Unit 1: Information Technology Systems – Strategy, Management and Infrastructure

Delivery guidance

This unit provides an opportunity to build core skills which will underpin the whole qualification. You will help learners to explore how computer hardware, digital devices and relevant software combine to form small- and large-scale systems. Focus on developing learners' understanding of how Information Technology systems (IT systems) can be used in vocational contexts to solve problems and/or meet the needs of organisations and users. Learners will need to be able to analyse the impact of IT systems, evaluate the effectiveness of systems in a range of contexts and, where appropriate, suggest and plan improvements to current solutions. Learners should be able to justify the solutions they propose.

Approaching the unit

IT systems are used in many ways to solve problems. Expose learners to a wide range of effective, and less effective, uses of IT systems. In addition to the obvious business systems, use real-world examples to illustrate the power of IT, such as: 'fly-by-wire' air travel; 'just-in-time' manufacturing; computerised banking; the use of IT in health (such as in hospitals for diagnosis, automated treatment and patient monitoring); self-drive transport; and sensor-controlled agriculture and horticulture. In each case, different technologies are used together in different ways to solve a range of problems and improve the ways in which people work.

Prepare learners to use IT systems effectively and help them to think about the wider implications of each application and use, by giving them opportunities to develop analytical and decision-making skills. Such skills will be beneficial in a managerial or project management role. For example, learners should be able to analyse problems and make justified suggestions as to how IT systems can be used in various settings, with comparison to alternatives where appropriate. The key is to find the best solution to solve a problem; however, there is not always a 'right' answer.

This unit is designed to be synoptic in nature and to draw on knowledge from other units within the qualification. You may deliver the underpinning content at the start of the qualification but assess this unit at the end.

This delivery guide does not cover everything to be delivered to complete this unit; instead, it gives examples of delivery methods. Refer to the specification for full details of the content to be covered. In the external assessment, learners may be tested on any of the content in the specification.

Delivering the learning aims

For learning aim A, show learners how digital devices can be used, individually or in combination with other devices, to form small- and large-scale IT systems. Develop learners' understanding of the features of different digital devices and the ways in which these features affect their use in an IT system, as well as the implications of the relationship(s) between devices and relevant peripherals.

Ensure learners understand the important role of software in any system. Show them how to analyse the impact of the features and uses of different types of software on the effectiveness of an IT system overall.

Equip learners with up-to-date knowledge of IT systems and give them opportunities to explore emerging technologies and their implications for organisations, IT systems and users.

Give learners opportunities to explore a range of contexts to which they can apply their knowledge and demonstrate their ability to choose appropriate IT systems to meet a range of needs. Help them to use their knowledge to make decisions, plan, and evaluate IT systems.

Learning aim A asks learners to explore the ways in which data is transmitted within and by computer systems. Allow learners to explore the technologies that enable devices and systems to communicate and share data with each other, and how the features and characteristics of these technologies affect each system and its effectiveness. Make learners aware of different connection types, the role of different networks and the issues relating to the use of technologies to transmit data.

Learners should understand that there is often a range of possible solutions, and that success in IT relies on an ability to explore and evaluate these options to find the best one. They should understand that, on some occasions, the solution chosen will be a compromise due to the limitations of available technologies, cost or efficiency, compatibility between new and existing systems, and perceived benefits (such as improved productivity or security).

In the final part of learning aim A, learners will explore how the increased use of internet-based technologies and services affects the ways in which users and organisations use and interact with IT systems. Allow learners to access different online systems for accessing, sharing and storing data. Ask them to research the ways in which online communities are integrated into many aspects of the IT systems used by individuals and organisations. Help learners to develop a strong understanding of the capabilities and limitations of available services, technologies and procedures, and to explore how and why these technologies are used.

Learners should not forget that there could be negatives from operating online as well as positives; there will be significant opportunities for discussion of issues such as personal privacy.

For learning aim B, learners consider how organisations use data and information. They begin by examining the difference between data and information and considering how information at various levels supports the activities of an organisation. Learners will benefit from visiting speakers who can demonstrate their use of business information. Each speaker should discuss data and information that their business generates and uses through its activities, such as stock levels, customer data, financial and cash flow data etc. They should aim to give a good insight into the differences between the data used at different levels of business, and the information required by different stakeholders (including customers).

Learners will also consider how businesses use online communities in different ways to generate business or provide post-sales support.

The final part of learning aim B focuses on the use and manipulation of data and provides an opportunity for learners to gather primary data, make use of their own previously gathered primary data (which has been interpreted to become secondary data), and work with numerical and data models to produce results. Explore the importance of primary and secondary data, and the use of models within the wider vocational context – for example: Why is it important for an organisation to get the correct data? Why would an organisation model a range of potential outcomes? etc.

Learning aim C introduces threats to IT systems and to the data those systems store and use. Ensure learners are able to assess the possible impact of a threat on a given situation if adequate steps are not taken to mitigate it. Ask learners to explore ways in which IT systems can be protected from threats and the possible implications of implementing (or not) the identified protection methods. Learners should consider threats to small- and large-scale systems as well as the measures and responsibilities – at both personal and organisational level – that can protect systems. Introduce a range of relevant legislation and allow learners to examine native practices to identify possible improvements.

Learners should explore the moral, legal and ethical issues resulting from the use of IT systems. Demonstrate how the use of IT systems by individuals and organisations affects the ways in which people conduct their personal and professional lives, and examine the subsequent implications of this. Help learners to gain a strong grasp of relevant local legislation relating to the use of IT systems, and ensure they understand the guidelines and codes of practice produced by relevant professional and public bodies. Learners must know how to remain informed about legal issues, for example: What are the sources of information? Where can they access information that will ensure they remain up-to-date?

Throughout this unit, give learners opportunities to explore and analyse situations to identify problems, suggest and evaluate solutions, and discuss the wider considerations of implementing and using IT systems. Deliver the content using a combination of tutor presentations, individual and group learning tasks, visits, guest speakers and detailed case studies.

In preparation for assessment, ensure learners understand the command words used (as detailed in the units) and, during teaching, allow learners to undertake classwork that demonstrates their understanding of the requirements to obtain full marks in response to these command words.

For further guidance on assessment, see the criteria and exemplification in the specification.

Assessment model

Learning aim	Key content areas	Recommended assessment approach
A Explore how IT infrastructure meets the needs of organisations and their stakeholders	**A1** Purpose and functions of organisations **A2** Digital devices, their functions and use **A3** Peripheral devices and media **A4** Computer software in an IT system **A5** Connectivity **A6** Networks **A7** Issues relating to transmission of data **A8** Online systems **A9** Emerging technologies	This unit will be assessed using a set assignment brief provided by Pearson. Learners will be required to respond to a Set Task Brief, which will give a scenario detailing the specific organisation. Learners will produce formal reports that contain: • an exploration of information technology and related data and procedures that could be implemented by an organisation • an assessment of how information technology and related data and procedures would impact the organisation and its stakeholders • an evaluation of choices made when developing policies.
B Understand how organisations make use of data and information	**B1** Data and information in an organisation **B2** Online communities **B3** Using and manipulating data	
C Develop policies for the use of IT within an organisation	**C1** Threats to data, information and systems **C2** Protecting data **C3** Moral and ethical issues **C4** Legal issues **C5** Professional guidelines and codes of practice **C6** Managing information technology within organisations	

Assessment guidance

This unit has a set assignment. Learners must complete a Pearson Set Assignment Brief. An assignment is set by Pearson and marked by the centre. Learners must complete it under supervised conditions. The suggested supervised assessment period for this unit is 20 hours.

Getting started

This gives you a starting point for one way of delivering the unit, based around the recommended assessment approach in the specification.

Unit 1: Information Technology Systems – Strategy, Management and Infrastructure

Introduction

IT systems support and enable individuals and organisations to achieve their aims and are present in almost everything people do. Being able to effectively select and use appropriate IT systems is a valuable skill in any area, vocational or personal. In delivering this unit, give learners a sound knowledge of a wide range of IT systems used to support the aims of individuals, groups or organisations.

Learners should be able to apply this knowledge to identify needs and plan solutions, and to analyse and evaluate situations and outcomes relating to the use of IT systems.

These transferable skills will equip learners for further study or employment in a wide range of vocational areas.

Learning aim A: Explore how IT infrastructure meets the needs of organisations and their stakeholders

A1: Purpose and functions of organisations

- Begin by introducing the aim of the unit (i.e. to become a highly-skilled IT user who can analyse situations to select appropriate IT systems). Explain how an understanding of IT systems, including their possibilities and limitations, can be applied to plan solutions and to analyse and evaluate outcomes or decisions in many situations.
- Briefly explore the functions of organisations. This will enable you to link IT system components with real functionality. If possible, invite a guest speaker who can talk to learners about their use of IT systems to support their activities.

A2: Digital devices, their functions and use

- Introduce the concept that an IT system can be anything from a single digital device to a global collection of computers and interconnected devices. Explain that even large IT systems are often made up of smaller devices across a range of technologies that can both perform isolated individual roles and be part of a larger IT system.
- Assess learners' prior knowledge of digital devices. Start with common devices (such as computers and mobile devices) before moving on to consider more specialised or less common devices. You may wish to introduce each digital device with an overview of the tasks it can perform, to give learners a little context. At the very early stages, only go into enough depth to allow learners to understand the key concepts; they will develop a deeper and more complex understanding of 'how' and 'why' as the unit progresses.

A3: Peripheral devices and media

- Ensure learners understand the concept of 'input – process – output' and know that this is the basis of any computer system. Establish learners' current understanding of common hardware used by computer systems. If necessary, spend some time ensuring learners have a sound grasp of subject-specific terminology in this area.

A4: Computer software in an IT system

- Use a range of group and individual activities to give learners opportunities to explore the concepts and implications of software in IT systems. Introduce more common uses of software first, before progressing to more specialised software.

- Ensure learners understand that, in the modern world, there are very few organisations that do not use computers and a range of software to manage their activities. Explain that most organizations realise technology can improve their core activity and organisational efficiency, using examples from:
    - education (such as remote learning, interactive learning, the use of MOOCs)
    - health (such as improvements in post-operative care through the interconnectivity of support services)
    - manufacturing (such as research and development and the use of IT in design, prototyping (using technologies such as 3D printing) and CAD/CAM systems to manage the full manufacturing process)
    - social care (such as faster critical response with higher-quality information).
- Make learners aware of both established and emerging technologies and how they influence the ways in which individuals and organisations use IT systems. Consider questions such as:
    - How can the Internet of Things (IoT) revolutionise manufacturing?
    - How does Big Data measured in real time contribute to maintenance in manufacturing to improve downtime and reduce costs?
- Support traditional classroom-based activities with visits and guest speakers.
- Give learners practical tasks in which they analyse scenarios and make informed choices about the selection of IT systems. Set these learning activities within realistic scenarios, to allow learners to consider a range of factors that might influence the choice of parts, or all, of a system. For example, the scenario below could be used as a basis for whole-class discussion, with all learners encouraged to contribute:
    - A large company wishes to introduce a CRM (Customer Relationship Management) system to be used across the business by both technical and non-technical users, including office-based and field-based staff. How would all users interact with the systems? What technologies could be used? What concerns could there be? Are there any technical restrictions that need to be accommodated?

  Remind learners that there is no right answer but, as IT practitioners, they must be able to defend their ideas and choices.
- Make links between this content and other topics in the unit. After ensuring learners have established a strong understand of the concepts of systems, hardware and software, continue to develop and reinforce their understanding in conjunction with other topics.

A5: Connectivity

- Introduce this topic by asking learners to consider different methods of connecting devices and systems and to think about the features, limitations and implications of different connection methods.
- Where possible, give learners practical tasks and opportunities to select and use different connection methods to achieve different aims. Allow learners to compare results from first-hand experience; this will give them a clearer idea of what can or cannot be achieved.

A6: Networks

- Demonstrate how devices and systems can be connected to form different types of network. Learners should develop a strong grasp of how different types of network are used and the factors that influence the choice of network. Explain how the component parts affect the function and performance of the network as a whole. Use a range of activities to support learning for this topic area, including:
    - visits to local employers to see how networks are used to meet organisational, user and customer needs
    - individual and group research and discussion tasks, supported by guest speakers and

case studies of real-world examples (such as a local library that has to connect with regional and national systems for inter-library loans, or a transport system (e.g. a city bus system) in which GPS updates are transmitted to bus stops along a route to inform customers about the arrival of the next bus, etc.)

- practical activities involving setting up and using different types of network.

A7: Issues relating to transmission of data

- Explain the factors to be considered when transmitting data, in addition to the impact of the devices and other hardware that form the network. Give learners opportunities to explore these factors, which include the protocols used, security issues and bandwidth. They should understand, for example, the implications of compression used to reduce file sizes and speed up transmission.
- Ask learners to work through tasks based on a variety of scenarios and to plan solutions and/or make and evaluate decisions relating to transmission of data. Learners should consider a wide range of implications and apply them to realistic and varied examples. Vary the level of scaffolding provided, to support learners effectively.
- Where possible, base these tasks on a scenario that contextualises the learning. For example, learners could consider:
  - a photographer sending image files to a printing service
  - a group of architects in different locations sharing architectural drawings
  - a graphic designer working on illustrations for a new book.

A8: Online systems

- Due to the integrated nature of many modern systems, you may already have touched on areas of this topic (depending on the scenarios used so far). Draw learners' attention to these natural links using suitable visits and case studies.
- Explain the ways in which online systems are used by individuals and organisations. Learners should explore the features of a range of online systems used to store data and perform tasks (such as contributing to an organisation's disaster recovery plan). They should then investigate the impact and implications of these systems.

A9: Emerging technologies

- Learners should understand that technology never stays still: there are always new, sometimes revolutionary, emerging technologies which affect the world in different ways.
- Consider human augmentation technologies (such as augmented intelligence, immersive workspaces, emotion AI and biotech), autonomous systems and automation in general, distributed cloud technologies, DARQ, personal profiling, AI, intelligence analytics, data analytics and data policing, medical developments etc.
- Learners should be able to debate the pros and cons of technology and understand how developments may fundamentally change what we know and can achieve.

Learning aim B: Understand how organisations make use of data and information

B1: Data and information in an organisation

- Learners should examine data and information in organisations – how it is generated and how it is used to support different levels of decision making (such as operational, strategic and management).
- Learners must be able to make judgements about the types of data that would be held and generated by different functional areas of an organisation. They should also make connections between different functional areas and the ways in which they use data in a range of contexts (e.g. managing day-to-day tasks, identifying and planning improvements, communicating with stakeholders such as staff, customers etc.).

- Enable learners to recognise and explain the five Vs in relation to data: volume, velocity, variety, veracity and value.

B2: Online communities

- Give learners opportunities to explore the widespread integration of online communities with personal and professional activities. For example, learners could investigate Microsoft's purchase of LinkedIn and consider questions such as:
    - What was the rationale for this purchase?
    - What benefits were there to Microsoft?
    - Were there any drawbacks?
- Learners should understand the features and services offered by these communities to individuals and organisations, and the impact and associated implications of their use. For example, continuing the example above, learners could consider whether all LinkedIn users would be happy about their data being available to a large commercial company.
- Learners should develop the ability to analyse impacts and implications in depth. Ask them to explore a wide range of factors (as listed in the specification) and consider how these factors link with, and have an impact on, each other.
- Make learners aware of the importance of data, and how it is collected, stored and processed by IT systems. Ask learners to explore the implications of storing, using and processing data, for individuals and organisations.

B3: Using and manipulating data

- Explain how data can be collected and processed and describe ways in which the accuracy and reliability of data can be improved. Learners should be able to apply their understanding to real-world scenarios. Support this learning using activities such as:
    - research projects exploring and comparing the usefulness, reliability and accuracy of primary and secondary sources
    - data collection exercises which use different collection methods or involve creating data collection systems for others to use (for example, using wearable technologies to gather data for sports performance analysis)
    - creating and using numerical models in spreadsheet software – for example, using what…if modelling to process scenarios with changing variables (such as the impact of increased oil prices on the profitability of a logistics business)
    - creating and using database software
    - individual and group research and discussion tasks supported by guest speakers (ideally from a market research or marketing company) and case studies.
- Use activities which integrate content from learning aim B. For example, learners could use different platforms to collect information and data, then manipulate/analyse and model this data to provide new/alternative information or targeted information for stakeholders in a given context.
- You could also use the outcome of testing activities in other units (*Unit 4: Programming*, *Unit 5: Data Modelling*, *Unit 6: Website Development*, *Unit 7: Mobile Apps Development*, *Unit 8: Computer Games Development*, *Unit 9: IT Project Management*, *Unit 11: Cyber Security and Incident Management*, *Unit 14: Customising and Integrating Applications* and *Unit 17: Digital Animation and Effects*). Testing outcomes will be drawn from a range of different testing activities using a variety of platforms. The data can then be modelled and used to provide targeted information for developers/development teams or more generic information for the client(s).
- Consider this topic in the wider context, taking in analytics in social media, cookies etc.

Learning aim C: Develop policies for the use of IT within an organisation

C1: Threats to data, information and systems

- Explore the importance of both data and systems security and ensure learners can identify the characteristics of threats to data. If possible, locate some local/native examples of successful attacks on systems and/or provide data for learners to examine. Global examples may also be relevant.
- Ensure learners understand that the impact of data threats goes beyond issues such as identity theft: it can seriously affect both individuals and organisations. Consider:
    - threats with a criminal intent, such as ransomware attacks
    - how organisations have to manage malicious insiders (company employees who steal or corrupt data with the intention of damaging the organisation)
    - how to mitigate against infrastructure disruption or technological failures, etc.

C2: Protecting data

- Data security is one of the most fundamental issues that organisations deal with – both protecting it against unlawful access and ensuring that data can be recovered in the event of data loss. Learners must understand the implications of lapses in data security, particularly in relation to the protection requirements in their own country.
- Learners should understand that threats can be both physical and logical. Explore software solutions to data and systems security (such as anti-virus software and firewalls) and physical access controls and policies. Also consider how data is protected during transmission, through encryption.
- Discuss physical controls, such as smartphone integration as a mobile access control method which provides a separate ID token. This is part of NFC (Near Field Communication).

C3: Moral and ethical issues

- Examination of the moral and ethical issues associated with information technology will allow significant opportunities for debate. This can be approached in various ways, for example:
    - a formal debate, with each side preparing in advance
    - a research and presentation task, in which learners must reassure users or organisations by highlighting both the threats and the resolutions.
- Learners are likely to find the idea of hacking versus ethical hacking particularly interesting, especially if their areas of interest are programming and cyber security.

C4: Legal issues

- Examine legal issues from a local/native and an international perspective. Ensure learners understand that trading in other countries means meeting the quality requirements of the destination country as well as the regulations in one's own country. This can be particularly difficult if you are trying to sell the same product or service in several countries, as the requirements can be quite different.
- At the very least, learners should understand legal requirements in their own country in relation to Health and Safety, copyright and intellectual property, data protection, computer misuse, consumer rights and accessibility.

C5: Professional guidelines and codes of practice

- Learners must understand the difference between legislation, professional guidelines and codes of practice. Introduce the concept of professionalism in the sector and discuss the reputational damage that can be caused by not adhering to expectations within the sector.
- A working knowledge of ISO and WCAG/W3C® is essential for any modern practitioner who wishes to work internationally.

C6: Managing information technology within organisations

- Explore how IT is managed in organisations, including the rationale for creating policies in different contexts. Examine your own in-house policies and, if possible, ask different guest speakers to talk about how they manage their IT systems internally (from managing assets (maintenance schedules and renewals), incident management (backup and recovery policies), use of performance metrics, and management of users and customers). Source online information relating to real companies around the world and the ways in which they manage their IT infrastructure and users.
- Finally, consider the notion of in-house versus external systems for the provision of IT systems and services. Consider outsourcing, the rise of outsourcing in the 80s, 90s and early 00s, and the reasons for its subsequent decline in the last decade. If time allows, consider the role of international call-centres supporting a range of sectors such as insurance, finance and e-commerce. You could access the following video on YouTube to support this content: Phoning from the Philippines: Outsourcing to Manila's Call Centres.

Details of links to other BTEC units and qualifications, and to other relevant units/qualifications

This unit links to:

- Unit 2: Creating Systems to Manage Information
- Unit 3: Using Social Media in Business
- Unit 5: Data Modelling
- Unit 11: Cyber Security and Incident Management
- Unit 12: IT Technical Support and Management
- Unit 14: Cloud Storage and Collaboration Tools.

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC Internationals in Information Technology. Check the Pearson website at http://qualifications.pearson.com/endorsed-resources for more information as titles achieve endorsement.

Journals

- *MDPI* – Publishes peer-reviewed open-access journals for all computing sectors.

Websites

- *DLA Piper Data Protection* – Includes information about 'Data Protection Laws of the World, which will allow learners to compare the legislative requirements of different countries.
- *BBC Technology* – The BBC's technology pages provide news and information about technology and IT.
- *Forbes.com* – This site contains news and information about technology and IT.

Pearson is not responsible for the content of any external internet sites. It is essential for tutors to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that tutors bookmark useful websites and consider enabling learners to access them through the school/college intranet.