Authentication

As with all coursework, the teacher must be able to verify that the work submitted for assessment is the candidate's own work. Sufficient work must be carried out under direct supervision to allow the teacher to authenticate the coursework marks with confidence.

4.3 Special Arrangements

For candidates who are unable to complete the full assessment or whose performance may be adversely affected through no fault of their own, teachers should consult the Inter-Board Regulations and Guidance Booklet for Special Arrangements and Special Consideration. In such cases, advice should be sought from OCR as early as possible during the course. Applications for special consideration in coursework units should be accompanied by Coursework Assessment Forms giving the breakdown of marks for each skill.

4.4 Differentiation

In the question papers, differentiation is achieved by setting questions which are designed to assess candidates at their appropriate levels of ability and which are intended to allow all candidates to demonstrate what they know, understand and can do.

In coursework, differentiation is by task and by outcome in the Structured Practical ICT Tasks and by outcome in the ICT Project. Candidates undertake coursework which enables them to display positive achievement.

4.5   Awarding of Grades

The Advanced Subsidiary GCE has a weighting of 50% when used in an Advanced GCE award. An Advanced GCE award is based on the aggregation of the weighted Advanced Subsidiary (50%) and A2 (50%) marks.

Both Advanced Subsidiary GCE and Advanced GCE qualifications are awarded on the scale A to E and U (unclassified).

4.6   Grade Descriptions

The following grade descriptions indicate the level of attainment characteristic of the given grade at Advanced GCE. They should be interpreted in relation to the content outlined in the specification; they are not designed to define that content. They give a general indication of the learning outcomes and levels of attainment likely to be shown by a representative candidate performing within each stated grade. In practice, most candidates will show uneven profiles across the attainments listed, with strengths in some areas compensating in the award process for weaknesses or omissions elsewhere.

Grade A

Candidates demonstrate:

- a good understanding of theoretical concepts, the management of information, organisational studies and the use of ICT in supporting organisational effectiveness;

- an appropriate and accurate use of technical language;

- a detailed knowledge of a range of applications and standard applications software;

- an informed opinion on the effects of ICT on society, the individual and organisations;

- the application of knowledge and understanding to unfamiliar problems;

- a good understanding of data types, files, databases, networks and other ICT structures, and how to utilise them;

- a good understanding of communications technology and how it is applied in a wide range of situations;

- a good understanding of human-computer interfaces and an ability to design suitable interfaces in a variety of different situations;

- an effective and appropriate use of a range of software;

- the ability to design and produce effective solutions to complex problems;

- a methodical, analytical and critical approach to problem solving;

- the ability to design, operate and justify appropriate testing strategies;

- clear communication of design decision and solutions to problems;

- effective skills of evaluation.

Grade C

Candidates demonstrate:

- an understanding of main theoretical concepts;

- accurate use of technical terms;

- knowledge of a range of common applications and standard applications packages;

- knowledge of the effects of ICT on society, the individual and organisations;

- the application of knowledge and understanding to familiar problems;

- an understanding of data types, files, databases, networks and common ICT structures;

- an understanding of communications technology and how it is applied in everyday situations;

- an understanding of human-computer interfaces and an ability to design suitable interfaces in a variety of familiar situations;

- the ability to use common generic applications software;

- the ability to produce solutions to substantiate problems;

- a methodical and analytical approach to problem solving;

- the ability to design and operate appropriate testing strategies;

- clear communication of solutions to problems;

- skills of evaluation.

Grade E

Candidates demonstrate:

- some relevant knowledge and limited understanding of theoretical concepts;

- use of basic technical terms;

- a basic knowledge of ICT applications and their effects;

- knowledge of some common applications and standard applications software;

- knowledge of communications technology and some of its applications;

- a basic understanding of human-computer interfaces recognition of hardware and software required for a particular application;

- some knowledge of data types, files and other ICT structures;

- a basic use of analytical methods to solve straightforward familiar problems;

- limited skill in justifying or considering alternatives;

- skills in using generic applications software;

- the ability to test solutions in a limited way;

- the ability to produce basic documentation;

- basic skills of evaluation.

5   Specification Content

Throughout this section the symbol   is used in the margin to highlight where Key Skills development opportunities are signposted. For more information on Key Skills coverage please refer to Appendix A.

These specifications are set out in the form of teaching modules. Each teaching module is assessed by its associated unit of assessment.

This section of the specifications gives the subject content for each module, as shown below.

Module	Module Title
2512	Information, Systems and Communications
2513	Structured Practical ICT Tasks
2514	Practical Applications of ICT Using Standard/Generic Applications Software
2515	Communications Technology and Its Application
2516	ICT Project
2517	ICT Systems and Systems Management

Each module is presented as a set of sub-sections, each with details of specification content and associated learning outcomes. An indication of recommended prior knowledge is given for each module together with details of any links to other modules.

Module 2512: Information, Systems and Communications is the foundation for all subsequent modules. It provides candidates with an understanding of the core aspects of ICT systems, which is developed and enhanced in subsequent units.

Module 2513: Structured Practical ICT Tasks provides candidates with opportunities to apply skills, knowledge and understanding from Modules 2512 and 2514 in a practical way. The Structured Practical ICT Tasks examine the skills of design, testing, implementation and documentation; thus they prepare candidates for the requirements of the ICT Project, in the A2 half of the Advanced GCE, which requires the integration of these elements in response to an identified need. Tasks require the use of an Information and Communication Technology system in their solution based on the use of an appropriate applications package(s).

Module 2514: Practical Applications of ICT using Standard/Generic Applications Software provides candidates with opportunities to acquire and apply skills, knowledge and understanding of the way standard software applications software is used in different contexts.

Module 2515: Communications Technology and its Application extend knowledge and understanding of concepts related to ICT systems. Some concepts previously encountered in Modules 2512 and 2514 are developed in greater depth, while some new concepts are introduced. The module covers communication between computers and interaction between humans and computers, and the converging technologies of IT and data communications.

Module 2516: ICT Project requires candidates to identify a well-defined problem, involving a third-party user, and to generate a solution using ICT. As for Module 2513, this is carried out using applications software or other appropriate software chosen by the candidate.

Module 2517: ICT Systems and Systems Management extends the work candidates have covered in previous modules by studying information in the organisation, management of change, advance database systems and project management.

5.1 Module 2512: Information, Systems and Communications

C3.1a, C3.1b, C3.2, C3.3; N3.1; IT3.1	**LP3.1, LP3.2, LP3.3**

This module covers the fundamental knowledge required to support all subsequent modules of study. It is intended to provide candidates with a deeper understanding and knowledge of basic concepts covered by a GCSE (Short Course) syllabus in ICT, however the depth of study is at Advanced Subsidiary GCE level and candidates are expected to respond appropriately and fully to question papers.

Content

The main areas to be covered are:

- Data, Information, Knowledge and Processing;

- Components of an Information System;

- Systems and User Interface Software;

- File and Database Concepts;

- The Role of Communications and Networking;

- The Role and Impact of ICT - Legal, Moral, and Social Issues.

Previous knowledge

No previous knowledge of ICT is assumed, although it is beneficial for candidates to have studied at least GCSE (Short Course) in Information and Communication Technology.

5.1.1 Data, Information, Knowledge and Processing

Content

- Terminology

- Sources of data

- Types of data

- Coding data

- Test data

- Quality of information

- Cost of information

- Knowledge and processing

- Input-process-output-feedback loop

Learning outcomes

Candidates should:

a   define the term data, using an example, clearly distinguishing the fact that data has no meaning;

b   describe what is meant by the term information, discussing the range of definitions which have different emphasis including semantic and syntactic aspects of information, representation methods to convey meaning such as symbols;

c   describe what is meant by the term knowledge, clearly distinguishing the difference between information and knowledge;

d   describe different data types: Boolean, real, integer, text/string, giving examples of suitable uses;

e   give examples of different sources from which data can be derived, for example, gathered from original source, from indirect source (data passed on or purchased), as a by-product of processing an original set of data, from archives;

f   describe the effect of the quality of the data source on the information produced;

g   discuss the problems and benefits associated with the coding of data, for example, interpretation, accuracy, conciseness, easier entry;

h   describe the purpose of test data and explain the importance of testing and test plans;

i   identify the factors affecting the quality of information: accuracy, relevance, age, completeness, presentation, level of detail;

j   describe and give examples of validation methods, including range type, check digit, length and presence; and their purpose, indicating that these methods can only ensure reasonable data is input to a system and that there is no certainty of accuracy;

k   describe and give examples of verification methods including double entry and manual; and their purpose, indicating that these methods can only ensure reasonable data is input to a system and that there is no certainty of accuracy;

l   describe the costs of producing information in terms of hardware, software and manpower;

m   discuss the fact that information is regarded as a commodity and has value but that this is subjective in certain circumstances, for example, train departure times are important to the person making a journey;

n   describe what is meant by the concept of expert systems, discussing the difference between business applications producing standard reports and those systems which rely on rules and probabilities to make deductions;

o   describe clearly the terms, input, processing, output, storage and feedback, drawing a diagram to illustrate how the terms are related.

5.1.2 Components of an Information System

Content

- Types of hardware

- Types of software

Learning outcomes

Candidates should:

a describe the difference between hardware and software, giving examples of each to illustrate the description and explaining the lack of standardisation affecting both hardware and software;

b describe the following components of a general purpose computer: control unit, Arithmetic and Logic Unit (ALU), Random Access Memory (RAM), stating the purpose and use of each;

c describe how computer performance is attributable to the speed of the machine cycle or the number of processors and describe different hardware and software measures that can be undertaken to improve computer performance;

d describe, commenting on their ergonomic design, common input devices including keyboard, numeric keypad, mouse, joystick, trackerball, microphone, touch screen, scanners, digital camera, graphics tablet, digitiser, push switch, sensor and analogue to digital converters (ADC);

e describe, commenting on their ergonomic design and typical uses, specialist devices for physically disabled users such as the foot-mouse, puff-suck switch and the eye-typer;

f describe common output devices including loud speaker, monitor, printer, plotter, indicating their typical uses, such as speech output and sound output;

g describe common storage devices including floppy discs, hard discs, CD-ROMs, DVDs, tape drives and memory sticks indicating their typical uses and distinguishing between magnetic storage media and optical storage media;

h explain the difference between backing up and archiving of data and give reasons why they are necessary;

i identify different types of software (operating systems, user interfaces, utilities, translation software, applications software, programming languages); in particular, a distinction should be drawn between generic/standard applications software, tailor-made software, off-the-shelf software packages and programming languages.

5.1.3   Systems and User Interface Software

Content

- Operating systems

- User interfaces

- Utilities

- Translators

Learning outcomes

Candidates should:

a   describe the difference between types of operating systems (single-user, multi-user, multi-tasking, interactive, real time, batch processing and distributed processing systems) by identifying their major characteristics;

b   describe the characteristics of different styles of user interface (including command-based, forms, menus, natural language, graphical user interfaces (GUIs)) and their appropriate uses;

c   describe the contents, purpose and importance of self-documenting systems and supplementary user documentation;

d   describe a range of utilities and other system software, including compression software (especially in relation to data transmission), drivers, configuration files;

e   describe the characteristics and purpose of translators, linkers and loaders.

5.1.4   File and Database Concepts

Content

- Files, records, fields, key field, data types

- File organisation and access

- Entity, attributes, tables, relations

- Comparison of flat file, hierarchical database and relational database

- Levels of access

Learning outcomes

Candidates should:

a describe the problems and benefits of storing data using fixed or variable length records;

b describe the characteristics, advantages and disadvantages of serial, sequential, indexed sequential and random access to data, showing an understanding of the type of application suitable for each;

c describe how data can be organised in secondary memory to facilitate different modes of access, including an explanation of the nature of hashing algorithms (with an example, illustrating what happens if there are collisions) to create addresses from keys, thereby facilitating direct access and the use of an index or set of indexes to facilitate indexed sequential access;

d select appropriate data types for a given set of data, and explain the advantages and disadvantages of alternative data types;

e describe the terms typically used in relational database terminology, e.g. tables, primary keys, fields, records, relationships, foreign keys, duplicate data, referential integrity, entity, attribute, explaining the role and purpose of each;

f describe the difference between flat files, relational and hierarchical database systems, discussing the comparative benefits and drawbacks of each;

g describe the access levels required for on-line files and databases, identifying the need for the different levels of access. Candidates will be expected to discuss user/supervisor modes and user IDs and passwords.

5.1.5   *The Role of Communications and Networking*

Content

- Protocols

- Networking

- Fax, e-mail, tele/video conferencing

Learning outcomes

Candidates should:

a describe the need for communication between devices, and between computers, and explain the need for protocols to establish communication links (candidates will not be expected to have detailed knowledge of specific protocols);

b describe the characteristics of a local area network (LAN) and a wide area network (WAN);

c describe the star, ring and bus network topologies (diagrams may be required);

d describe how analogue signals are converted to digital signals for use by digital networks;

e   explain the importance of bandwidth when transmitting data;

f   compare typical hardware and software, explaining the role of each item, needed for a local area network (LAN) and for accessing a wide area network (WAN);

g   describe the advantages and disadvantages of networking;

h   explain the need for user IDs and passwords, stating their purpose, use, and how they may remain effective in the long term;

i   describe the facilities of various communication media (including fax, e-mail, bulletin boards, tele/video conferencing) and discuss their relative merits.

5.1.6   *The Role and Impact of ICT: Legal, Moral and Social Issues*

Content

- Capabilities and limitations of ICT

- The role of communication systems

- The impact of ICT on individuals, society and organisations

- Legal and moral implications resulting from the impact of ICT

- Professional frameworks, codes of conduct and regulating bodies

- Data protection

- Health and safety

Learning outcomes

Candidates should:

a   discuss the capabilities and limitations of ICT and how communications systems have changed our use of ICT;

b   discuss the social impact of ICT upon individuals, for example, in terms of eroding work/social boundaries through teleworking, the facility to shop from home on the Internet, job satisfaction, ease of tasks, benefits to the disabled and elderly;

c   discuss the impact of ICT on organisations, for example, change in organisational structure, reduced number of employees, less office space/shop floor space;

d   discuss the impact of ICT on society, for example, in the home, education, medicine and in commerce, with reliance on automated systems, such as Automatic Teller Machines (ATMs);

e   describe the main aspects of the Data Protection Act (1998) and subsequent changes/updates;

f   discuss the purpose and implications of the Data Protection Act (1998) and its purpose, including the legal rights of individuals;

g   discuss the purpose of the Computer Misuse Act (1990), Copyright, Designs and Patents Act (1988), Regulation of Investigatory Powers Act (2000) and Electronic Communications Act (2000) and subsequent changes/updates;

h   describe methods for combating a range of ICT crime;

i   discuss ethics and ICT with reference to codes of conduct, for example, British Computer Society code of conduct and ACM Code of Ethics and Professional Conduct;

j   describe the purpose and activities of professional bodies, for example, British Computer Society;

k   describe a range of health and safety problems related to working with ICT, including repetitive strain injury, carpal tunnel syndrome, ulnar neuritis, deep vein thrombosis, eye and eyesight defects, fatigue and stress, trailing wires, risk of fire and electrocution;

l   describe appropriate measures for avoiding health problems.

5.2   Module 2513: Structured Practical ICT Tasks

C3.3; N3.2, N3.3; IT3.2	WO3.2; LP3.1; LP3.2, LP3.3; PS3.1, PS3.2, PS3.3

This module is designed to develop practical aspects of the subject in a way that is not possible when leading to a formal written examination. A structured approach is possible which is suitable for Advanced Subsidiary GCE candidates.

The following skills are developed:

- Design

- Software Development

- Testing

- Documentation

This module covers basic knowledge and understanding, as well as skills. No one task tests all four skills. Each task addresses two of the four skills.

- One task may involve the design of a system.

- Another may involve the derivation and production of a testing strategy.

- Some tasks involve the use of hardware for implementation.

5.2.1   Design

Candidates should be able to specify and document a design, using appropriate algorithms/models. The design specification may include the method of solving a problem.

Content

- General hardware and software requirements

- Interface design including hardware requirements

- Data structures/model

- Special routines/requirements

- Specification of any security measures required

Learning outcomes

Candidates should:

a   specify in general terms the required hardware and software for a given problem (related in particular to sections 5.1.2, 5.1.5);

b   specify and document data capture forms and/or screen layouts/displays, report layouts and/or other forms of output (for example, audio output), together with any special input/output devices required for designing a good user interface (related to sections 5.1.2, 5.1.3);

c design and document the data structures necessary to model a given problem (related in particular to section 5.1.4);

d specify and document any required tailoring/routines or any special requirements (related in particular to section 5.1.1 and relevant parts of 5.3);

e specify any security measures required (related to sections 5.1.2, 5.1.4, 5.1.5).

5.2.2 Software Development

Content

- Interpreting a design solution

- Developing a tailored software solution

Learning outcomes

Candidates should:

a interpret a design solution specifying any variables and data structures using an appropriate software tool (related to sections 5.1.1, 5.1.3, 5.1.4);

b interpret a design solution for the interface preparing any interface requirements as a user prototype (related to section 5.1.3);

c develop routines, including macros and queries, and use wizards to tailor applications software to meet the design, security and user interface requirements (related to sections 5.1.3, 5.1.4 and relevant parts of 5.3).

5.2.3 Testing

Content

- Test strategy

- Test data

- Software testing

Learning outcomes

Candidates should:

a identify, develop and document a test strategy for a given problem, testing in particular navigational paths and interactivity, as well as functionality (related in particular to section 5.1.1);

b select suitable test data and test actions/responses for a given problem (related in particular to section 5.1.1);

c test a software solution, providing documented evidence that the solution works and plan for its implementation (related to section 5.1.1).

5.2.4   Implementation

Content

- User documentation

Learning outcomes

Candidates should:

a   prepare user documentation for the software solution (related to section 5.1.3).

5.3   Module 2514: Practical Applications of ICT using Standard/Generic Applications Software

C3.1b; N3.1; IT3.1, IT3.3	LP3.1, LP3.2, LP3.3

The purpose of this module is to give a practical understanding of the concepts covered in Module 2512, through use of a range of standard application packages. Module 2514 may be taught alongside, or before, Module 2513.

Content

- Characteristics of Standard Applications Software and Application Areas

- Applications Software used for Presentation and Communication of Data

- Standard/Generic Application Software for Modelling Data

- Relational and Online Database Management Systems

Recommended Prior Knowledge

Candidates should study Module 2512 first although once the basic aspects of hardware, software, files and databases have been covered, study on this module may begin to run in parallel with other parts of Module 2512.

5.3.1   *Characteristics of Standard Applications Software and Application Areas*

Content

- Common features of standard applications software

- Basic characteristics of applications found in business, commerce and education

- Style sheets, templates and wizards

- Benefits and problems associated with tailoring applications software using forms, menus, buttons and macros

- Transfer of data between application areas

Learning outcomes

Candidates should:

a   compare custom-written with off-the-shelf software and evaluate the relative advantages of each;

b   describe the common features such as wizards, style sheets, help systems, macros, buttons, etc. found in each standard/generic application area: word processors, desktop publishers (DTP), presentation software (including multimedia publishing packages and slideshow software), graphics packages, spreadsheets and database software;

c   identify basic tasks which standard/generic applications software can readily be used for, inluding letter writing, memos, theses, reports, flyers, brochures, posters, business cards, graphs, data modelling, forecasting and data pattern analysis, data handling, sorting, searching, mail merging, web page authoring, presentations, etc.;

d   describe the characteristics of common applications found in business, commerce and education, inluding diary systems, stock control, on-line banking, electronic mail, booking systems, customer records/accounts, school administration, self-paced teaching systems, multimedia training systems, library electronic catalogues, route finders and travel timetables;

e   compare a spreadsheet to a database management system as a means of storing and handling data, highlighting the features of database software which make it more suitable for data handling in certain application areas/tasks;

f   describe and explain the purpose of wizards, style sheets, templates and macros, discussing their benefits and drawbacks;

g   describe how standard/generic applications software can be tailored using templates and macros to make them easier to use;

h   explain the need for a consistent house style in an organisation;

i   describe how master documents/slides, style sheets and templates aid the production of documents/presentations and the sharing of a style between a team of people;

j   describe how, through the use of buttons, forms, menus and macros, a system interface can be tailored to meet the needs of the user and explain the benefits and problems associated with doing this;

k   explain the need for different file types;

l   describe how to convert between different file types and import/export files between standard/generic applications.

5.3.2 *Applications Software used for Presentation and Communication of Data*

Content

- Applications software used for presenting information

- Standard documents

- Importing/exporting text and images

- Clip art galleries and image libraries

- Mail merge techniques for fixed and variable fields

- Word processing and desktop publishing tools

- Graphics tools and effects

- Multimedia and hypertext tools

Learning outcomes

Candidates should:

a describe the features of word processing (including wordwrap, report layouts, standard formats/templates) and desktop publishing (DTP) software (such as rotate, flip, arrange/layering), explain their relative benefits and analyse a given task to identify which (WP or DTP) package is most appropriate;

b analyse the needs of different users of word processing, desktop publishing (DTP) and slideshow/hypertext tools (e.g. scientific author requires a technical dictionary and Thesauras, section numbering and automatic indexing and formatting into report style, office secretary requires greater range of fonts, and spelling and grammar checkers);

c explain how word processing and desktop publishing (DTP) software can be used with data from a spreadsheet or database for mail merge, and state the benefits of using this technique, particularly with respect to inserting merge fields and the word fields ASK, FILL-IN, IF..THEN..ELSE, NEXT RECORD, SKIP RECORD IF;

d describe the attributes of documents, including character, paragraph, sections, frames, headers, footers, footnotes and pages and describe how page formatting (size, style, position) may be modified to suit the needs of a given application;

e evaluate how the reformatting of text and images within a document may better meet the needs of a task or user, describing how, for example, the grouping of text frames and picture frames facilitates easy re-arrangement of objects on a page;

f discuss the merits and drawbacks of using clip art and image libraries;

g analyse graphic images and explain how they are created;

h describe the difference between vector and bitmap graphics and evaluate their suitability for given applications;

i explain how graphic libraries are used in applications such as kitchen design, cartography, PCB design;

j describe the following features found in graphics software: fill, shade, layering, brightness, contrast, size, orientation, negative, soften, sharpen;

k describe the features of presentation software, including sound, video, animation, slide transition, hyperlinks, hotspots;

l describe the use and purpose of multimedia presentations in a range of applications;

m describe the difference between use of overhead projector transparencies (OHTs) and use of presentation software, explaining the relative benefits of their characteristics when making presentations such as slide transition effects, combining different types of media e.g. video and text, use of consistent layout/background, use of sound, etc;

n compare web authoring software with standard applications software (e.g. word processing, spreadsheet) for creating web pages;

o describe different modes of navigation (using buttons, automatic and manual transition from slide to slide) and identify when each method is more suitable.

5.3.3 *Standard/Generic Applications Software for Modelling Data*

Content

- Characteristics of modelling software

- Variables, formulae, functions and rules

- Worksheets, workbooks, rows, columns, cells, ranges

- Graphs and charts

- Customising worksheets

Learning outcomes

Candidates should:

a describe the characteristics of modelling software and give reasons why a model might be used;

b explain how variables, formulae, rules and functions are used in modelling software;

c describe how a data model may be used for answering 'what-if?' questions and explain the benefit of being able to answer such questions using a data model;

d explain the purpose and use of worksheets, workbooks, rows, columns, cells and ranges in spreadsheet software;

e describe absolute and relative replication, and give examples of typical uses of each method;

f describe the ways in which numerical data can be presented graphically and match the appropriate types of chart to a given task;

g describe ways in which worksheets in spreadsheet software can be customised using form controls and macros, giving examples of use.

5.3.4   Relational and Online Database Management Systems

Content

- Normalisation

- Entities, tables and relationships, records and fields

- Data dictionary

- Data-entry forms, reports

- Simple and complex queries

- Static and dynamic data

- Filters, search engines

Learning outcomes

Candidates should be able to:

a   identify tables, records, fields, primary keys and foreign keys and define relationships between entities;

b   identify the characteristics of data in first normal form, second normal form and third normal form;

c   describe the advantages of normalisation;

d   describe the components of a data dictionary;

e   explain the use and design considerations of tailored data-entry screens, tailored reports and queries for meeting user requirements

f   describe different types of queries and explain when they might be used, including cross-tab queries, parameter queries, complex queries;

g   evaluate the use of static information sources (for example CD-ROM) compared to dynamic sources (for example, the World Wide Web), including use of indexes and keyword searches;

h   explain the purpose of filtering access to information that can be obtained over the Internet.

5.4   Module 2515: Communications Technology and its Application

| C3.1a, C3.1b; IT3.1 | LP3.1, LP3.2, LP3.3 |

This module covers communications between computers and interactions between humans and computers. Ranges of other information and communications technologies are also covered. The convergence of communications technology and information technology and their impact on society, commerce and industry is an integral part of the module. Candidates are expected to acquire a more in depth knowledge of the range of application areas covered in Module 2514 and demonstrate knowledge of the growing range of applications resulting from advances in ICT.

Candidates should be able to demonstrate knowledge of communications-based applications of ICT, both in general and within the context of a scenario.

Content

- Features of Networked Systems and the Systems Cycle

- Communications and Networked Systems

- The Role and Implications of Communication Systems

- Applications of ICT

Recommended Prior Knowledge

Candidates are expected to have covered the content of Modules 2512, 2513 and 2514 before attempting this module.

5.4.1   Features of Networked Systems and the Systems Cycle

Content

- The development of networking

- Training and re-skilling

- The importance of standards

- Systems cycle

Learning outcomes

Candidates should, within context, be able to:

a   discuss the development of networking and the significant improvements in quality of services built around modern communications technology;

b   discuss the effects of new communications technology applications (such as electronic commerce and video conferencing) on society and the resulting need for retraining and re-skilling to cope with changing work practices;

c   explain the importance of standards for communicating and describe the benefits of the Open Systems Interconnection (OSI) model;

d   describe the systems cycle stages (definition of the problem, investigation and analysis, design, development, testing, implementation, monitoring, evaluation and maintenance) and how the stages relate to ICT cyctems;

e   describe how analysts adopt the user-centred approach;

f   describe the contents of the requirements specification and the design specification, distinguishing between them, in particular stating how the system specification should illustrate clearly the user interface design, its functionality and how it relates to systems data and other system functions.

5.4.2   *Communications and Networked Systems*

Content

- Benefits and drawbacks of network topologies

- Network components

- Analogue and digital communication

- Cable television networks

- Mobile communications

- Satellite communications

- Optical communications

- Circuit switching and packet switching

- Layers and protocols

- Data transmission errors and bandwidth

Learning outcomes

Candidates should, in general and within the context of a scenario, be able to:

a   explain the benefits and drawbacks of bus, ring and star network topologies;

b   explain the purpose of the following network components: switches, hubs, network interface cards (NIC), routers, repeaters, bridges, gateways and servers;

c   discuss the facilities available on modern telephone systems including voicemail, menus and ringback;

d   explain the benefits and drawbacks of using broadband including Integrated Services Digital Network (ISDN), Asynchronous Digital Subscriber Lines (ADSL) and Digital Subscriber Lines (DSL) and their limitations for handling data traffic;

e   describe the range of services offered by cable television networks;

f   describe mobile communications systems, explaining how a cellular radio network operates and how cellular technology is also being applied to satellite systems;

g   describe satellite communications, explaining the advantages and disadvantages and giving examples of typical applications such as data services, direct broadcasting, weather monitoring, etc;

h   describe optical communications, their advantages, disadvantages and typical applications such as computer networks, computer controlled telecommunications, transmitting signals from aircraft etc;

i   describe wireless communication methods, their advantages, disadvantages and typical applications;

j   explain the difference between circuit switching and packet switching, and the reasons, economic and technical, for preferring one to the other in a given scenario;

k   explain the principle of organising interfaces in a layered fashion to facilitate intercommunication and the need for standard protocols to enable a variety of devices to work together;

l   describe methods of detecting and correcting errors that occur during data transmission;

m   explain the importance of bandwidth with respect to the transmission of data, and how different communication media governs the bandwidth available.

5.4.3   The Role and Implications of Communication Systems

Content

- Technology, devices and communications

- Network environments: intranets, internets, on-line services

- Issues of confidentiality of data

- Encryption and authentication

Learning outcomes

Candidates should, within context, be able to:

a   explain the purpose of a range of input, output and storage devices (studied in section 5.1.2) relating them to applications (both common and specialist);

b   discuss the concept of dialogue in terms of interaction and the importance of feedback from the computer;

c   discuss the concept and implication of good human-device communications, particularly human-computer interfaces (HCI) including command line interfaces, menus/submenus, Graphical User Interfaces (GUIs), natural languages (including speech input-output) and forms/dialogue boxes;

d   describe the characteristics and purpose of common network environments, including intranets, the Internet, information services and open networks;

e   discuss the problems of confidentiality of data, including problems of an open network, and how to address these problems using access rights, firewalls, audit logs;

f   explain the purpose of encryption and authentication techniques (candidates will **not** be expected to know any technique in detail).

5.4.4   Applications of ICT

Content

- Applications and limitations of ICT

- Converging communications and information technologies

- Distributed databases

Learning outcomes

Candidates should:

a   Explain the use of telecommunication and information technology in the following applications: telephone directory enquiries, banking, emergency services, production control, government information systems and geographical information systems ;

b explain the limitations of using ICT in society today and how advances in such technology may overcome some of those limitations;

c describe the concept and facilities of the information super highway (ISH) and its capability to exchange information;

d discuss developments in ICT including including videophones, interactive television and networked audience participative broadcasting, describing their characteristics, purpose, advantages and limitations;

e explain how databases may be stored in more than one physical location and how distribution may be carried out using different approaches: partitioned between sites, entire databases duplicated at each site, central database with remote local databases;

f discuss the advantages and disadvantages of implementing distributed database systems;

g discuss security issues of distributed databases including encryption, protection against and checking for viruses.

5.5   Module 2516: ICT Project

	C3.2, C3.3; N3.1, N3.2, N3.3;	WO3.1, WO3.2, WO3.3; LP3.1, LP3.2, LP3.3; PS3.1, PS3.2, PS3.3

This module allows candidates to develop their knowledge and understanding of ICT and the skills described in Assessment Objective 2. The project is a substantial piece of work requiring analysis and design over an extended period of time, which is organised, evaluated and presented in a report.

Candidates choose, in conjunction with their teacher, a well defined user-driven problem which enables them to demonstrate their skills to

- analyse a problem,

- design a solution to the problem,

- develop the software solution,

- test the solution against the original design,

- document the solution,

- evaluate the solution.

Recommended Prior Knowledge

Candidates are likely to have completed Modules 2512, 2513 and 2514 before starting the ICT project. The project will be conducted in parallel with the study of Modules 2515 and 2517.

Candidates should choose a problem to solve rather than a project to complete. Each candidate must submit a report on their piece of work, supported by evidence of software development and testing.

The teacher marks the project using a mark scheme provided by OCR, after which moderation takes place according to OCR procedures.

ICT projects are assessed as follows:

- Definition, Investigation and Analysis   [25 marks]

- Design   [21 marks]

- Software Development, Testing and Implementation   [35 marks]

- Documentation   [24 marks]

- Evaluation   [15 marks]

More detailed marking criteria are given in Appendix B.

5.5.1   Definition, Investigation and Analysis   25 marks

Explanation of the problem to be solved, the user's requirements and how they were obtained. There should be a clear statement of requirements.

Content

- Define a problem

- Investigate the problem

- Record findings

- Analyse findings

- Identify problems/inefficiencies with current system

- Specify requirements: user, hardware, software

Learning outcomes

Candidates should:

a   define the nature of the problem to be solved (related to section 5.4.1);

b   identify methods by which to investigate the problem (including questionnaires, observation and structured interviews) and use such methods to inform their analysis of the problem;

c   identify sources of data (related to section 5.1.1);

d   record information/data and gather sample documents currently used (related to section 5.4.1);

e   identify the current user activities and current data structures (sections 5.1.2, 5.1.4, 5.4.1);

f   analyse the data and tasks carried out by the user;

g   specify inefficiencies and problems apparent from discussions with the user and the analysis work carried out;

h   specify the user and information requirements of a system (related to section 5.4.1);

i   specify the hardware and software requirements;

j   consider a number of different methods for satisfying the requirements of the system and make a reasoned determination of the most effective.

5.5.2   Design   21 marks

Detailed system design including data structures, input-output format and processing involved. There should be a clear set of objectives.

Content

- User interface design
- Data structures/model
- Task model

Learning outcomes

Candidates should:

a   create a set of objectives based on the requirements of the new system;

b   design and document data capture forms and/or screen layouts, to include detailed designs of the proposed interface and outputs (related in particular to sections 5.1.2, 5.4.1, 5.6.2);

c   specify any validation required and interactive feedback required if any data is input in error (related to sections 5.1.1);

d   design and document (using appropriate techniques where applicable e.g. normalisation/entity relationship models) the data structures necessary to solve the problems indicated in the objectives (related to sections 5.3.4, 5.4.3);

e   identify the advantages that will accrue from the development of the new system;

f   identify the limitations of the solution.

5.5.3   Software Development, Testing and Implementation   35 marks

A software solution is developed from the design and the comprehensive test plan is developed from the set of objectives, which should show that the system satisfies those objectives with cases of valid, invalid and extreme data (or, if it does not, under which circumstances it fails). The test plan should be clearly cross-referenced with evidence of these tests. It is important to test the user interface (navigation and displays etc) as well as system functionality. User testing should be in evidence.

Content

- Test strategy/plan
- Test data
- Software development
- Testing a software solution and planning for its implementation
- User testing

Learning outcomes

Candidates should:

a   identify, develop and document a test strategy an test plan for the design (related in particular to section 5.1.1);

b   select suitable test data and test actions/responses for the design (related in particular to section 5.1.1);

c   tailor standard application packages or utilise other software to develop their design (related to section 5.3);

d   develop the data structures of the design using the appropriate features of a software package (related to section 5.3);

e   develop a tailored interface for their user (related to section 5.3);

f   test the software solution, illustrating how the software solution evolves (related to 5.1.1);

g   produce detailed output from the testing, cross referencing evidence to the test plan (related to sections 5.1.1, 5.2.2, 5.2.3, 5.4.1);

h   test the software solution with the user, providing documented evidence that the user has successfully used the solution (related to sections 5.1.1 and 5.2.2);

I   produce a strategy for implementing the system into the host organisation (related to section 5.4.1).

5.5.4   Documentation   24 marks

Content

• Technical documentation

• User guides

Technical Manual

This should include an explanation of the structure of the design and the solution. This contains all the necessary information about the system that would allow someone else to maintain and develop it.

User Manual

This should include step by step instruction for operating all aspects of the system, including a means of dealing with any errors that may occur. As well as a Guide, User Documentation should include appropriate "Help" and messages within the software solution, or be present in the form of a hypertext document.

Learning outcomes

Candidates should:

a   develop a detailed technical manual (related to sections 5.1.3, 5.4.1);

b   develop a detailed user manual (related to sections 5.1.3, 5.2.3, and 5.4.1);

c   include appropriate help messages within the software solution.

5.5.5 *Evaluation*   *15 marks*

Discussion of the degree of success in meeting the set of objectives. The acceptability to the user, including a letter of acceptance (or equivalent, hard copy, acknowledgement) from the user and reference to user testing results.

A critical discussion of what has been achieved to include any desirable extensions.

Content

- Evaluate results against the set of objectives

- User evaluation of solution

- Identify the good and bad points of the final system, including any limitations and necessary extensions to the system

Learning outcomes

Candidates should:

a   evaluate the final system against the criteria described in the set of objectives (relates to section 5.4.1);

b   identify the good and bad points of the final system highlighting any limitations and necessary extensions to the system, indicating how the extensions could be carried out.

5.6   Module 2517: ICT Systems and Systems Management

C3.1a, C3.2, C3.3	LP3.1, LP3.2, LP3.3

The purpose of this module is to extend the fundamental ICT concepts developed in Modules 2512, 2513 and 2514. It provides candidates with a more detailed understanding of the nature of both information technology and communications technology and the importance and potential of both for a wide range of applications drawn from the business environment.

A range of ICT is discussed along with the need for communication between computer-based information systems, and between human users and computer-based information systems. Candidates are introduced to the design and selection of ICT solutions to a range of business problems.

Candidates are expected to have knowledge of a range of application areas, including:

- Information systems

- Office systems

- Embedded systems

- Safety critical systems

Candidates should be able to demonstrate knowledge of information and communications technologies and their applications and capabilities, both in general and within a context.

Content

- Information and the Organisation

- Designing Computer-based Information Systems

- Implementing Computer-based Information Systems

- Implications of ICT

Recommended Prior Knowledge

This module assumes the knowledge, understanding and skills covered in Modules 2512, 2513 and 2514.

5.6.1 *Information and the Organisation*

Content

- Types of organisations

- The structure of the organisation

- The role of information within an organisation

- Information processing systems

- Managing information

Learning outcomes

Candidates should:

a describe the characteristics and behaviour of organisations in terms of their boundaries, relationship to the environment, systems and subsystems, internal resources (human, technological, accommodation etc.);

b discuss the importance of ensuring that information within the organisaton is exchanged accurately and in a timely manner within an organisation;

c explain the role of data and information within the organisation, including exchange of information with the environment and between its subsystems;

d explain the use of information in decision-making and strategic planning;

e describe the nature and role of the following information processing systems: personnel, financial and stock;

f explain the need for effective management of information;

g explain the use of ICT in integrated office systems and its role in the management of information flow.

5.6.2 *Designing Computer-based Information Systems*

Content

- The characteristics and advantages of modern computer-based information systems

- Project management

- Systems analysis and design

- Process modelling

- Data modelling

- Designing the user interface

- The design specification

Learning outcomes

Candidates should:

a describe the characteristics of modern computer-based information systems for a given application: for example, easy-to-use interactive interfaces, use of advanced technologies, fact processing, rapid response;

b explain the advantages of utilising modern technology for a given application;

c explain the need for project planning, including a discussion of budget, deadlines, and identifying the techniques and tools available to the project manager: for example critical path analysis and project management software;

d identify the roles and responsibilities of the project team including the project manager, systems analyst, systems designer, programmers, database administrators, etc;

e describe the stages of systems analysis, design, production and implementation, highlighting the technique of prototyping and explaining how iteration around these stages is important, particularly when developing the user interface;

f describe a range of process modelling and data modelling techniques, giving examples of suitable approaches for a given application;

g discuss different types of processing system (batch, interactive, real-time) in terms of processing methods, response time and user interface requirements;

h explain the importance of the effective design of the human-computer interface (including colour layout, quantity of information on screen) indicating how perception, attention, memory, and learning affect design choices;

i discuss how different factors have contributed to good design techniques for human-computer interfaces such as cognitive psychology, ergonomics, artificial intelligence (AI), design of computer input-output devices and software, including speech systems and visual systems;

j discuss the importance of designing a system model which matches closely the user's mental model;

k describe the user interface designers tool known as the 'Model Human Processor', developed by Card, Moran and Newell, and its application;

l describe the contents of the design specification.

5.6.3   Implementing Computer-based Information Systems

Content

- The purpose-built and off-the-shelf approaches

- Upgrading systems

- System installation

- System maintenance

Learning outcomes

Candidates should be able, in general and in the context of a scenario, to:

a   describe the steps involved in producing a custom-written computer-based information system, explaining the advantages and disadvantages of producing a custom-written rather than an off-the-shelf solution;

b   discuss the costs and benefits of implementing solutions using off-the-shelf software;

c   explain the factors (for example, expertise of staff, costs, benefits, current systems, etc.) affecting decisions which must be made when upgrading software;

d   describe a range of methods for installing a new computer-based information system, explaining the importance of implementation planning and highlighting the advantages and disadvantages of each method;

e   give reasons for choice of a particular installation method(s) for a range of applications;

f   discuss the support required during the installation of a new computer-based information system;

g   explain the role of reviews during the life of a computer-based information system, describing how reviews may be planned for and carried out effectively;

h   explain the need for maintenance during the life of a computer-based information system, describing its management and implementation.

5.6.4   Implications of ICT

Content

- The impact of external change

- Managing change

- The impact of ICT on the role of the manager

- Quality issues

- Advanced systems

Learning outcomes

Candidates should be able, in general and in the context of a scenario, to:

a   discuss the impact of external change on an organisation, individuals within the organisation, and on the systems in use;

b   describe change management and factors which must be considered, such as the staff capability, staff views, systems, equipment and accommodation;

c   discuss the importance of consultation, participation and communication when managing change, including reference to methodologies which emphasise participation;

d   discuss the need for training and re-training when managing change and the ways in which software tools such as Computer Aided Learning (CAL) and Computer Based Training (CBT) may be used to assist in this area;

e   discuss the ways in which ICT assist decision making at managerial and executive level through Management Information Systems (MIS), decision support systems and video conferencing;

f   discuss how the development of desktop and portable computer-based information systems has enabled managers greater freedom and access to information;

g   describe the characteristics and discuss the implications of nomadic network environments using portable computers and mobile phones;

h   discuss the need for agreed standards of quality and reliability in information processing systems and in the design of computer software;

i   discuss hardware and software developments which are changing the face of ICT (candidates will be expected to discuss a range of examples and indicate applications where these advances are to be utilised);

j   Candidates will be expected to keep up to date with advances in technology utilising recently published material.

6 Further Information and Training for Teachers

To support teachers using these specifications, OCR will make the following materials and services available:

- up-to-date copies of these specifications;

- a full programme of In-Service Training (INSET) meetings;

- a dedicated subject-specific telephone number;

- specimen question papers and mark schemes;

- past question papers and mark schemes after each examination session;

- coursework guidance materials;

- written advice on coursework proposals;

- a Report on the Examination, compiled by senior examining personnel, after each examination session.

If you would like further information about these specifications, please contact OCR.

7   Reading List

The books referred to below may prove useful in delivering Advanced Subsidiary GCE and Advanced GCE Information and Communication Technology.

The list is not intended to be exhaustive nor does inclusion on the list constitute a recommendation of the suitability of the resource for the specification. The list below contains books that are available in spring 2005. The possibility exists that more up to date texts which have been prepared for the revised GCE specifications may become available.

Whilst the books detailed within the reading list should prove a useful resource to assist in preparation for assessment it should be noted that assessment content and structure is not necessarily mirrored within these texts. Candidates and Teachers should take care that their preparation for examination and their coursework submissions comply fully with the specification requirements. Teachers will need to use their professional judgement in assessing the suitability of the material contained in the list.

General

Zorkoczy, P. and Heap, N. *Information Technology: An Introduction.* Pitman Publishing (general A2 for teacher use)

Heathcote, P.M. *A Level Information Technology.*

Heathcote, P.M. *Succesful ICT Projectsin Access.* Payne-Gallway Publishers

Heathcote, P.M. *Succesful ICT Projects in Word.* Payne-Gallway Publishers

Heathcote, P.M. *Successful ICT Projects in Excel.* Payne-Gallway Publishers

Heathcote, P.M. *Succesful ICT Projects in Front Page.* Payne-Gallway Publishers

Mott, J. and Rendell, I. *Database Projects in Access for Advanced Level* Hodder & Stoughton

Mott, J. and Rendell, I. *Spreadsheet Projects in Excel for Advanced Level* Hodder & Stoughton

Mott, J and Leeming, A. *Information & Communication Technology for AS Level* Hodder & Stoughton

The British Computer Society. *A glossary of Computing Terms. Tenth Edition* Addison-Wesley

A dedicated text is being written for the AS modules and will be published by Nelson Thornes.

Module 2512

All above especially Zorkoczy, P. and Heap, N.

Module 2513, 2514 and 2516

Lansdale, M. and Oberond, T. *Understanding Interfaces.* Loughborough University Academic Press.

Background Reading/Library Reference

Earl, M. (Ed) *Information Management: The Organisational Dimension.* Oxford University Press

Recommended Reading

Knott, G. and Waites, N. *Information and Communication Technology GCE AS/A2 modular award.* Business Education Publishers Limited.

Heathcote, P.M. '*AS' Level ICT.* 2nd Edition. Payne-Gallway Publishers Ltd.

Student Support Material

Steve McWeeney   Student support material for Module 2512 and 2514. A set of black-line masters for copying and distribution within the centre. Supplied as Word 97 file. Smcweeney@aol.com telephone 0797 710 4921 The Cottage, Hartburn, Morpeth, Northumberland NE61 4JB

Useful Website

www.ocrit.org   This is an independent website that is not linked to OCR

www.paullong.net

Appendix A

Key Skills

These specifications provide opportunities for candidates to develop and generate evidence for assessing the Key Skills of *Communication, Application of Number, Information Technology, Working with Others, Improving Own Learning* and *Performance and Problem Solving.*

Through classwork, coursework and preparation for external assessment, candidates may produce evidence for these Key Skills at Level 3. However, the extent to which this evidence fulfils the requirements of the QCA Key Skills specifications at this level will be dependent on the style of teaching and learning adopted for each module. In some cases, the work produced may meet the evidence requirements of the Key Skills specifications at a higher or lower level.

Throughout section 5 the symbol ⚷ is used in the margin to highlight where Key Skills development opportunities are signposted. The following abbreviations are used to represent the above Key Skills:

C =   Communication

N =   Application of Number

IT =   Information Technology

WO = Working with Others

LP =   Improving Own Learning and Performance

PS =   Problem Solving

These abbreviations are taken from the QCA Key Skills specifications for use in programmes starting from September 2000. References in section 5 and Appendix A, for example **IT3.1**, show the Key Skill (IT), the level (3) and subsection (1).

Centres are encouraged to consider the OCR Key Skills scheme to provide certification of Key Skills for their candidates.

Key Skills Coverage

The following matrix indicates those Key Skills for which opportunities for at least some coverage of the relevant Key Skills exist.

	Communication	Application of Number	IT	Working with Others	Learning Performance	Problem Solving
Module	Level 3	Level 3	Level 3	Level 3	Level 3	Level 3
2512	✓	✓	✓		✓	
2513	✓	✓	✓	✓	✓	✓
2514	✓	✓	✓		✓	
2515	✓		✓		✓	
2516	✓	✓		✓	✓	✓
2517	✓				✓	

Detailed opportunities for generating Key Skills evidence through this specification are posted on the OCR website, www.ocr.org.uk

Appendix B

Guidance on Setting and Marking the ICT Project (Unit 2516)

Guidance on Setting Information and Communication Technology Projects

Since the ICT project seeks to assess the systems analysis section of the specification in a practical manner, the candidate should **not** produce a system from their own limited knowledge of the requirements of the organisation.

A Project should:

- allow candidates to demonstrate their knowledge and understanding of ICT systems and the skills in the assessment objectives;

- encourage the sensible use of computers and communications systems to produce a solution, which solves a problem sensibly, within the constraints of resources available to candidates;

- show the successful completion of a whole task from definition involving a third party to acceptance and evaluation by that user. Projects which involve much repetitive design, analysis or especially implementation, leading to unwieldy reports, are to be discouraged;

- involve all elements of the skills of definition, analysis, design, development, testing, documentation, implementation, and evaluation. Projects need not be 'stand alone': the enhancement or modification of an existing system provided that all these elements are covered, is more likely to be a real world situation;

- involve a third party user, who will provide information for the analysis, use the implemented solution and contribute towards its evaluation. The third party user is likely to be a user (or potential user) of a computer-based information system in business or in other organisations in the community. Whilst a teacher could act as the third party user, this arrangement is far from ideal. Candidates should be encouraged to look beyond school life into businesses and organisations in the community for their projects; involve the organisation and present them with a report on the work which has been carried out.

The 'third-party' user has to be someone who is willing to be involved in the project throughout, but particularly

- In the analysis of the problem, where the user's requirements are obtained. This may take the form of a recorded interview with the candidate.

- at the software development, testing and implementation stages, where the user is involved in 'prototyping'.

- at the evaluation stage, where the user is involved in checking that the system is completed as specified and, leading on from this, is then willing to write a letter of acceptance of the system, including any criticisms of it.

Candidates should make the final choice of the problem for solution in collaboration with the potential end user, although guidance about the suitability, and throughout the stages of the project should be given by the supervisor. This should include guidance on the appropriateness of an implementation on a stand-alone or networked small computer-based information system or other available facility. In a well-organised project the candidate will focus on the production of an overall system analysis and design. The solution may be implemented using one or more of: a standard generic applications software package, pre-written modules and toolkits/authoring/publishing software and interface/client software (including HTML/JAVA).   Brief descriptions of any software used, together with reasons for their selection, should be included in the report.

Test data should be devised and used systematically to test the package thoroughly. The choice of test data used, and the reason for choice, should be included. A description of the methods of testing should also be included, together with evidence of testing.

The projects should contain the title, a contents list, a description and justification of investigation, analysis, design and methods used, an evaluation and bibliography. Pages should be clearly numbered. The report must be supported by appropriate evidence of implementation, such as screen dumps or photographs of screen layouts and printouts, paper based user documentation and a letter from the third party user to support the evaluation. Candidates should **not** submit magnetic or optical media as supporting evidence but can make references to web pages available over the Internet, or to photographic or video (VHS only) evidence supplied.

The projects will seldom involve programming or the installation of hardware but will probably involve the choosing of the type of hardware that will be needed to implement the solution.

Some possible ideas are given below. However, it is important for candidates to realise that the project chosen should be user driven. This means that candidates must understand that they should find possible users of ICT systems and find out their needs before developing an idea.

The examples do not show the analysis of the problem nor do they give all facilities which may be required by the user. For example, the staff who run the school bank may well require many other facilities which can only be ascertained by interviewing the appropriate staff and, possibly, some of the pupils who use the bank. The examples only give a few ideas of the type of project, which could provide candidates with the opportunities to demonstrate Advanced GCE ICT skills and an understanding of solving real life problems.

Example 1

The local village hall committee has a bank that is used by a large number of local people to save money for Christmas.   The staff who run the bank must keep details of people who use the bank as well as details of individual accounts. It is useful to have a list of all the people who use the bank together with addresses and so on, which help the staff to contact them. Sometimes the staff need to contact someone urgently.

Villagers need bank statements from time to time. This occurs when someone asks for a statement or at the end of November.

The bank statements must give details of each transaction such as deposit number, amount withdrawn, amount deposited and an up-to-date balance. It should also show any interest payments.

The staff have to be able to create a separate statement for each person and it must only be accessed by the person's account number. Sometimes pupils forget their account numbers and the staff must be able to provide them on proof of identity.

The committee who run the scheme are particularly worried about the security of the files.

Candidates would be expected to produce a tailored solution with an appropriate interface. Limitations and extensions should be suggested.

Example 2

A local hotelier wants to have a website to advertise the facilities available at the hotel.

You are to design a computer-based information system that could be used by the hotelier.

This would involve the student in analysing the problem, collecting the necessary information and designing a solution, which would include a full implementation of the site.

Candidates should be aware that, on one level, this is a fairly trivial problem. The teacher/examiner will be looking for detailed analysis of the problem, and design solutions, which involve the hotelier at all stages. It will also be necessary to ensure that some of the implementation is at more than a basic level, examples could include the ability to download documents like the hotel brochure from the site, and the ability to book rooms and pay for them in advance through the site.

Example 3

Ms Johnson has a small newsagent's shop and employs eight people to deliver the papers. She wishes to be able to produce delivery lists for each morning round and each evening round. At the moment she does not deliver Sunday papers but may wish to in the future.

She wants to keep details of her customers, including which morning papers and which evening papers they have and which delivery round they are on. Some customers only have one morning and one evening paper, others do not have both a morning and evening paper. Some customers have weekly magazines, some fortnightly magazines and some monthly magazines.

Ms Johnson would also like to be able to produce a weekly paper bill for each customer.

You are to design a computer-based information system that could be used by Ms Johnson including the facility to browse on-line for information.

This is an example of a popular type of project. Candidates should be aware that what appears to be a fairly straight forward problem to solve is actually extremely difficult to solve properly. It is a good example of the necessity of the teacher/superviser carefully explaining the problems that might arise in the middle of a project.

Example 4

The student is asked by the headteacher of a school to develop an information system for use in classrooms and public areas. The information needs to be on computer screens, which can be amended from a central location.

The student is involved in analysing the problem in respect to site of screens, user interfaces, types of information, passwording to allow users to edit only their pages...

You are to design a computer-based information system that could be used by the school.

The implementation of the system is relatively straightforward using a piece of authoring software. However, the candidate can enlarge the scope of the project by including, for instance, a budgeting system so that individual departments are allocated a set amount of time, or an accounting system so that departments can be billed on a monthly basis. Another extension might be to include an archiving system to store messages for future inspection.

The teacher/examiner would be looking for a detailed analysis of the requirements and a measure of extension to the basic problem, which would illustrate the candidate's ability to integrate the information into other software.

Guidance on Marking Information and Communications Technology Projects

The project should be awarded marks according to its stages:

(a)	Definition, Investigation and Analysis	**[25 marks]**
(b)	Design	**[21 marks]**
(c)	Software Development, Testing and Implementation	**[35 marks]**
(d)	Documentation	**[24 marks]**
(e)	Evaluation	**[15 marks]**

(a)   *Definition, Investigation and Analysis*   *[25 marks]*

(i) Definition - nature of the problem solved   [5 marks]

A candidate should not expect the examiner to be familiar with the theory and practice in the area of the chosen system. This section is designed to allow a brief description and introduction to the problem.

1   A vague description of the organisation.

2   Some description of both the stages of study and organisation involved.

3   A good description of either the area or organisation with some description of the other.

4   A clear description with one element missing (for example, origins of data).

5   An excellent description with all elements present.

The report should contain:

- a description of the organisation that has the problem and the place of the problem within it. This does not have to be in any great detail, as a guide, half a side of A4 should be adequate

- a description of how the chosen problem is dealt with at the moment. This can only be a sketchy description because, until the analysis section has been completed, it is not possible to describe the area in any detail.

- a clear description of the data that is used in the area of the problem. The exact date that will form part of the solution is not yet known because the problem has not yet been fully specified, however, it is necessary to be aware of all the data that may be required.

- a clear indication of where the data came from, how it is collected.

(ii) Investigation and Analysis [20 marks]

This section is the 'systems analysis'. The question is not how a system performs detailed tasks, but rather how the project progresses from the original data to the results.

Evidence

1 - 5   Some elements have been discussed but little or no user involvement.

6 - 10   Some evidence that an attempt has been made to interview the user and some recording of it has been made. Attempts at some of the other items have been made. An attempt has been made to develop a requirements specification.

11 - 15   Good user involvement and recording of the interview(s). Most of the necessary items have been covered including a detailed discussion of alternative approaches. However, one or two items have been omitted. A requirements specification is present but with some omissions.

16 - 20   The collection of information, particularly the interview(s) has been well planned. Excellent user involvement with detailed recording of the user's requirements. Alternative approaches have been discussed in depth. All other items must be present, showing a thorough analysis of the system to be computerised. A detailed requirements specification has been produced.

The report should contain:

- detail relating to the planning of the end-user interview.

- the original plan of the questions, showing that all areas had been planned to be covered and that sensible follow up questions have been considered.

- transcript of the interview itself, including an element of later analysis and isolation of important facts.

- further evidence of information collection relevant to the problem area.

- possibly a data flow diagram (or some other representation) showing how the present system works.

- consideration of different methods of solving the problem, together with some evidence that the end user has been involved in the decision making.

- hardware and software requirements of the system with discussion about the needs for each and any problems that may be anticiapated.

- a requirement specification stemming from the data collection.

(b)   *Design* [21 marks]

(i) Nature of the solution [13 marks]

This section of the report should specify the candidate's design of the solution. Prototypes should be produced and active involvement of the ultimate user should be sought in approving designs.

Evidence

1 - 2   Some vague discussion of what the system will do with a brief diagrammatic representation of the new system.

3 - 6   The major objectives of the new system have been adequately summarised, but omissions have been made. There is a brief outline of a design specification, including mock ups of inputs and outputs. However there is a lack of completeness with omissions from the task model, inputs and outputs. Data structures have been identified but there may be inadequate detail.

7 - 10 A clear set of objectives have been defined and a full design specification is included but there may be some errors or logical inconsistencies, for example validation specified may be inadequate or field lengths incorrect.

11-13   A clear set of objectives with a detailed and complete design specification, which is logically correct. There are also detailed written descriptions of any processes/modules and a clear, complete definition of any data structures. The specification is sufficient for someone to pick up and develop an end result using the software and hardware specified in the requirements specification.

The report should contain:

- a list of objectives against which the final product can be measured. This report should be signed by the end user.

- an explanation of the way the data is to be collected.

- an explanation of the way the data is to be input to the system together with any initial screen designs for the output of data.

- details of the file structures that are to be used and the links between them.

- explanation of the way the data is manipulated through the system. This swction should contain diagrammatic representation of the data through the system.

- if the solution is to be attempted in module form there should be a description of the way the problem has been modularized and also how the modules will fit together.

(ii) Intended benefits   **[3 marks]**

There should be some discussion of the relative merits of the intended system and of the previous mode of operation. This may include any degree of generality beyond the original scope of the system.

One mark should be awarded for each valid benefit up to a maximum of three marks.

(iii) Limits of the scope of the solution   **[5 marks]**

This section is intended to make the candidate consider that all problem solutions suffer from limitations and how important it is to be aware of them.

Evidence

1   A vague discussion of what the system limitations are.

2 - 3   The major limitations of the system have been adequately summarised, but omissions have been made.

4 - 5   A detailed description of the system limitations has been given, including the estimate of the size of the files required for the implemented system.

This report should contain:

- a description of the contents and data types stored in each of the files to be used together with an approximation of their size.

- any adjustments that the candidate thinks are necessary to their solution compared to the real thing.

- a list of any limitations that have been placed on the solution because of the hardware available and the software available.

(c) Software Development, Testing and Implementation [35 marks]

(i) Software Development and Testing [18 marks]

A technical description of how the solution relates to the design specification produced and agreed with the user should be included. It is the responsibility of the candidates to produce evidence of their development work and for producing a test plan for the system. It is vital to produce test cases and to show that they work. To do this, it is necessary not only to have test data, but to know what the expected results are with that data.

An attempt should be made to show that all the original objectives of the system have been tested, including those sections dealing with unexpected or invalid data as well as extreme cases. Showing that many other cases of test data are likely to work - by including the outputs that they produce - is another important feature. Evidence of testing is essential. Comments by teachers and others are of value, but the test plan must be supported by evidence in the report of a properly designed testing process. The examiner must be left in no doubt the system actually works in the target environment. This evidence may be in the form of hardcopy output (possibly including screen dumps), photographs or VHS video.

Evidence

1 - 4   Evidence of tailoring of a software package or integration of interface software is tailored into a system and is provided in the form of printouts but with no annotation or relationship to a test plan or test run. The developed solution does not fulfil the design specification. A collection of hardcopy test run outputs with no test plan, or a test plan with no hardcopy evidence may also be present. A teacher may award up to 2 marks if they have been shown the system working satisfactorily and there is no hard evidence in the project report.

5 – 8   Evidence of tailored software packages/tailored interface software/tailored client software etc are provided in the form of printouts. Data structures are illustrated as part of the listings where appropriate, detailing their purpose. There is some annotation evident to illustrate how the package was tailored for a particular purpose or to indicate the purpose of sections of code in a program listing. The developed solution has logical flaws and does not fulfil the system objectives. There is little

evidence of testing with a badly developed test plan with clear omissions. There is no description of the relationship between the structure of the development work and the testing in evidence.

9 - 13   Evidence of tailored software packages/tailored interface software/ tailored client software are provided in the form of printouts. Data structures are illustrated as part of the listings where appropriate, detailing their purpose. There is some annotation evident to illustrate how the package was tailored for a particular purpose or to indicate the purpose of sections of code in a program listing. The developed solution partially fulfils the system objectives. Eight different test are carried out together with a test plan and hardcopy evidence. However, the test plan has not been designed to test all the objectives.

14 - 18   Technical evidence is provided in the form of printouts. Data structures are illustrated as appropriate, detailing their purpose. There is a full set of printouts showing input and output as well as data structures. All hardcopy is fully annotated and cross-referenced. The developed solution completely fulfils the design objectives. A full test plan, with evidence of each test run is present in the report, together with the expected output. The test plan should cover all the objectives, inluding valid, invalid and extreme cases.

The report should contain:

* a testing strategy that is devised before the development of the solution and that will lead to….

* the testing plan. This should consist of at least 8 different areas of the solution to be tested, including an indication of what is expected as the outcome. For full marks in this section the candidate should include enough testing to be able to test all the different areas of the solution, though they should remember that it is not possible to test every aspect of the solution with all possible values.

* data structures are described and their existence is proved by means of printing them out.

* input and output screens are described and produced. They should be fully annotated to show their effectiveness.

* the file before and after the input of the data to show that the test has proven that the data is input to the file. Remember that it is not good enough to simply type in the different fields of a record and print out the forms to call it a test.

* for each of the tests planned the intention of the test run and the reason why this particular test is necessary. What is it testing? It is also necessary to have a clear idea of what the expected result is. If the test does not produce the expected result there should be a detailed explanation as to why the expectations were not met.

* detailed and annotated program listing if any original code has been produced.

(ii) Implementation   [10 marks]

It is recognised that the user organisation (preferably 'third party') may not fully implement the system, although this is the ultimate aim. There should be an implementation plan written, including details of system changeover, training required and details of user testing. For full marks there should be evidence that at least parts of this implemention plan have been carried out.

Evidence

0   No evidence that the third party user has used the system. No written implementation plan

1 - 4   Details of system changeover have been documented with some recognition that the user(s) will require training. Some evidence of user testing is given, usually by questionnaire or written comments by fellow students or others who were not directly involved in the development of the system.

5 - 7   A good implementation plan considering different methods of implementation, with details of training required. There is written evidence available from the third party user indicating that they have seen the system in operation. Consideration has been given to the creation of necessary data files.

8 - 10   A clear and detailed implementation plan, including detailed stages of user testing. All aspects of user testing, user acceptance, implementation and system changeover have been documented. There is written evidence available from the user that the system has been fully tested.

The report should contain:

- evidence that the end-user, or some other representative of the organization, has seen the system.

- evidence that the end-user has used the system.

- meaningful results obtained from the system.

- evidence that the end-user has been involved at different stages of the system development and has not just been included at the end.

- some evidence that the opinions of the end-user have been used to adapt the solution.

- details of the training that will need to be available for the staff that must use the new system.

- details of the means by which the new files are going to be created, including some indication of the scale of the problem.

- details of the changeover anticipated.

(iii) Appropriateness of structure and exploitation of available facilities   [7 marks]

Some discussion of the suitability of methods and any product (e.g. hardware or software) used for the particular system should be included. Some recognition and discussion of the problems encountered and actions taken when appropriate should also be included. A log of such problems could be kept. Suitability for subsequent maintainability and extendibility.

Evidence

1 - 3   Some attempt at discussing either the suitability of the hardware and software, or the problems encountered.

4 - 7   A detailed log illustrating the development of the solution. A complete discussion of the hardware and software available and how they were suitable in solving the given problem, together with a good, informative explanation of the problems encountered and how they were overcome.

The report should contain:

- a critical appraisal of the hardware that has been used, to include comments about more appropriate hardware if the candidate feels it necessary.

- a critical appraisal of the software that has been used, to include comments about more appropriate software if the candidate feels it necessary.

- a log of all the problems that were encountered during the production of the solution. This log should include a detailed description of the measures taken to solve the problems found. There should be references to the evidence that the solutions had the desired effects.

(d)   Documentation   [24 marks]

(i) Technical   [10 marks]

Much of the documentation will have been produced as a by product of design and development work and also as part of writing up the report to date. However a technical guide is a standalone document produced to facilitate easy maintenance and upgrade of a system. The contents of the guide should, where relevant, include the following: data structures used and/or database modelling and organisation including relationships, screens, reports and menus; data dictionary, where appropriate; data flow (or navigation paths through the system); annotated software details in the form of printouts; detailed flowcharts/transition diagrams as necessary; details of any functions, procedures, macros etc and any formulae used. All parts of the guide should be fully annotated since this is very important for subsequent development of the system. The specifications of the hardware and software on which the system can be implemented should be included.

Since the system in the technical guide will differ from one project to another, professional judgement as to what would be necessary for another analyst to maintain and develop the system has to be made.

Evidence

1 - 2   Some items are present but little annotation.

3 - 6   One or two major omissions, but the rest is fully annotated.

7 - 10   No major omissions, with all parts fully annotated. Marks will be lost for inadequate items of documentation for example, non-specification of hardware on which the system can be implemented. For full marks the guide should be well presented rather than just a collection of items.

The report should contain:

- a description of the records used and the fields within the records. The types of data should be described as should the data structures used to hold the data. Any data handling implies that data has been stored. Whether the project is based on programming or on tailoring software, it is going to be necessary to explain how the data is being stored.

- if a database solution has been produced, an explanation of the relationships between the various files, or tables, and the linkages used.

- the screens used and the menu system for the input of data along with the form designs where these items are appropriate to the particular project.

- a data dictionary or list of variables used and details of the formulae used, the queries employed, and the algorithms for any original coding, whether it be SQL in helping to analyse a database, or another HLL which has been used to produce a piece of original software.

- any algorithms should be fully annotated and supported by annotated code which takes advantage of automatic annotation techniques like comments and indentations.

- a listing of the recommended hardware and software configuration needed to run the system.

(ii) User   [14 marks]

Clear guidance, as friendly as possible, should be given to the user for all operations that they would be required to perform. These would include input format with screens displays, print options, back-ups (file integrity routines), security of access to data and a guide to common errors that may occur. (Note the candidate would not be required to copy out large volumes of any underlying software's user guide, but to produce a non-technical and easy to follow guide for someone with little computer knowledge.) Some mention here of the relationship between items of software and the data they deal with may be relevant. The user guide should be well-presented with an index and, where necessary, a glossary of the terms used. Alternatively, an electronic guide could be based around hypertext links (screen dumps will be required).

Evidence

1 - 2   An incomplete, badly produced guide. No screens displays/interface mock ups. Some options briefly described but difficult for the user to follow.

3 - 4   A standalone guide has been produced which, though incomplete, contains details of the required input and output and some error conditions. Some screen displays are present in the guide.

5 - 9   All but one or two options fully described (for example, back-up routines not mentioned). In the main the options are easy for the user to follow with screen displays.

10 - 14   A full user guide with all options described, well-presented (possibly as a booklet) with an index and a glossary. No omission of any of the options available (including back-up routines, and a guide to common errors). For full marks, good on-screen help should exist.

The report should contain:

- a contents page and possibly an index.

- details of input requirements including examples of valid and invalid data with explanations, examples of the input screens so that the user knows what the screen will look like. How to move from input to input on the screen, how to show that the screen input is completed.

- methods of output. How to select them, where the output will appear, how to facilitate output, even simple things like 'ensure the printer is switched on'. If there is a choice of hardcopy output, how is the choice made and what criteria are used to decide on which output device to use?

- explanation of the error messages that may appear. In most projects these will tend to be related either to the printer or to data that has failed a validation test on input to the system.

- back-up routines and data archiving strategies.

- methods that have been used to protect the data. For example passwords on files.

- a certain amount of on-screen help. This may take the form of error messages or may be more active, allowing the user to access advice about a particular part of the solution from within the solution. Screen dumps or photographs of these on-screen help facilities will be needed as evidence.

- a glossary of any words or terms that a typical user of the system may find confusing.

(e) *Evaluation* *[15 marks]*

(i) Discussion of the degree of success in meeting the original objectives.   [6 marks]

This discussion should demonstrate the candidate's ability to evaluate the effectiveness of the completed system. For full marks it is important that the user provides sets of data as they are likely to occur in practice, and that the results arising from such data be given. This data is typical data rather than test data and it may show up faults or problems that the candidate's own test data failed to find.

Evidence

0   No discussion present.

1 - 3   Some discussion about a number objectives, but some omissions or inadequate explanation of success or failure. No attempt to use 'real' data to test the system objectives.

4 - 6   A full discussion, taking each objective mentioned in (b) (i) and explaining the degree of success in meeting them, indicating where in the project evidence can be found to support this or reasons why they were not met.

The report should contain:

- a clear matching up of the agreed objectives of the project with evidence that the objectives have been met. For each objective a discussion about the degree of success that the candidate believes has been achieved (with reference to the evidence in the rest of the report), any short comings that the candidate has been able to identify and the reasons why such shortcomings occurred.

- the results that were obtained upon using 'real' data rather than manufactured test data. It is understood that any problems outlined earlier about restrictions because of the DPA or similar are still accepted. The distinction between the two types of data should be seen as – test data has been specially chosen to have a certain characteristic which can be used to test a specific area of the software solution, while real data is the sort of data that will arise in the operation of the system.

(ii) Evaluate the users' response to the system   [5 marks]

It is important that the user is not assumed to be an expert in computer jargon, so some effort must be made to ensure that the system is user-friendly. It will be assumed that the user will have considerable knowledge of the underlying theory of the business being computerised. Clarity of menus, clear on-screen help and easy methods of inputting data are all examples of how the system can be made user-friendly. Here marks are awarded for the degree of satisfaction that the user indicates in the acceptance procedure. Could the system, or its results be used? Was the system specification achieved? Do any system faults still exist? The candidate should evaluate the users' response to the final version of the system.

Evidence

1   Some effort has been made to make the system user-friendly, but the user still has difficulty using the system.

2 - 3   The system is, in the main, user-friendly, but there is room for improvement (e.g. no on-screen help has been provided). The user indicates that the system could be used but there are some faults, which need to be rectified.

4 - 5   A fully user-friendly system has been produced. The user indicates that the system fully meets the specification given in section (a), and there are no known faults in the system.

The report should contain:

- a letter from the end-user stating that they have used the software solution and listing the things that they managed to do and those that they could not, or that still need work to improve them.

- some evidence to support the letter. For example a printout showing an amendment to a record in the file.

- some indication of the degree of success that the candidate has achieved in the opinion of the end user.

- candidates must be aware that comments made by the end user in the letter of acceptance must be supported by evidence in the rest of the report.

(iii) Desirable extensions [4 marks]

As a result of completing the system, the candidate should identify the good and bad points of the final system highlighting any limitations and necessary extensions to the system, indicating how the extensions could be carried out.

Evidence

One mark for each of:

- Identifying good points of the work

- Identifying bad points of the work

- Identifying limitations in the report

- Identifying areas for extension work.

The report should contain:

- A list of those parts of the system that the candidate believes are satisfactorily completed.

- A list of those areas that have not been successful. A reason why the candidate holds that opinion and what should be done about it if there was enough time to rectify that situation.

- Areas within the system where previously identified limitations have had a marked effect on the results

- A clear indication that the candidate realise that, although the project is finished, the solution is not and that there are a number of possibilities for extending the solution with brief outlines about what would be involved in such extensions.

Appendix C

Overlap with VCE ICT Units

The following grid shows modules in these specifications which have some overlap in content with VCE in Information and Communication Technology units.

AS/Advanced GCE	VCE ICT
Module 2512	Unit(s)
5.1.1	7317, 7320, 7340
5.1.2	7318
5.1.3	7318
5.1.4	7320
5.1.5	7337
5.1.6	7323
Module 2513	
5.2.1	7317, 7320, or other depending on task
5.2.2	7317, 7320, or other depending on task
5.2.3	7317, 7320, or other depending on task
5.2.4	7317, 7320, or other depending on task
Module 2514	
5.3.1	7315, 7316
5.3.2	7315, 7321, 7333
5.3.3	7317
5.3.4	7319, 7320

AS/Advanced GCE	VCE ICT
Module 2515	**Unit(s)**
5.4.1	7337, 7338
5.4.2	7337, 7338
5.4.3	7318, 7321, 7337, 7338
5.4.4	7323
Module 2516	
5.5.1	7319, 7328
5.5.2	any depending on project
5.5.3	any depending on project
5.5.4	any depending on project
5.5.5	any depending on project
5.5.6	any depending on project
Module 2517	
5.6.1	7316
5.6.2	7319, 7328, 7337
5.6.3	7337, 7338
5.6.4	7316, 7323