

INTERNATIONAL ADVANCED LEVEL

INFORMATION TECHNOLOGY SPECIFICATION

Pearson Edexcel International Advanced Subsidiary in Information Technology (XIT11)

Pearson Edexcel International Advanced Level in Information Technology (YIT11)

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Issue 2



Edexcel, BTEC and LCCI qualifications

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Summary of Pearson Edexcel International Advanced Subsidiary/Advanced Level in Information Technology specification Issue 2 changes

Summary of changes made between previous issue and this current issue	Page number
<i>Unless otherwise stated, changes listed below have been made for clarification and do not constitute changes to the current specification content.</i>	
In Unit 1, section 1.3 <i>Unit content, Topic 1: Hardware and software:</i> 1.1.1 <i>Features and functions</i>, item <i>connectivity</i> has been expanded to list these cable types: USB and HDMI 1.1.1 <i>Contemporary digital devices</i>, item <i>computers</i> has been expanded to list desktop PCs, tablets, smart TVs, games consoles, microprocessors / single board computers, wearable computers and supercomputers 1.1.1 <i>Contemporary digital devices</i>, item <i>embedded systems</i> has been removed as it is listed in 1.1.4. 1.1.1 <i>Contemporary digital devices</i>, item <i>peripheral devices</i> has been expanded to list keyboards, mice, joysticks, microphones, scanners, monitors, speakers, printers, video cameras, webcams, touch screens, graphics tablets, biometric scanners, barcode readers, chip and pin devices, and sensors 1.1.1 <i>Contemporary digital devices</i>, item <i>mobile phones</i> has been expanded to list smartphones 1.1.1 <i>Contemporary digital devices</i>, item <i>storage devices</i> has been expanded to list magnetic storage, solid state and optical hard drives, magnetic tape drives, removable solid state (SSD) cards, network-attached storage (NAS), RAID storage 1.1.3, term 'technical convergence' has been corrected and now reads: 'technological convergence'.	14-15
In Unit 1, section 1.3 <i>Unit content, Topic 3: The online environment:</i> 3.1.1 Term 'Domain Name Service' has been corrected and now reads: 'Domain Name System' 3.2.3 After term 'digital footprint', examples of 'active, passive' have been added.	19
In Unit 1, section 1.3 <i>Unit content, Topic 5: Data and databases:</i> 5.2.2 item <i>composite keys</i> has been added to show a comprehensive list of keys, and the subsequent two items have been re-lettered accordingly.	21
In Unit 2, section 2.3 <i>Unit content, Topic 8: Understanding the functionality of CSS:</i> 8.2.4 Statement 'Be able to styles to elements' has been corrected and now reads: 'Be able to add styles to elements'	28-29

Summary of changes made between previous issue and this current issue	Page number
8.3.4 Statement 'Understand responsive design techniques' has been expanded and now reads: 'Understand and be able to use responsive design techniques.'	
In Unit 2, section 2.3 <i>Unit content, Topic 11: The semantic web:</i> 11.1.5 Item <i>heading groups</i> has been removed as it is no longer a valid element of the HTML5 language, and the subsequent items have been re-lettered accordingly.	33
In Unit 3, section 3.3 <i>Unit content, Topic 12: Manipulating data:</i> 12.2 Heading 'Data normalisation' has been changed to 'Relational databases' 12.2.4 The example of 'normalised data and relations' has been expanded and now reads: 'normalised data, relations and relationships'.	35
In Unit 3, section 3.3 <i>Unit content, Topic 13: Enabling technologies:</i> 13.3.3 Statement 'Interface design' has been removed. 13.3.4 has been added as it constitutes a separate point and now reads as follows: 'Understand interface design to meet the needs and requirements of individuals and organisations:'	37
In Unit 3, section 3.3 <i>Unit content, Topic 14: Using IT systems in organisations:</i> 14.1.5 item a. <i>intelligent transportation system</i> has been reworded to read <i>scheduling and route planning</i>.	38
In Unit 3, section 3.3 <i>Unit content, Topic 15: Systems development:</i> 15.1.7 'Be able to analyse a completed project to identify strengths and weaknesses in project management' has been removed as this goes beyond required content 15.4 'Diagrams used in system design and development' has been added 15.4.1 'Be able to create and interpret information flow diagrams for a given scenario' has been added in this section.	40
In Unit 3, section 3.3 <i>Unit content, Topic 16: Emerging technologies:</i> 16.3.6 'Be able to interpret and create information flow diagrams for a given scenario' has been removed from this section as it is now covered on page 40.	41

Earlier issue shows previous changes.

If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com/en/support/contact-us.html.

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About this specification

The Pearson Edexcel International Advanced Subsidiary in Information Technology and the Pearson Edexcel International Advanced Level in Information Technology are part of a suite of International Advanced Level qualifications offered by Pearson.

These qualifications are not accredited or regulated by any UK regulatory body.

Key features

This specification includes the following key features:

Structure

The Pearson Edexcel International Advanced Subsidiary in Information Technology and the Pearson Edexcel International Advanced Level in Information Technology are modular qualifications. The Advanced Subsidiary can be claimed on completion of the International Advanced Subsidiary (IAS) units.

The International Advanced Level can be claimed on completion of all the units (IAS and IA2 units).

Content

The content is relevant for learners who want to study this subject at a higher level. The qualifications include a variety of topics, including IT systems, coding for the web and relational databases.

Assessment

At International AS Level, assessment consists of two externally assessed written papers. The International A Level consists of two further externally assessed written papers. In each qualification, the second paper requires students to carry out activities using a computer.

Approach

Students will develop their knowledge and understanding of information technology by applying the concepts given in this specification to a range of different problems that include a variety of contexts. Students will develop their practical skills, particularly in coding for the web and databases.

Specification updates

This specification is Issue 2 and is valid for first teaching from September 2018. If there are any significant changes to the specification, we will inform centres in writing. Changes will also be posted on our website.

For more information please visit [qualifications.pearson.com](https://www.pearson.com/qualifications).

Using this specification

This specification gives teachers guidance and encourages effective delivery of these qualifications. The following information will help you get the most out of the content and guidance:

Compulsory content: as a minimum, all the topics in the content must be taught. The word 'including' in content specifies the detail of what must be covered.

Examples: throughout the content, we have included examples of what could be covered or what might support teaching and learning. It is important to note that examples are for illustrative purposes only and centres can use other examples. We have included examples that are easily understood and recognised by international centres.

Assessments: use a range of material and are not limited to the examples given. Teachers should deliver these qualifications using a good range of examples to support the assessment of the content.

Depth and breadth of content: teachers should use the full range of content and all the assessment objectives given in the subject content section.

Up-to-date content: questions in the first assessment series will use current practices and standards, for example: HTML 5. However, to ensure that the specification is up to date, questions in later assessment series may use practices and standards that are developed over the lifetime of the specification. Details of any updated practices that we will use in questions, and when these questions will be set, will be given on our website.

Qualification aims and objectives

The aims and objectives of these qualifications are to enable students to develop:

- essential knowledge and understanding of different areas of the subject and how they relate to each other
- competence and confidence in mastering practical skills, such as producing coding for the web and relational databases
- their interest in and enthusiasm for the subject, including developing an interest in further study and careers associated with the subject.

Qualification abbreviations used in this specification

The following abbreviations appear in this specification:

International Advanced Subsidiary – IAS

International A2 – IA2 (the additional content required for an IAL)

International Advanced Level – IAL.

Why choose Pearson Edexcel qualifications?

Pearson – the world’s largest education company

Edexcel academic qualifications are from Pearson, the UK’s largest awarding organisation. With over 3.4 million students studying our academic and vocational qualifications worldwide, we offer internationally recognised qualifications to schools, colleges and employers globally.

Pearson is recognised as the world’s largest education company, allowing us to drive innovation and provide comprehensive support for Pearson Edexcel students in acquiring the knowledge and skills they need for progression in study, work and life.

A heritage you can trust

The background to Pearson becoming the UK’s largest awarding organisation began in 1836, when a royal charter gave the University of London its first powers to conduct exams and confer degrees on its students. With over 150 years of international education experience, Edexcel qualifications have a firm academic foundation, built on the traditions and rigour associated with Britain’s educational system.

Results you can trust

Pearson’s leading online marking technology has been shown to produce exceptionally reliable results, demonstrating that at every stage, Pearson Edexcel qualifications maintain the highest standards.

Developed to Pearson’s world-class qualifications standards

Pearson’s world-class standards mean that all Pearson Edexcel qualifications are developed to be rigorous, demanding, inclusive and empowering. We work collaboratively with a panel of educational thought leaders and assessment experts to ensure that Pearson Edexcel qualifications are globally relevant, represent world-class best practice and maintain a consistent standard.

For more information on the World Class Qualification process and principles please go to *Appendix 2: Pearson World Class Qualification design principles* or visit our website: uk.pearson.com/world-class-qualifications.

Why choose Pearson Edexcel International Advanced Subsidiary/Advanced Level qualifications in Information Technology?

We have listened to feedback from all parts of the international school subject community, including a large number of teachers. We have made changes that will engage international learners and give them skills that will support their progression to further study of information technology and to a wide range of other subjects.

Key qualification features – up-to-date, engaging content with a clear structure and straightforward, engaging assessments.

Clear and straightforward question papers – our question papers are clear and accessible for students of all ability ranges. Our mark schemes are straightforward so that the assessment requirements are clear.

Broad and deep development of learners' skills – we designed the International Advanced Level qualifications to expand students' knowledge by broadening and deepening skills. For example, students will:

- engage with web and database design in a practical, externally-assessed examination. This allows students to apply the knowledge and understanding they gain in the classroom
- discover how to plan and implement an IT project and learn about key areas such as emerging technologies, the online environment and systems analysis and design.

Progression – International Advanced Level qualifications enable successful progression to higher education. Through our world-class qualification development process, we have consulted with higher education providers and teachers to validate the appropriateness of these qualifications, including content, skills and assessment structure.

Our International A Level in Information Technology sits within our wider subject offer for information technology. We also offer BTEC National qualifications in Information Technology and Computer Science.

More information can be found on our website (qualifications.pearson.com) on the Pearson Edexcel International Advanced Level pages and BTEC pages.

Supporting you in planning and implementing these qualifications

Planning

- Our *Getting Started Guide* gives you an overview of the Pearson Edexcel International Advanced Subsidiary/Advanced Level in Information Technology qualifications to help you understand the changes to content and assessment, and what these changes mean for you and your students.
- We will provide you with an editable course planner and a scheme of work.

Teaching and learning

- We will provide teaching and learning resources that promote anytime, anyplace learning to improve student motivation and encourage new ways of working.

Preparing for examinations

We will also provide a range of resources to help you prepare your students for the assessments, including:

- exemplar candidate scripts to support assessment and indicate standards required at different grade levels in these qualifications
- Examiner Reports following each examination series.

ResultsPlus

ResultsPlus provides the most detailed analysis available of your students' examination performance. It can help you identify the topics and skills where further learning would benefit your students.

examWizard

This is a free online resource designed to support students and teachers with examination preparation and assessment.

Training events

In addition to online training, we host a series of face-to-face training events each year for teachers to deepen their understanding of our qualifications.

Get help and support

Our subject advisor service will ensure that you receive help and guidance from us. You can sign up to receive the Pearson Edexcel newsletter for qualification updates and product and service news.

Qualification at a glance

Qualification overview

The Pearson Edexcel International Advanced Subsidiary in Information Technology

This qualification consists of two externally examined units.

The International Advanced Subsidiary is the first half of the International Advanced Level qualification and consists of two IAS units: Unit 1 and Unit 2. This qualification may be awarded as a discrete qualification or may contribute 50 percent to the International Advanced Level qualification.

The Pearson Edexcel International Advanced Level in Information Technology

This qualification consists of four externally examined units.

The International Advanced Level consists of the two IAS units (Unit 1 and Unit 2) plus two IA2 units: Units 3 and 4. Students wishing to take the International Advanced Level must, therefore, complete all four units.

Course of study

The structure of these qualifications allows teachers to construct a course of study that can be taught and assessed as either:

- distinct modules of teaching and learning with related units of assessment taken at appropriate stages during the course; or
- a linear course assessed in its entirety at the end.

Content and assessment overview

IAS Unit 1	*Unit code: WIT11/01	
Externally assessed Written examination: 2 hours Availability: June First assessment: June 2019 80 marks	50% of the total IAS	25% of the total IAL
Content overview Students must study all of the following topics: • Topic 1: Hardware and software • Topic 2: Networks • Topic 3: The online environment • Topic 4: IT systems • Topic 5: Data and databases • Topic 6: Wider issues. Students will: • demonstrate knowledge and understanding of the concepts of information technology • apply knowledge and understanding of the concepts of information technology • analyse and evaluate information technology problems • use analysis and evaluation to design solutions.		
Assessment overview • This paper may include multiple-choice, short-open-response, open-response and extended open-response questions. • All four assessment objectives are assessed. • Candidates must answer all questions.		

IAS Unit 2	*Unit code: WIT12/01	
Externally assessed practical examination Written examination: 3 hours Availability: June First assessment: June 2019 80 marks	50% of the total IAS	25% of the total IAL
Content overview Students must study all of the following topics: • Topic 7: Understanding the functionality of HTML • Topic 8: Understanding the functionality of CSS • Topic 9: Understanding the functions of Javascript • Topic 10: Designing web pages • Topic 11: The semantic web. Students will: • demonstrate knowledge and understanding of the concepts of information technology • apply knowledge and understanding of the concepts of information technology • analyse and evaluate information technology problems • use analysis and evaluation to design solutions.		
Assessment overview • This paper consists of theoretical and practical questions and may include short-open-response, open-response and extended open-response questions. • Data files will be provided for some questions. Some responses will be written, others will involve the submission of files. • All four assessment objectives are assessed. • Each candidate will need access to a computer during the examination. • Candidates must answer all questions.		

IA2 Unit 3	*Unit code: WIT13/01	
Externally assessed Written examination: 2 hours Availability: June First assessment: June 2020 80 marks	50% of the total IA2	25% of the total IAL
Content overview Students must study all of the following topics: • Topic 12: Manipulating data • Topic 13: Enabling technologies • Topic 14: Using IT systems in organisations • Topic 15: Systems development • Topic 16: Emerging technologies. Students will: • demonstrate knowledge and understanding of the concepts of information technology • apply knowledge and understanding of the concepts of information technology • analyse and evaluate IT problems • use analysis and evaluation to design solutions.		
Assessment overview • This paper may include short-open-response, open-response and extended open-response questions. • All four assessment objectives are assessed. • Candidates must answer all questions.		

IA2 Unit 4	*Unit code: WIT14/01	
Externally assessed practical examination Written examination: 3 hours Availability: June First assessment: June 2020 80 marks	50% of the total IA2	25% of the total IAL
Content overview Students must study all of the following topics: • Topic 17: Use of features of database solutions • Topic 18: Relational database concepts • Topic 19: Database solutions. Students will: • demonstrate knowledge and understanding of the concepts of information technology • apply knowledge and understanding of the concepts of information technology • analyse and evaluate information technology problems • use analysis and evaluation to design solutions.		
Assessment overview • This paper consists of practical and theoretical questions and may include short-open-response, open-response and extended open-response questions. • Data files will be provided for some questions. • All responses will be submitted using a word-processed candidate evidence template. • All four assessment objectives are assessed. • Each candidate will need access to a computer during the examination. • Candidates must answer all questions.		

*See *Appendix 1: Codes* for a description of this code and all other codes relevant to these qualifications.

Information Technology content

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Unit 1

IAS compulsory unit

Externally assessed

1.1 Unit description

The way we live and work in today's society is enabled by the use of digital technologies. In this unit, you will develop an understanding of what these technologies are, how they work together, and how they enable our digital world to function.

Hardware and software underpin all digital technologies. In this unit, you will understand a range of digital technologies, understand how to evaluate their characteristics and select digital components to provide solutions to today's challenges.

Networks are the backbone of communication in today's society. In this unit, you will understand how networks enable communication and collaboration, and understand how to ensure that communication is secure. You will understand the internet as a network and the world wide web as a collection of information. You will understand how cloud storage, cloud computing and online communities enable the way we work and share information in the digital world.

IT systems, the combination of hardware and software, are pervasive in all aspects of life. Understanding how hardware and software work together will enable you to design technology systems that meet the demands of today's society.

Data is the most valuable asset of both individuals and organisations. It is paramount that data be maintained and manipulated to provide relevant and accurate information. In this unit, you will understand how to organise, store and extract data to meet the information needs of individuals and organisations.

Our society is often challenged by the quick pace of technological advancement. The value of these new technologies is influenced by the moral and ethical concerns of society. The implementation of any technology must be carried out under the auspices of current legal frameworks. In this unit, you will understand how to critically assess the value and impact of new technologies.

1.2 Assessment information

- First assessment: June 2019.
 - The assessment is 2 hours.
 - The assessment is out of 80 marks.
 - Where appropriate, questions will be set in a context.
 - Candidates must answer all questions.
 - The paper may include multiple-choice, short-open, open-response and extended-response questions.
-

1.3 Unit content

Topic 1: Hardware and software

Digital devices consist of both hardware and software components. From the hardware perspective, it is important to understand the technologies that enable these devices. From the software perspective, it is important to understand licensing and maintenance. Understanding both the hardware and software will enable students to assess and select components to meet the requirements of an individual, organisation or scenario.

What students need to learn

1.1 Hardware

1.1.1 Understand the features and functions of contemporary digital devices.

Features and functions:

- a. portability
- b. performance
- c. storage
- d. user interface
- e. connectivity (cable types (USB, HDMI))
- f. media support
- g. energy consumption
- h. expansion capability
- i. security features.

Contemporary digital devices:

- a. computers (desktop PCs, tablets, smart TVs, games consoles, microprocessors/single board computers, wearable computers, supercomputers)
- b. peripheral devices (keyboards, mice, joysticks, microphones, scanners, monitors, speakers, printers, video cameras, webcams, touch screens, graphics tablets, biometric scanners, barcode readers, chip and pin devices, sensors)
- c. mobile phones (smartphones)
- d. storage devices (magnetic storage, solid state and optical hard drives, magnetic tape drives, removable solid state (SSD) cards, network-attached storage (NAS), RAID storage).

1.1.2 Understand the technologies used by digital devices and how they impact on the design and uses of devices:

- a. Global Positioning System (GPS)
- b. biometrics
- c. touchscreen
- d. sensor
- e. memory
- f. storage
- g. battery power
- h. miniaturisation
- i. processor
- j. radio-frequency identification (RFID)
- k. near-field communication (NFC)
- l. quick response (QR) code
- m. connectivity.

1.1.3 Understand the term 'technological convergence' in the context of digital devices.

1.1.4 Understand the concept of and the need for features and functions of embedded systems.

1.1.5 Understand the concept of and the need for firmware, including where it is stored.

1.1.6 Understand factors that can be used to assess the performance of digital devices:

- a. speed
- b. capacity
- c. portability
- d. bandwidth
- e. power efficiency.

1.1.7 Be able to calculate data file size and time needed to transmit a file.

1.1.8 Be able to use and convert between binary and denary, as defined by the International Electrotechnical Commission (IEC). (These are different from SI units.)

bit	kibibyte (KiB) 2^{10}
nibble	mebibyte (MiB) 2^{20}
byte	gibibyte (GiB) 2^{30}
	tebibyte (TiB) 2^{40}

1.1.9 Be able to select digital devices to meet the needs and requirements of individuals and organisations.

1.2 Software

- 1.2.1 Understand the purpose of:
 - a. systems software
 - b. applications software.
- 1.2.2 Understand the role of the operating system in managing:
 - a. devices
 - b. processes
 - c. users
 - d. security.
- 1.2.3 Understand the different sources of software and copyright types:
 - a. free
 - b. open-source
 - c. proprietary
 - d. creative commons.
- 1.2.4 Understand licensing options:
 - a. single user
 - b. multiple user
 - c. institutional
 - d. fixed term
 - e. indefinite
 - f. network.
- 1.2.5 Understand the purpose of, and how to manage, software updates:
 - a. patch
 - b. automatic
 - c. upgrade
 - d. compatibility issues.
- 1.2.6 Be able to select software to meet the needs and requirements of individuals and organisations.

Topic 2: Networks

Computer networks are essential to most organisations, enabling them to access their information irrespective of its geographical location; make efficient use of hardware and software resources, and communicate effectively. Network design, based on an understanding of protocols, is fundamental to the way networks work. Such reliance on networks in our society is founded on the assumption that there are mechanisms for securing access to them.

What students need to learn

2.1 Network models and protocols

2.1.1 Understand the features and functions of computer network models:

- a. client-server
- b. peer-to-peer
- c. ad hoc networks
- d. tethering.

2.1.2 Understand the features and purposes of network communication protocols:

- a. Wi-Fi
- b. ZigBee®
- c. Bluetooth®
- d. cellular – Global System for Mobile (GSM) communications (3G/4G)
- e. infrared
- f. ethernet.

2.1.3 Understand the features, functions, and use of network standards and protocols:

- a. Transmission Control Protocol/Internet Protocol (TCP/IP)
- b. Voice Over Internet Protocol (VOIP)
- c. Session Initiation Protocol (SIP)
- d. 7-layer Open Systems Interconnection (OSI) Model.

2.2 Network design and implementation

2.2.1 Understand the characteristics of different network transmission media:

- a. wireless:
 - (i) microwave
 - (ii) radio
 - (iii) light
 - (iv) satellite
- b. wired:
 - (i) copper – twisted pair and cable
 - (ii) fibre
 - (iii) powerline.

2.2.2 Understand a variety of network metrics:

- a. speed
- b. bandwidth
- c. throughput
- d. scalability
- e. latency
- f. error rate
- g. packet loss
- h. availability
- i. jitter.

2.2.3 Understand the role of components in networks:

- a. switch
- b. bridge
- c. gateway
- d. router
- e. multi-function device – combined router/switch
- f. modem
- g. repeater
- h. server
- i. Network Interface Card (NIC)
- j. wireless access point
- k. hubs.

2.2.4 Be able to produce outline designs for networks to meet specified requirements that take account of location of devices.

2.2.5 Understand the characteristics and function of:

- a. IP addressing:
 - (i) Internet Protocol version 4 (IPv4)
 - (ii) Internet Protocol version 6 (IPv6)
 - (iii) static
 - (iv) dynamic
 - (v) Dynamic Host Configuration Protocol (DHCP)
- b. Media Access Control (MAC) addressing.

2.3 Network security

- 2.3.1 Understand the impact of network security issues on individuals and organisations (threats and solutions, open networks).
- 2.3.2 Understand how to secure a network using both hardware and software:
 - a. firewall
 - b. security settings
 - c. anti-malware
 - d. user controls/access/rights/profile
 - e. authentication types (including passwords, two-factor, biometrics)
 - f. encryption techniques
 - g. physical controls.

Topic 3: The online environment

The internet and the world wide web are fundamental parts of our digital activity. The rise of cloud storage and cloud computing require more online activity. As more and more people work online and participate in online communities, the issues of potential and risk need to be considered.

What students need to learn

3.1 The internet and the world wide web

- 3.1.1 Understand what is meant by the internet and how it is structured (Internet Protocol (IP) addressing and Domain Name System (DNS)).
- 3.1.2 Understand the features, functions, impact, and potential of the world wide web.
- 3.1.3 Understand the difference between static and dynamic web page content, and the need to use the different types.
- 3.1.4 Understand the role of client-side scripting.
- 3.1.5 Understand the role of server-side scripting.

3.2 Operating online

- 3.2.1 Understand the impact and potential of working in online environments for individuals and organisations.
- 3.2.2 Understand the security risks to personal data stored online and methods of protection.
- 3.2.3 Understand what a digital footprint (active, passive) is and the positive and negative aspects of these.

3.3 Online communities

- 3.3.1 Understand the concept of an online community and that online communities exist for social and professional purposes.
- 3.3.2 Understand the impact of online communities on individuals and organisations.

3.3.3 Understand the monetisation opportunities provided by online communities:

- a. use of customer data with targeted advertising
- b. pay-per-click advertising
- c. selling of customer data
- d. paid subscriptions (paywalls)
- e. sponsored content.

3.4 The cloud

3.4.1 Understand the concept, use and impact of cloud storage.

3.4.2 Understand the concept, use and impact of cloud computing.

Topic 4: IT systems

IT systems are pervasive in organisations. They are used for stock control, booking, asset management, and logistics. These systems operate effectively because they are designed and planned. An understanding of conventional notation will enable students to design systems consisting of both hardware and software components.

What students need to learn

4.1 Systems design

4.1.1 Understand the concept of an IT system:

- a. hardware
- b. software
- c. processes
- d. people.

4.1.2 Understand how to decompose a system into smaller sub-systems and components.

4.1.3 Be able to design IT systems, from individual components and sub-systems, to meet specified requirements. (Symbols are given in *Appendix 7*.)

4.1.4 Understand the concept of 'fitness for purpose' when evaluating systems.

4.2 Dataflow

4.2.1 Understand the concept of and the need for dataflow diagrams.

4.2.2 Be able to interpret and create dataflow diagrams for a given scenario. (Symbols are given in *Appendix 7*.)

4.3 Flowcharts

4.3.1 Understand the concept of and the need for flowcharts.

4.3.2 Be able to interpret and create flowcharts for a given scenario. (Symbols are given in *Appendix 7*.)

4.4 Systems

- 4.4.1 Understand the advantages and disadvantages of IT systems for individuals and organisations.
- 4.4.2 Understand how a range of contemporary digital devices, peripheral devices, storage devices and memory are used in IT systems to meet the needs of individuals and organisations.

Topic 5: Data and databases

Our digital world runs on data. Whether it is personal data or institutional data, it must be organised in such a way that it can be retrieved, manipulated, and understood to have value. Databases are one way in which data is organised, retrieved and manipulated.

What students need to learn

5.1 Data and information

- 5.1.1 Understand the difference between data and information.
- 5.1.2 Understand sources of and the difference between structured and unstructured data.
- 5.1.3 Understand the value to organisations of extracting meaningful information from data.

5.2 Structured data

- 5.2.1 Understand why databases are used to structure data.
- 5.2.2 Understand the structure of a relational database:
 - a. tables
 - b. primary keys
 - c. foreign keys
 - d. composite keys
 - e. records
 - f. fields.
- 5.2.3 Understand the concept of entities and the relationships between them:
 - a. one-to-one
 - b. one-to-many
 - c. many-to-many.
- 5.2.4 Be able to interpret and create entity relationship diagrams for a given scenario. (Symbols are given in *Appendix 7*.)

5.3 Structured query language (SQL)

- 5.3.1 Understand how and why SQL is used to manipulate data and data structures.
- 5.3.2 Know how to select and use appropriate SQL commands, features and functions to manipulate data:
 - a. perform queries and subqueries
 - b. create tables using appropriate data types

- c. populate tables/insert, amend, delete
- d. link tables (UNION, JOIN)
- e. use wildcards (%) and _)
- f. group, order, count.

Topic 6: Wider issues

The pervasive use of technology has an impact, not just for individuals, but also for the environment and society as a whole. The ability to make judgements about technology is underpinned by an understanding of the moral and ethical issues and the legal frameworks that are part of our lives.

What students need to learn

6.1 Environmental

- 6.1.1 Understand the environmental impact of construction, use and disposal of information technology equipment.
- 6.1.2 Understand the positive impact that information technology makes to environmental monitoring (including smart houses and smart cities) and efficient use of resources.

6.2 Legal, moral and ethical

- 6.2.1 Understand the legal issues associated with the use of information technology systems:
 - a. data protection
 - b. copyright
 - c. computer misuse
 - d. intellectual property.
- 6.2.2 Understand the moral and ethical issues associated with the use of information technology systems:
 - a. privacy
 - b. inclusion
 - c. civil liberties
 - d. access
 - e. accessibility
 - f. expression
 - g. association.

6.3 Society

- 6.3.1 Understand the impact of ubiquitous wireless access:
 - a. smart cities
 - b. location awareness.

Unit 2

IAS compulsory unit

Externally assessed

2.1 Unit description

Websites, social media and apps are part of our everyday lives. Web designers and developers are continually innovating and developing new ways for us to access information and interact with the web. In this unit, you will learn real-world, best practices in writing code for the web and understand how coding and programming languages combine to create an effective user experience.

HTML is the foundation of all web products. It is used to add structure and content to web products. Understanding the fundamentals of how HTML interacts with the web browser is the first step to building content-rich, standards-compliant code.

CSS documents contain styling rules that describe how HTML elements are displayed. Understanding CSS sizing, alignment, spacing and responsiveness will allow you to control the layout of a web page and create consistent and visually appealing web pages that can adapt to different device sizes.

Modern web pages are dynamic, responding to the user input in real time. JavaScript is the programming language that provides much of this interactivity and responsiveness. You will understand how to write JavaScript and reference the content of the HTML to create interactive features.

Creating user-friendly web products begins at the design stage. If you are going to build accessible, coherent and balanced designs that are easy to navigate and make good use of colour, typography and other visual elements, you will need to understand how to make effective use of the design, prototyping and iterative process.

HTML is a markup language. Writing semantic markup means using appropriate HTML elements to describe the content of a web page and learning to be semantic when writing HTML makes the markup more meaningful. You will learn how to create well-structured, semantic web pages that will enable you to create consistent web products that function better and provide a better experience for the user.

2.2 Assessment information

- First assessment: June 2019.
 - The assessment is 3 hours.
 - The assessment is out of 80 marks.
 - Candidates will be asked to apply their knowledge of coding for the web in a practical examination.
 - Candidates must answer all questions.
-

2.3 Unit content

Topic 7: Understanding the functionality of HTML

HyperText Markup Language (HTML) is the language common to every website. HTML code is used by web designers and developers to structure web content and give it meaning and purpose. HTML tells the browser how to display web pages and to build or edit websites and web applications, students will need to understand how to write HTML.

What students need to learn

7.1 Document structure

7.1.1 Understand how HTML is used to structure web pages:

- a. doctypes
- b. elements
- c. tags
- d. attributes.

7.1.2 Understand how to declare the language of an HTML document.

7.1.3 Understand how the head element is used to supply information about the document:

- a. metadata
- b. document title
- c. scripts
- d. styles
- e. links to external files.

7.1.4 Be able to write organised syntax:

- a. use lowercase letters within element names, values and attributes
- b. indent nested elements
- c. use double quotes
- d. omit the values on Boolean attributes
- e. remove the forward slash at the end of self-closing elements.

7.1.5 Understand how global attributes are used to define elements:

- a. class
- b. id
- c. style
- d. accesskey
- e. lang
- f. tabindex
- g. data
- h. hidden.

7.2 Structural markup

- 7.2.1 Understand what is meant by block-level elements and inline elements.
- 7.2.2 Understand that elements can belong to different content models which follow certain rules:
 - a. flow
 - b. sectioning
 - c. heading
 - d. phrasing
 - e. embedded
 - f. interactive.
- 7.2.3 Be able to use some key elements to define the structure and formatting of text on a web page:
 - a. articles
 - b. sections
 - c. headings
 - d. paragraphs
 - e. thematic breaks
 - f. emphasis
 - g. importance.
- 7.2.4 Be able to create lists:
 - a. unordered
 - b. ordered (and use the start and type attributes)
 - c. definition/description
 - d. nesting lists.
- 7.2.5 Be able to create links:
 - a. internal
 - b. external
 - c. email
 - d. open links in a new browser window or tab
 - e. link to a specific part of the same page
 - f. link to a specific part of another page.

7.3 Page components

7.3.1 Be able to add images to web pages:

- a. file format
- b. image size
- c. resolution
- d. retain original proportions
- e. position images
- f. alt tag.

7.3.2 Be able to represent information in a table:

- a. rows
- b. data
- c. headings, body and footers
- d. combine multiple cells.

7.3.3 Be able to create a form on a web page:

- a. form structure
- b. form elements
- c. form controls
- d. form buttons
- e. organise and group form elements
- f. input types
- g. text areas
- h. drop-down lists.

7.3.4 Understand how web forms work:

- a. how information is sent from the browser to the server
- b. form validation.

7.3.5 Be able to prepare and add audio and video:

- a. multiple file formats
- b. embed in a web page
- c. controls
- d. customise controls
- e. add attributes
- f. use the source element to specify multiple resources.

7.3.6 Understand how to use inline frames to add dynamic content from external websites.

Topic 8: Understanding the functionality of CSS

Cascading Style Sheets (CSS) is one of the core technologies for building websites as it is used to control the design and layout of a web page. CSS is still evolving and understanding the latest CSS concepts, such as the box model, specificity and the cascade, transforms and responsiveness, will enable students to develop modern interfaces that work across a variety of screen sizes.

What students need to learn

8.1 Writing CSS

8.1.1 Understand the purpose of CSS:

- a. control page layout
- b. consistent page design.

8.1.2 Be able to reference CSS within the HTML code:

- a. inline styles
- b. internal style sheets
- c. external style sheets
 - (i) folder structure
 - (ii) naming conventions
 - (iii) relative path.

8.1.3 Understand how to write CSS rules:

- a. selectors
- b. properties
- c. values.

8.1.4 Understand CSS selectors:

- a. type
- b. class
- c. ID
- d. universal
- e. attribute
- f. child
- g. descendant
- h. adjacent sibling
- i. general sibling
- j. multiple selectors.

8.1.5 Understand how to write efficient style sheets through general rules that apply to most elements and how to apply specific rules to individual elements:

- a. cascade
- b. inheritance.

8.1.6 Understand the CSS Box Model.

8.1.7 Be able to create rules using CSS attribute selectors that apply to elements that have an attribute with a specific value:

- a. existence
- b. equality
- c. space
- d. prefix
- e. substring
- f. suffix.

8.2 Styling web pages

8.2.1 Be able to specify colours:

- a. colour names
- b. hexadecimal notation
- c. RGB values.

8.2.2 Understand how to manipulate colour:

- a. opacity
- b. gradients
- c. HSL values.

8.2.3 Be able to specify length values:

- a. absolute lengths
- b. relative lengths.

8.2.4 Be able to add styles to elements:

- a. text layout
- b. fonts
- c. links
- d. lists
- e. tables
- f. forms
- g. images.

8.2.5 Be able to use the box model to add backgrounds (background images, gradients, CSS sprites) and borders to elements.

8.3 Positioning content

8.3.1 Be able to control the position of elements:

- a. normal flow
- b. relative positioning
- c. absolute positioning
- d. fixed positioning
- e. floating elements
- f. overlapping elements.

8.3.2 Be able to use the box model to control the appearance of boxes:

- a. display
- b. width
- c. height
- d. borders
- e. margins and padding.

8.3.3 Understand how to design for differently sized screens:

- a. fixed width layouts
- b. liquid layouts
- c. layout grids
- d. CSS frameworks.

8.3.4 Understand and be able to use responsive design techniques.

8.4 CSS animations

8.4.1 Be able to use CSS transitions and transforms to create animations:

- a. transition properties
- b. transform properties
- c. 3D transforms
- d. cubic-bezier.

Topic 9: Understanding the functions of JavaScript

JavaScript is the programming language that, when applied to an HTML document, provides dynamic interactivity, such as image sliders, galleries and fluctuating layouts. To make web pages interactive, the JavaScript selects elements on the page. If a student can select an element through the Document Object Model (DOM), they can affect it to make it behave a certain way when a user interacts with it. Developing an understanding of fundamental programming concepts and the syntax of the language will enable students to use JavaScript to create interactive web pages that respond to user actions.

What students need to learn

9.1 Document Object Model

- 9.1.1 Understand how the Document Object Model (DOM) allows JavaScript to access and update the content of a web page while it is in the browser window.

9.2 Regular expressions

- 9.2.1 Understand regular expressions.
- 9.2.2 Understand regular expressions used for validation check. Search for matching:
 - a. letters and sequences of upper/lower case characters
 - b. numbers
 - c. punctuation and other symbols.
- 9.2.3 Be able to interpret and construct patterns consisting of repeating characters and digits.

9.3 Programmed functionality

- 9.3.1 Understand how to add JavaScript to web pages.
- 9.3.2 Be able to program functionality:
 - a. comments
 - b. assignment
 - c. 1D and 2D data structures
 - d. selection
 - e. repetition
 - f. iteration
 - g. variables
 - h. subprograms
 - i. object orientation.

9.3.3 Understand how events can be used to trigger a function in the JavaScript code:

- a. User Interface (UI) events
- b. keyboard events
- c. mouse events
- d. focus and blur events
- e. form events.

9.3.4 Understand how to combine JavaScript with HTML and CSS to create page components:

- a. slideshows
- b. modal boxes
- c. modal images
- d. filter lists
- e. sort lists
- f. pop-ups
- g. tabbed content.

9.3.5 Understand how to use error handling and debug JavaScript.

Topic 10: Designing web pages

Adopting a design, implement, test and iterate approach to coding for the web enables web designers and developers to build functional web pages for specific audiences and purposes. Effective page layout and design is essential to guiding the user through a web product. Students who understand how to incorporate the principles of design, accessibility and usability within their coding will be best placed to create visually appealing page layouts that enhance the user experience.

What students need to learn

10.1 Principles of design

10.1.1 Understand how to design web pages:

- a. wireframes
- b. mock-ups
- c. web-design style guide
- d. prototyping.

10.1.2 Be able to use web typography:

- a. web-safe fonts
- b. embedding web fonts.

10.1.3 Understand how to use design principles to create effective page layout and design:

- a. visual hierarchy
- b. flow
- c. colour theory
- d. balance and contrast.

10.2 Principles of accessibility

10.2.1 Understand how to make websites accessible to the widest possible audience referring to the Web Content Accessibility Guidelines (WCAG).

10.3 Principles of usability

10.3.1 Be able to design intuitive navigation systems:

- a. horizontal scroll menus
- b. vertical menus
- c. dropdown menus
- d. breadcrumb navigation
- e. button groups.

10.3.2 Understand how to target specific devices and browsers:

- a. cross-browser compatibility
- b. functionality and usability testing
- c. code validation
- d. browser development tools.

Topic 11: The semantic web

Writing semantic code is the practice of giving content on the web page meaning and structure by using the correct HTML element. Semantic code describes the content rather than how the content should look and therefore enables computers, screen readers, search engines and other devices to understand the content on a web page. Semantic HTML adds functionality to web pages, works better on mobile devices and supports Search Engine Optimisation (SEO). Semantic markup also makes the code easier to write and maintain as it shows what each piece of content is about, as well as enabling students to take advantage of default styles and functionality.

What students need to learn

11.1 Writing semantic code

11.1.1 Understand how to add semantic markup to web pages that describes the content of a web page and how this is used by browsers and assistive technologies.

11.1.2 Be able to use elements that define what the content is on the web page:

- a. headers and footers
- b. navigation
- c. articles
- d. asides
- e. sections
- f. main.

11.1.3 Understand that you can still group elements together even if there is not a relevant semantic tag:

- a. div
- b. span.

11.1.4 Understand how semantic code is used by search engines (Search Engine Optimisation (SEO)).

11.1.5 Be able to use semantic markup to add textual meaning:

- a. importance
- b. emphasis
- c. quotations
- d. abbreviations and acronyms
- e. citations and definitions
- f. addresses
- g. marks.

11.1.6 Be able to use semantic markup with self-contained content:

- a. figure
- b. caption.

11.1.7 Know how Web Accessibility Initiative – Accessible Rich Internet Applications (WAI-ARIA) can be used to provide additional semantics and improve accessibility:

- a. functionality through roles
- b. states and properties
- c. live regions for dynamic content
- d. enhanced keyboard navigation.

Unit 3

IA2 compulsory unit

Externally assessed

3.1 Unit description

It is impossible to imagine a world that does not depend on data in one form or another. With this dependence comes responsibility. In this unit, you will understand how to ensure that data is relevant, accurate and valid. You will understand how to design and create mechanisms to ensure that data maintains its value as a resource. In this unit, you will understand how to design mechanisms that reinforce the relationships between different data components. You will also understand the uses of Big Data and the mechanisms involved in collecting, storing, and accessing it.

Changes in the way we live and work are underpinned by a specialised group of enabling technologies. They are IT systems in themselves. In this unit, you will understand how virtualisation and distributed systems are used to solve problems effectively. One very important enabling technology is that of human computer interaction. You will understand how to design interfaces for devices and software with which humans can interact in intuitive ways. The issue of security is paramount with any technology. In this unit, you will understand encryption as a basis for securing the storage and transmission of data.

Organisations rely on their IT systems for many aspects of functionality, including finance, customer management and logistics. In this unit, you will understand the role of IT systems in supporting a variety of functions. Just having an IT system is not enough: there are challenges in ensuring that these systems are suitable, operational, and maintained. You will understand issues related to use policies, changeover, risk management and maintenance of IT systems.

Developing systems that exploit new technologies is challenging. However, in common with other developments, there is a need for project-management skills. In this unit, you will understand aspects of project management, including the value of targets, mechanisms for measuring progress and evaluating success. You will understand two approaches to project management, the waterfall method and a generalised 'agile' approach.

It is impossible to predict the impact of new technologies on individuals, organisations and societies. In this unit, you will understand several emerging technologies, including machine learning, virtual and augmented reality and the Internet of Things. You will consider their implementation and their impact on individuals, organisations and society.

3.2 Assessment information

- First assessment: June 2020.
 - The assessment is 2 hours.
 - The assessment is out of 80 marks.
 - Where appropriate, questions may be set in a context.
 - Students must answer all questions.
 - The paper may include short-open, open-response and extended-writing questions.
-

3.3 Unit content

Topic 12: Manipulating data

Our world runs on data but that data must be relevant, accurate, and valid. It must be stored and manipulated in ways that allow it to be of value to individuals and organisations. Collecting, storing and manipulating data is the focus of many IT systems.

What students need to learn

12.1 Data integrity

- 12.1.1 Understand the importance of data integrity and the methods of maintaining it (data governance).
- 12.1.2 Understand the concept of, the features of, and the functions of a data dictionary.
- 12.1.3 Be able to interpret and construct a data dictionary.
- 12.1.4 Understand the concept of and the need for data validation.
- 12.1.5 Be able to interpret and design validation rules for a given situation:
 - a. presence
 - b. range
 - c. lookup
 - d. list
 - e. length
 - f. format
 - g. check digit.

12.2 Relational databases

- 12.2.1 Understand the concept of data redundancy and the problems associated with it.
- 12.2.2 Understand the concept of and the need for normalisation.
- 12.2.3 Be able to normalise a collection of data into first, second, and third normal forms.
- 12.2.4 Be able to design a logical data model (normalised data, relations and relationships).

12.3 Big Data

- 12.3.1 Understand the concept of Big Data and the issues associated with its collection:
 - a. volume
 - b. velocity
 - c. variety
 - d. veracity
 - e. value.

12.3.2 Understand the underlying infrastructure and services which allow Big Data to happen:

- a. collection
- b. storage
- c. transmission.

12.3.3 Understand the impact of storing Big Data:

- a. access
- b. processing time
- c. transmission time
- d. security.

12.3.4 Understand the concepts of data mining, data warehousing and data analytics:

- a. descriptive
- b. predictive
- c. prescriptive.

12.3.5 Understand how Big Data is used by individuals, organisations and society:

- a. healthcare
- b. infrastructure planning
- c. transportation
- d. fraud detection.

Topic 13: Enabling technologies

It is not always possible to have access to or set up tangible hardware and software environments. Virtualisation allows us to work with software-based systems. Distributed systems allow us to share data and computing resources across geographical boundaries to solve problems more quickly. Storing and securing data, especially across distributed systems, is of paramount importance. Encryption is one way to ensure that data is secure. Ultimately, humans need to interact with new technologies and the interface for a new device or technology may determine whether it succeeds or fails.

What students need to learn

13.1 Virtualisation

13.1.1 Understand the concept of and reasons for using virtualisation.

13.1.2 Understand ways of achieving virtualisation:

- a. containerisation
- b. virtual machines.

13.2 Distributed systems

13.2.1 Understand the concept of and the need for distributed systems.

13.2.2 Understand the issues associated with distributed systems:

- a. failure
- b. concurrency
- c. replication
- d. performance.

13.3 Human computer interaction

13.3.1 Understand the importance of effective human computer interaction and its impact on the user experience.

13.3.2 Understand the ways in which human computer interaction can be implemented:

- a. visual
- b. audio
- c. haptic.

13.3.3 Understand the ergonomic principles that underpin human-computer interaction.

13.3.4 Understand interface design to meet the needs and requirements of individuals and organisations:

- a. menus
- b. icons
- c. accessibility
- d. windows
- e. pointers.

13.4 Storing and securing data

13.4.1 Understand how data is stored in the cloud.

13.4.2 Understand how data is secured using file encryption and password protection.

13.4.3 Understand the features and functions of a Database Management System (DBMS) in controlling access and views.

13.5 Encryption

13.5.1 Understand the features and functions of symmetric encryption.

13.5.2 Understand the features and functions of asymmetric (public-key) encryption.

13.5.3 Understand the features and functions of certificate-based encryption:

- a. certificate
- b. public-key certificate.

Topic 14: Using IT systems in organisations

The use of IT systems is pervasive in different organisational sectors: retail, education, manufacturing, finance, transportation, safety, commerce and public service. Organisations rely on IT systems for managing production, customers and finances. Ongoing activities revolving around risk management, system changeovers, maintenance and disaster recovery are carried out by IT professionals.

What students need to learn

14.1 Role of IT systems

14.1.1 Understand the role of IT systems in organisations:

- a. operational support
- b. collaboration
- c. knowledge management
- d. product development
- e. service delivery.

14.1.2 Understand the concept of transaction processing (TP) and how and why organisations use TP systems:

- a. electronic point of sale (EPOS)
- b. order processing
- c. financial
- d. Bacs Payment Schemes Limited (Bacs).

14.1.3 Understand the concept of customer relationship management (CRM), and how and why organisations use CRM systems:

- a. synchronise marketing events
- b. loyalty scheme
- c. buying trends
- d. customer service
- e. customer retention
- f. upselling.

14.1.4 Understand the concept of management information and the use of management information systems (MIS):

- a. record-keeping
- b. decision-making
- c. project management.

14.1.5 Understand the concept of intelligent transportation systems (ITS) and how they are used:

- a. scheduling and route planning
- b. timetabling
- c. locations
- d. fleet management.

14.1.6 Understand the concept of expert systems and how expert systems are used:

- a. diagnosis
- b. identification.

14.2 Operational issues

14.2.1 Understand the need for and features of IT governance and policy:

- a. business continuity
- b. disaster recovery
- c. risk management
- d. user policy.

14.2.2 Understand the need for and ways of managing IT changeover:

- a. phased
- b. direct
- c. parallel
- d. pilot.

14.2.3 Understand the need for system maintenance and ways of implementing it:

- a. perfective
- b. adaptive
- c. corrective.

14.2.4 Understand the need for and implications of archiving data.

14.2.5 Understand the need for and features of disaster recovery plans:

- a. key data
- b. risk analysis
- c. team actions
- d. management.

Topic 15: Systems development

The success or failure of IT projects depends on project-management skills. The appropriate use of targets, planning, and analysis are common to all approaches. The classic waterfall method is an easily understood method, which is still relevant. However, agile approaches to project management are more commonly found in practice.

What students need to learn

15.1 Project management

15.1.1 Understand the concept of and need for project management when developing IT systems.

15.1.2 Understand the characteristics of successful IT projects.

15.1.3 Understand the concept of project outcomes using SMART targets.

15.1.4 Be able to specify SMART targets.

15.1.5 Understand tools of project management:

- a. nodes and Gantt charts
- b. requirements
- c. critical path analysis
- d. precedence tables.

15.1.6 Be able to interpret and use tools of project management:

- a. Gantt charts
- b. requirements
- c. critical path analysis
- d. precedence tables.

15.2 Waterfall method

15.2.1 Understand the concept and features of the waterfall method.

15.2.2 Understand the phases of the waterfall method:

- a. requirements/analysis
- b. design
- c. implementation
- d. testing/debugging
- e. installation
- f. maintenance.

15.2.3 Understand the type of activities that take place in each phase of the waterfall method.

15.3 Agile approach

15.3.1 Understand the concept and features of an agile approach:

- a. iterative
- b. incremental.

15.3.2 Understand the phases of an agile approach:

- a. requirements
- b. plan
- c. design
- d. develop
- e. release.

15.3.3 Understand the type of activities that take place when using an agile approach:

- a. scrum
- b. sprints.

15.4 Diagrams used in system design and development

15.4.1 Be able to create and interpret information flow diagrams for a given scenario.

Topic 16: Emerging technologies

Machine learning, in association with Big Data, has the potential to change the way we live and work. Virtual and augmented realities already play a part in entertainment and safety assurance. The Internet of Things, as more and more devices come online, will affect our daily lives. Being able to critically assess these emerging technologies will enable us to become more astute users of the IT systems around us.

What students need to learn

16.1 Machine learning

16.1.1 Understand the concept, features and functions of machine learning:

- a. supervised learning (labelled dataset)
- b. unsupervised learning (unknown dataset).

16.1.2 Understand the impact of and possibilities associated with machine learning:

- a. natural language processing
- b. speech recognition
- c. image recognition
- d. pattern recognition.

16.2 Virtual and augmented reality

16.2.1 Understand the concept of and uses of virtual reality.

16.2.2 Understand the concept of and uses of augmented reality.

16.3 Internet of Things

16.3.1 Understand the concept of the Internet of Things (IoT).

16.3.2 Understand the impact of the Internet of Things (IoT) on individuals, organisations and data.

16.3.3 Understand the underlying infrastructure that allows the Internet of Things to work:

- a. sensors
- b. networks
- c. embedded systems
- d. storage.

16.3.4 Understand some of the security issues related to the IoT.

16.3.5 Be able to produce high-level designs for systems that make use of the Internet of Things.

Unit 4

IA2 compulsory unit

Externally assessed

4.1 Unit description

This unit develops students' understanding of relational databases.

The unit allows students to develop core problem-solving skills through the application of relational database software.

4.2 Assessment information

- First assessment: June 2020.
 - The assessment is a 3-hour unseen practical and theoretical examination.
 - The assessment is out of 80 marks.
 - The examination will be set in an overall context. Students will perform practical tasks using database tools and respond to a series of structured questions to produce a solution to an unseen problem and provide responses which will test their analytical and evaluative skills. All responses will be submitted using a word-processed candidate evidence template.
-

4.3 Unit content

Topic 17: Use of features of database solutions

Students should understand the need for relational databases and how they are used to solve problems.

Students will explore how databases are used in different contexts (for example, in education and commerce) and how the factors of each context affect the data to be held and the features of the database.

Students will explore how the needs of the user affect what is required from a database solution. They will look at how the design of a database is informed by the needs and skills of the intended users of the system, and how this impacts on the final solution.

What students need to learn

17.1 Database applications

- 17.1.1 Understand why database software is used to hold and manipulate data.
- 17.1.2 Understand how the features of a database are affected by the requirements of a given context.
- 17.1.3 Be able to evaluate the effectiveness and appropriateness of database features for a given scenario.

17.2 User needs

17.2.1 Be able to analyse the needs of users in a range of contexts.

17.2.2 Be able to apply understanding of user characteristics to develop appropriate database solutions.

17.2.3 Be able to evaluate the appropriateness of the design of a database for specific user needs and suggest improvements.

17.3 User experience

17.3.1 Understand how the characteristics of the user affect aspects of the database design:

- a. interface type (textual, graphical)
- b. interface characteristics (colour, typeface, etc.)
- c. complexity
- d. use of language
- e. compatibility.

17.3.2 Understand how the design of a database solution can affect user experience:

- a. interface design
- b. ease of use
- c. appropriateness of features
- d. efficiency
- e. user help
- f. compatibility
- g. stability
- h. data accuracy.

17.3.3 Be able to apply understanding of user characteristics to develop database solutions that give a suitable user experience.

17.3.4 Be able to evaluate the effect a database will have on user experience and suggest improvements.

Topic 18: Relational database concepts

Students are expected to understand how database software is used to structure data, and the benefits of using structured data.

Students will develop an understanding of how data is stored and structured to ensure accuracy and to meet specific needs.

What students need to learn

18.1 Structuring data

18.1.1 Be able to construct and amend relational databases in terms of:

- a. tables
- b. records
- c. fields
- d. relationships.

18.1.2 Be able to use appropriate data types when structuring data:

- a. text (limited length, unlimited length, memo)
- b. number (byte, integer, long integer, double, decimal)
- c. date/time
- d. currency
- e. Boolean (yes/no, on/off, true/false).

18.1.3 Be able to format data types using common and customised formats.

18.1.4 Be able to evaluate the appropriateness and effectiveness of a data structure in relation to the requirements of a given scenario.

18.2 Relational data structures

18.2.1 Understand the need for and function of relational data structures.

18.2.2 Be able to implement the features and attributes of data relationships in terms of:

- a. relationships (many-to-one, many-to-many, one-to-one)
- b. primary, foreign and composite keys
- c. referential integrity.

18.2.3 Be able to evaluate the appropriateness and effectiveness of a relational data structure in relation to the requirements of a given scenario.

18.3 Data entry and validation techniques

18.3.1 Understand the need to ensure that stored data is suitable for processing and the methods used to achieve it.

18.3.2 Be able to use validation techniques that can be used to ensure data accuracy:

- a. presence check
- b. range check
- c. lookup check
- d. list check
- e. format (picture) check
- f. length of data check.

18.3.3 Be able to construct appropriate error messages that give users appropriate and helpful feedback as to the nature of the problem.

18.3.4 Be able to use techniques to aid and improve the quality of data entry:

- a. user help
- b. input masks
- c. dropdown lists
- d. radio buttons
- e. check boxes
- f. automated processes.

18.3.5 Be able to evaluate the use of data accuracy techniques in relation to a given problem.

Topic 19: Database solutions

Students are expected to understand how database software can be used to create a solution to handle and manipulate data, including developing existing data structures and/or producing relational structures based on sample, unstructured data.

Students must be able to use database software to create data structures and manipulate data in response to a given problem. They should be able to select and use appropriate tools and features in the chosen database software.

Students should be able to select and use appropriate tools and features in the chosen database software to create appropriate user interfaces for a database solution.

What students need to learn

19.1 Using database software

19.1.1 Be able to update, insert, modify and delete data.

19.1.2 Be able to create relational data structures to handle given data sets.

19.1.3 Be able to retrieve data for specific purposes:

- a. queries
- b. filters
- c. reports.

19.1.4 Be able to construct calculated fields in queries and reports to generate meaningful information and solve problems.

19.1.5 Be able to output data in appropriate formats to suit intended purpose and user.

19.1.6 Be able to import data from external sources:

- a. xls, xlsx
- b. csv
- c. txt.

19.1.7 Be able to export data to external sources:

- a. .xls, xlsx
- b. .csv
- c. .txt
- d. .html
- e. .pdf.

19.1.8 Be able to evaluate the effectiveness and appropriateness of selected database tools and techniques used in relation to a given problem.

19.2 User interface

19.2.1 Be able to create:

- a. data entry forms to amend existing data
- b. data entry forms to enter new data
- c. menus/dashboards
- d. action buttons.

19.2.2 Be able to create appropriate system outputs for a database solution that aid users effectively:

- a. data tables
- b. reports
- c. charts
- d. error messages.

19.2.3 Be able to create system outputs and user interface components that support users through:

- a. selecting/omitting fields
- b. appropriate help text
- c. meaningful error messages
- d. sensible and meaningful data entry field names
- e. data entry features
 - (i) dropdown
 - (ii) radio buttons
 - (iii) input masks
- f. restricting editing
- g. intuitive layout
- h. features of good design.

19.2.4 Be able to create and use macros to add functionality to user interface objects and/or shorten user processes, including:

- a. use of program flow to add conditional response (*if, then, else*)
- b. data import/export
- c. filter data/perform queries
- d. user interface management (e.g. *open form, close menu*).

19.2.5 Be able to evaluate the appropriateness and effectiveness of a user interface and justify features in relation to a given problem.

19.3 Testing the solution

19.3.1 Understand the need to test that solutions to a problem work as intended and are fit for purpose.

19.3.2 Understand the importance of testing as a database solution is developed, with intended users.

19.3.3 Be able to design and carry out tests to ensure that their solution meets the specified requirements such as:

- a. menus work correctly
- b. validation checks prevent unacceptable data from being entered
- c. outputs are complete, accurate and in the required format.

19.4 Evaluation and enhancement

19.4.1 Be able to evaluate the effectiveness and appropriateness of a completed solution and identify whether the solution is fit for purpose.

19.4.2 Be able to suggest suitable enhancements in the context of a problem.

Assessment information

Assessment requirements

The Pearson Edexcel International Advanced Subsidiary in Information Technology consists of two externally-examined unit.

The Pearson Edexcel International Advanced Level in Information Technology consists of four externally-examined unit.

Candidates must complete all assessments.

Please see the *Assessment availability and first award* section for information on when the assessment for each unit will be available from.

Unit	IAS or IA2	Assessment information	Number of raw marks allocated in the unit
Unit 1	IAS	Written examination. The assessment is 2 hours. This paper may include multiple-choice, short-open-response, open-response and extended open-response questions. Candidates must answer all questions.	80
Unit 2	IAS	Written examination. The assessment is 3 hours. This paper consists of theoretical and practical questions and may include short-open-response, open-response and extended open-response questions. Data files will be provided for some questions. Some responses will be written, others will involve the submission of files. All four assessment objectives are assessed. Each candidate will need access to a computer during the examination. Candidates must answer all questions.	80

Unit	IAS or IA2	Assessment information	Number of raw marks allocated in the unit
Unit 3	IA2	Written examination. The assessment is 2 hours. This paper may include short-open-response, open-response and extended open-response questions. All four assessment objectives are assessed. Candidates must answer all questions.	80
Unit 4	IA2	Written examination. The assessment is 3 hours. This paper consists of practical and theoretical questions and may include short-open-response, open-response and extended open-response questions. Data files will be provided for some questions. All responses will be submitted using a word-processed candidate evidence template. All four assessment objectives are assessed. Each candidate will need access to a computer during the examination. Candidates must answer all questions.	80

Sample assessment materials

Sample papers and mark schemes can be found in the *Pearson Edexcel International Advanced Subsidiary/Advanced Level in Information Technology Sample Assessment Materials (SAMs)* document.

A full list of command words that may be used in the external assessments can be found in *Appendix 6: Taxonomy*.

Assessment objectives and weightings

		% in IAS	% in IA2	% in IAL
AO1	Demonstrate knowledge and understanding of the concepts of Information Technology	24	10	17
AO2	Apply knowledge and understanding of the concepts of Information Technology	40	36	38
AO3	Analyse and evaluate Information Technology information and problems	10	14	12
AO4	Use analysis and evaluation to design solutions	26	40	33

Relationship of assessment objectives to units for the International Advanced Subsidiary qualification

Unit number	Assessment objective			
	AO1	AO2	AO3	AO4
Unit 1	20%	10%	8%	12%
Unit 2	4%	30%	2%	14%
Total for the International Advanced Subsidiary	24%	40%	10%	26%

NB Totals have been rounded either up or down.

Relationship of assessment objectives to units for the International Advanced Level qualification

Unit number	Assessment objective			
	AO1	AO2	AO3	AO4
Unit 1	10%	5%	4%	6%
Unit 2	2%	15%	1%	7%
Unit 3	5%	8%	5%	7%
Unit 4	0%	10%	2%	13%
Total for the International Advanced Level	17%	38%	12%	33%

NB Totals have been rounded either up or down.

Assessment availability and first award

Unit	June 2019	June 2020	June 2021	June 2022
1	✓	✓	✓	✓
2	✓	✓	✓	✓
3	✗	✓	✓	✓
4	✗	✓	✓	✓
IAS award	✓	✓	✓	✓
IAL award	✗	✓	✓	✓

From June 2020, **all four units will be assessed** in June for the lifetime of the qualifications.

From June 2020, **IAL and IAS will both be awarded** in June for the lifetime of the qualifications.

Administration and general information

Entries, resitting of units

Entries

Details of how to enter students for the examinations for these qualifications can be found in our *International Information Manual*. A copy is made available to all examinations officers and is available on our website, qualifications.pearson.com

Resitting of units

Candidates can resit any unit irrespective of whether the qualification is to be cashed in. If a candidate resits a unit more than once, only the better of the two most recent attempts of that unit will be available for aggregation to a qualification grade. Please refer to the *Entry, Aggregation and Certification* document on our website: qualifications.pearson.com/IAL-entry-certification-procedures

Access arrangements, reasonable adjustments, special consideration and malpractice

Equality and fairness are central to our work. Our equality policy requires all students to have equal opportunity to access our qualifications and assessments, and our qualifications to be awarded in a way that is fair to every student.

We are committed to making sure that:

- students with a protected characteristic (as defined by the UK Equality Act 2010) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to students who do not share that characteristic
- all students achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Language of assessment

Assessment of these qualifications will be available in English only. All student work must be in English.

We recommend that students are able to read and write in English at Level B2 of the Common European Framework of Reference for Languages.

Access arrangements

Access arrangements are agreed before an assessment. They allow candidates with special educational needs, disabilities or temporary injuries to:

- access the assessment
- show what they know and can do without changing the demands of the assessment.

The intention behind an access arrangement is to meet the particular needs of an individual candidate with a disability without affecting the integrity of the assessment. Access arrangements are the principal way in which awarding bodies comply with the duty under the Equality Act 2010 to make 'reasonable adjustments'.

Access arrangements should always be processed at the start of the course. Candidates will then know what is available and have the access arrangement(s) in place for assessment.

Reasonable adjustments

The Equality Act 2010 requires an awarding organisation to make reasonable adjustments where a student with a disability would be at a substantial disadvantage in undertaking an assessment. The awarding organisation is required to take reasonable steps to overcome that disadvantage.

A reasonable adjustment for a particular candidate may be unique to that individual and therefore might not be in the list of available access arrangements.

Whether an adjustment will be considered reasonable will depend on a number of factors, including:

- the needs of the candidate with the disability
- the effectiveness of the adjustment
- the cost of the adjustment; and
- the likely impact of the adjustment on the candidate with the disability and other candidates.

An adjustment will not be approved if it involves unreasonable costs to the awarding organisation, timeframes or affects the security or integrity of the assessment. This is because the adjustment is not 'reasonable'.

Special consideration

Special consideration is a post-examination adjustment to a candidate's mark or grade to reflect temporary injury, illness or other indisposition at the time of the examination/assessment, which has had, or is reasonably likely to have had, a material effect on a candidate's ability to take an assessment or demonstrate their level of attainment in an assessment.

Further information

Please see our website for further information about how to apply for access arrangements and special consideration.

For further information about access arrangements, reasonable adjustments and special consideration, please refer to the JCQ website: www.jcq.org.uk

Candidate malpractice

Candidate malpractice refers to any act by a candidate that compromises or seeks to compromise the process of assessment or which undermines the integrity of the qualifications or the validity of results/certificates.

Candidate malpractice in controlled assessments discovered before the candidate has signed the declaration of authentication form does not need to be reported to Pearson.

Candidate malpractice found in controlled assessments after the declaration of authenticity has been signed, and in examinations **must** be reported to Pearson on a *JCQ Form M1* (available at www.jcq.org.uk/exams-office/malpractice). The completed form should be emailed to candidatemalpractice@pearson.com. Please provide as much information and supporting documentation as possible. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report candidate malpractice constitutes staff or centre malpractice.

Staff/centre malpractice

Staff and centre malpractice includes both deliberate malpractice and maladministration of our qualifications. As with candidate malpractice, staff and centre malpractice is any act that compromises or seeks to compromise the process of assessment, or which undermines the integrity of the qualifications or the validity of results/certificates.

All cases of suspected staff malpractice and maladministration **must** be reported immediately, before any investigation is undertaken by the centre, to Pearson on a *JCQ Form M2(a)* (available at www.jcq.org.uk/exams-office/malpractice).

The form, supporting documentation and as much information as possible should be emailed to pqsmalpractice@pearson.com. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice itself constitutes malpractice.

More-detailed guidance on malpractice can be found in the latest version of the document *Suspected Malpractice in Examinations and Assessments Policies and Procedures*, available at www.jcq.org.uk/exams-office/malpractice.

Awarding and reporting

The Pearson Edexcel International Advanced Subsidiary in Information Technology will be graded on a five-grade scale from A to E. The Pearson Edexcel International Advanced Level in Information Technology will be graded on a six-point scale A* to E. Individual unit results will be reported. Only Units 1 and 2 will contribute to the International Advanced Subsidiary grade. All four units will contribute to the International Advanced Level grade.

The first certification opportunity for the Pearson Edexcel International Advanced Subsidiary in Information Technology will be in August 2019. The first certification opportunity for the Pearson Edexcel International Advanced Level in Information Technology will be in August 2020. A pass in an International Advanced Subsidiary subject is indicated by one of the five grades A, B, C, D, E, of which grade A is the highest and grade E the lowest. A pass in an International Advanced Level subject is indicated by one of the six grades A*, A, B, C, D, E, of which grade A* is the highest and grade E the lowest. Candidates whose level of achievement is below the minimum judged by Pearson to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

Unit results

Students will receive a uniform mark between 0 and the maximum uniform mark for each unit.

The uniform marks at each grade threshold for each unit are:

Units 1, 2, 3 and 4

Unit grade	Maximum uniform mark	A	B	C	D	E
	100	80	70	60	50	40

Qualification results

The minimum uniform marks required for each grade:

International Advanced Subsidiary (cash-in code: XIT11)

Qualification grade	Maximum uniform mark	A	B	C	D	E
	200	160	140	120	100	80

Candidates with a uniform mark in the range 0–79 will be Unclassified (U).

International Advanced Level (cash-in code: YIT11)

Qualification grade	Maximum uniform mark	A	B	C	D	E
	400	320	280	240	200	160

Candidates with a uniform mark in the range 0–159 will be Unclassified (U).

To be awarded an A*, candidates will need to achieve an A for the International Advanced Level qualification (at least 320 uniform marks) **and** at least 90% of the total uniform mark available across the IA2 units combined (at least 180 uniform marks).

Student recruitment and progression

Pearson follows the JCQ policy concerning recruitment to our qualifications in that:

- they must be available to anyone who is capable of reaching the required standard
- they must be free from barriers that restrict access and progression
- equal opportunities exist for all candidates.

Prior learning and other requirements

Students who would benefit most from studying these qualifications are likely to have a Level 2 qualification such as a GCSE in Information Technology or equivalent.

Progression

Students can progress from these qualifications to:

- higher education where they may study a related degree
- further training, such as an apprenticeship.

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Appendix 1: Codes

Type of code	Use of code	Code
Unit codes	Each unit is assigned a unit code. This unit code is used as an entry code to indicate that a candidate wishes to take the assessment for that unit. Centres will need to use the entry codes only when entering candidates for their examination.	Unit 1: WIT11/01 Unit 2: WIT12/01 Unit 3: WIT13/01 Unit 4: WIT14/01
Cash-in codes	The cash-in code is used as an entry code to aggregate the candidate's unit scores to obtain the overall grade for the qualification. Centres will need to use the entry codes only when entering candidates for their qualification.	International Advanced Subsidiary – XIT11 International Advanced Level – YIT11
Entry codes	The entry codes are used to: • enter a candidate for the assessment of a unit • aggregate the candidate's unit scores to obtain the overall grade for the qualification.	Please refer to the <i>Pearson International Information Manual</i> , available on our website.

Appendix 2: Pearson World Class Qualification design principles

Pearson's World Class Qualification design principles mean that all Pearson Edexcel qualifications are developed to be **rigorous, demanding, inclusive and empowering**.



We work collaboratively to gain approval from an external panel of educational thought leaders and assessment experts from across the globe. This is to ensure that Pearson Edexcel qualifications are globally relevant, represent world-class best practice in qualification and assessment design, maintain a consistent standard and support learner progression in today's fast-changing world.

Pearson's Expert Panel for World-Class Qualifications is chaired by Sir Michael Barber, a leading authority on education systems and reform. He is joined by a wide range of key influencers with expertise in education and employability.

"I'm excited to be in a position to work with the global leaders in curriculum and assessment to take a fresh look at what young people need to know and be able to do in the 21st century, and to consider how we can give them the opportunity to access that sort of education." Sir Michael Barber.

Endorsement from Pearson's Expert Panel for World Class Qualifications for the International Advanced Subsidiary (IAS)/International Advanced Level (IAL) development process

May 2014

"We were chosen, either because of our expertise in the UK education system, or because of our experience in reforming qualifications in other systems around the world as diverse as Singapore, Hong Kong, Australia, and a number of countries across Europe.

We have guided Pearson through what we judge to be a rigorous world class qualification development process that has included, where appropriate:

- extensive international comparability of subject content against the highest-performing jurisdictions in the world
- benchmarking assessments against UK and overseas providers to ensure that they are at the right level of demand
- establishing External Subject Advisory Groups, drawing on independent subject-specific expertise to challenge and validate our qualifications.

Importantly, we have worked to ensure that the content and learning is future oriented, and that the design has been guided by Pearson's Efficacy Framework. This is a structured, evidenced process which means that learner outcomes have been at the heart of this development throughout.

We understand that ultimately it is excellent teaching that is the key factor to a learner's success in education, but as a result of our work as a panel we are confident that we have supported the development of Edexcel IAS and IAL qualifications that are outstanding for their coherence, thoroughness and attention to detail and can be regarded as representing world-class best practice."

Sir Michael Barber (Chair)

Chief Education Advisor, Pearson plc

Dr Peter Hill

Former Chief Executive ACARA

Professor Jonathan Osborne

Stanford University

Professor Dr Ursula Renold

Federal Institute of Technology, Switzerland

Professor Janice Kay

Provost, University of Exeter

Jason Holt

CEO, Holts Group

Professor Lee Sing Kong

Dean and Managing Director, National Institute of Education International, Singapore

Bahram Bekhradnia

President, Higher Education Policy Institute

Dame Sally Coates

Director of Academies (South), United Learning Trust

Professor Bob Schwartz

Harvard Graduate School of Education

Jane Beine

Head of Partner Development, John Lewis Partnership

All titles correct as at May 2014

Appendix 3: Transferable skills

The need for transferable skills

In recent years, higher-education institutions and employers have consistently flagged the need for students to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

The Organisation for Economic Co-operation and Development (OECD) defines skills, or competencies, as 'the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to successfully and consistently perform an activity or task and can be built upon and extended through learning.'^[1]

To support the design of our qualifications, the Pearson Research Team selected and evaluated seven global 21st-century skills frameworks. Following on from this process, we identified the National Research Council's (NRC) framework ^[2] as the most evidence-based and robust skills framework, and have used this as a basis for our adapted skills framework.

The framework includes cognitive, intrapersonal skills and interpersonal skills.



The skills have been interpreted for this specification to ensure they are appropriate for the subject. All of the skills listed are evident or accessible in the teaching, learning and/or assessment of the qualifications. Some skills are directly assessed. Pearson materials will support you in identifying these skills and developing these skills in students.

The table overleaf sets out the framework and gives an indication of the skills that can be found in information technology and indicates the interpretation of the skill in this area. A full subject interpretation of each skill, with mapping to show opportunities for student development is given on the subject pages of our website: qualifications.pearson.com

¹ OECD – *Better Skills, Better Jobs, Better Lives* (OECD Publishing, 2012)

² Koenig J A, National Research Council – *Assessing 21st Century Skills: Summary of a Workshop* (National Academies Press, 2011)

Cognitive skills	Cognitive processes and strategies	• Critical thinking • Problem solving • Analysis • Reasoning/argumentation • Interpretation • Decision making • Adaptive learning • Executive function	Developing a well-rounded, clearly articulated argument to support a view and using it to justify one or more conclusions.
	Creativity	• Creativity • Innovation	
Intrapersonal skills	Intellectual openness	• Adaptability • Personal and social responsibility • Continuous learning • Intellectual interest and curiosity	Taking ownership of own work, acting independently and making own decisions.
	Work ethic/conscientiousness	• Initiative • Self-direction • Responsibility • Perseverance • Productivity • Self-regulation (metacognition, forethought, reflection) • Ethics • Integrity	
	Positive core self-evaluation	• Self-monitoring/self-evaluation/self-reinforcement	
Interpersonal skills	Teamwork and collaboration	• Communication • Collaboration • Teamwork • Cooperation • Empathy/perspective taking • Negotiation	Communicating ideas to peers and teachers verbally or in writing.
	Leadership	• Responsibility • Assertive communication • Self-presentation	

Appendix 4: Level 3 Extended Project qualification

What is the Extended Project?

The Extended Project is a standalone qualification that can be taken alongside International Advanced Level (IAL) qualifications. It supports the development of independent learning skills and helps to prepare students for their next step – whether that be higher education or employment. The qualification:

- is recognised by higher education for the skills it develops
- is worth half of an International Advanced Level (IAL) qualification at grades A*–E
- carries UCAS points for university entry.

The Extended Project encourages students to develop skills in the following areas: research, critical thinking, extended writing and project management. Students identify and agree a topic area of their choice for in-depth study (which may or may not be related to an IAL subject they are already studying), guided by their teacher.

Students can choose from one of four approaches to produce:

- a dissertation (for example an investigation based on predominately secondary research)
- an investigation/field study (for example a practical experiment)
- a performance (for example in music, drama or sport)
- an artefact (for example creating a sculpture in response to a client brief or solving an engineering problem).

The qualification is non-examination assessment based and students are assessed on the skills of managing, planning and evaluating their project. Students will research their topic, develop skills to review and evaluate the information, and then present the final outcome of their project.

The Extended Project has 120 guided learning hours (GLH) consisting of a 40-GLH taught element that includes teaching the technical skills (for example research skills) and an 80-GLH guided element that includes mentoring students through the project work. The qualification is 100% internally assessed and externally moderated.

How to link the Extended Project with information technology

The Extended Project creates the opportunity to develop transferable skills for progression to higher education and to the workplace through the exploration of either an area of personal interest or a topic of interest from within the information technology qualification content.

Through the Extended Project, students will develop skills that support their study of information technology, including:

- conducting, organising and using research
- independent reading in the subject area
- planning, project management and time management
- defining a hypothesis to be tested in investigations or developing a design brief
- collecting, handling and interpreting data and evidence
- evaluating arguments and processes, including arguments in favour of alternative interpretations of data and evaluation of experimental methodology
- critical thinking.

In the context of the Extended Project, critical thinking refers to the ability to identify and develop arguments for a point of view or hypothesis and to consider and respond to alternative arguments. This supports the development of evaluative skills, through evaluating information technology arguments and using qualitative and quantitative evidence to support informed judgements and propose evidence-based solutions to issues.

Types of Extended Project related to information technology

Students may produce a dissertation on any topic that can be researched and argued, for example a controversial information technology issue.

A dissertation might involve an investigation such as:

- the impact of information technology on society
- ease of use of information technology in a chosen country.

The dissertation uses secondary research sources to provide a reasoned defence or a point of view, with consideration of counter-arguments.

An alternative might be an investigative project or field study involving the collection of data from primary research, for example:

- a study of the impact of unemployment on the local community
- a statistical survey of changing social attitudes towards online purchasing.

Using the Extended Project to support breadth and depth

In the Extended Project, students are assessed on the quality of the work they produce and the skills they develop and demonstrate through completing this work. Students should demonstrate that they have extended themselves in some significant way beyond what they have been studying in information technology. Students can demonstrate extension in one or more dimensions:

- **deepening understanding** – where a student explores a topic in greater depth than in the specification content. This could be an in-depth exploration of one aspect of a current development in information technology.
- **broadening skills** – where a student learns a new skill. This might be learning how to design a website or about a new statistical technique that can be used in the analysis of either primary or secondary data collected by the student
- **widening perspectives** – where the student's project spans different subjects.
A student studying information technology with geography may wish to research the impact of tourism on a particular region or locality. A student studying information technology with business may wish to use information technology to analyse market data and research one aspect of a market in more detail.

A wide range of information to support the delivery and assessment of the Extended Project, including the specification, teacher guidance for all aspects, an editable scheme of work and exemplars for all four approaches, can be found on our website.

Appendix 5: Glossary

Term	Definition
Assessment objectives	The requirements that students need to meet to succeed in the qualification. Each assessment objective has a unique focus, which is then targeted in examinations or coursework. Assessment objectives may be assessed individually or in combination.
External assessment	An examination that is held at the same time and place in a global region.
International Advanced Subsidiary	Abbreviated to IAS.
International Advanced Level	Abbreviated to IAL.
International A2 (IA2)	The additional content required for an IAL.
Modular	Modular qualifications contain units of assessment. These units can be taken during the course of study. The final qualification grade is worked out from the combined unit results.
Raw marks	Raw marks are the actual marks that students achieve when taking an assessment. When calculating an overall grade, raw marks often need to be converted so that it is possible to see the proportionate achievement of a student across all units of study.
Uniform Mark Scale (UMS)	Candidate's actual marks (or raw marks) will be converted into a UMS mark so that it is possible to see the proportionate result of a candidate. Two units may each be worth 25% of a total qualification. The raw marks for each unit may differ, but the uniform mark will be the same.
Unit	A modular qualification will be divided into a number of units. Each unit will have its own assessment.

Appendix 6: Taxonomy

The following table lists the command words that may be used in the IAS/IAL Information Technology assessments.

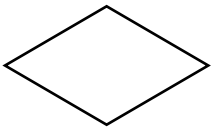
Command word	Description
Amend	Requires changes/additions/deletions/rearrangement of a symbolic representation.
Analyse and recommend	Examine elements in detail and provide support for a course of action.
Apply	Make use of skills and knowledge of databases in a given context, for example applying a data validation rule to a specific field in a table.
Assess	Give careful consideration to all the factors or events that apply and identify which are the most important or relevant. Make judgements about significance/importance.
Complete	Requires the completion of a table/diagram/algorithm (in any notation).
Construct	Usually requires creation of an artefact using subject-specific symbolic representation, rules, and syntax.
Create	Usually requires creation of an artefact using subject-specific symbolic representations.
Describe	To give an account of something. Statements in the response need to be developed as they are often linked but they do not need to include justification or a reason.
Design	Consider a given problem, scenario or context and the factors that will influence aspects of the database such as the tasks that it can perform, how users will interact with it and how it will work with other systems.
Develop	Produce a database solution based on given set of requirements, either by enhancing an existing data structure or creating new data structures based on given requirements and sample data sets.
Discuss	Explore all aspects of an issue/situation/problem/argument by reasoning or argument.
Draw	Produce a diagram/image using either a ruler or freehand. May require labelling/annotation to express meaning. Used when symbolic representations need to be manipulated.
Evaluate	Review information then bring it together to form a conclusion, drawing on evidence, including strengths, weaknesses, alternative actions, relevant data or information. Come to a supported judgement of a subject's qualities and relation to its context.

Command word	Description
Extract	Using software tools to process and output data into a different format so that it can be used by other systems or for different purposes.
Explain	An explanation requires a justification/exemplification of a point. The answer must contain some element of reasoning/justification linked to a point/idea that has been identified.
Give/state/name	All of these command words are really synonyms. They generally all require recall of one or more pieces of information.
Identify	Usually requires some key information to be selected from a given stimulus/resource.
Implement	To create and deploy a solution for a given context either in the form of a complete solution or amendment of a current system.
Import	Using tools in a database to bring in data from a source outside of the database, such as a text file, and process it so that it can be used by the database.
Set up	Add or modify a feature in a database so that it meets specific user requirements, e.g. set up a data-entry list on a table.
Write	Usually requires manipulation/creation/amendment of an artefact using subject-specific symbolic representations.

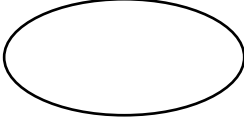
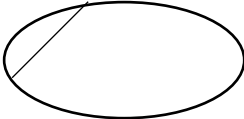
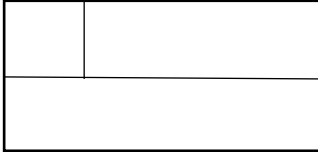
Appendix 7: Symbols

This appendix shows the symbols that will be used in the external assessments.

Flowchart

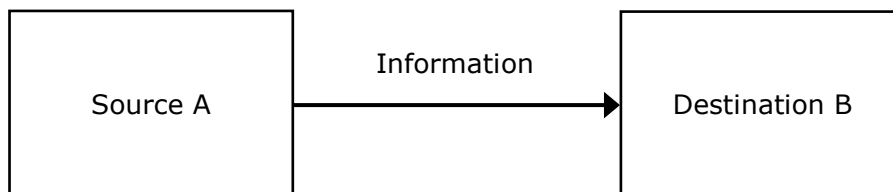
Purpose	Symbol
Input/Output	
Process	
Subprocess	
Decision	
Terminator	
Labels	Yes No
Flow	

Dataflow symbols

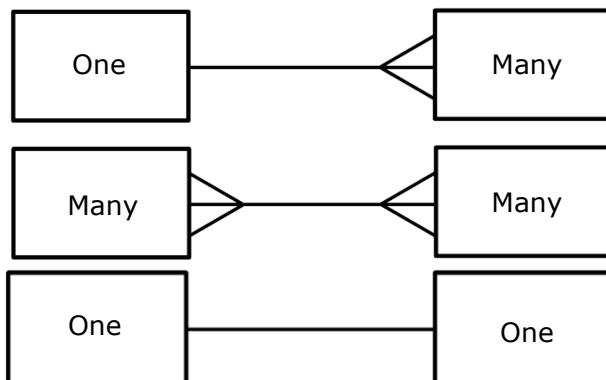
Purpose	Symbol
Data source or destination (inputs and outputs)	
Duplication data source or destination	
Process	
Data store	

Information flow symbols

Students should be able to use and create appropriately labelled diagrams to express meaning.



Entity relationship symbols



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