



Richmond College

Advanced Education



Qualification Specification for :

Level 5 Diploma in Computing

610/3714/X

Level 5 Extended Diploma in Computing

610/3715/1

Pathways:

Level 5 Extended Diploma in Computing (DataTechnologist)

Level 5 Extended Diploma in Computing (SoftwareEngineer)

Level 5 Extended Diploma in Computing (NetDevOps Engineer)



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athe AWARDS FOR
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HIGHER EDUCATION

Unit Specifications

Unit 1 Computing Projects for Digital Transformation			
Unit aims	This unit enables learners to begin to think about how digital transformation may benefit their organisation, their job role, or the day-to-day activities within their organisation or their team. This understanding should be pathway neutral as learners at Level 5 will be expected to understand and contribute to plans for a digital transformation, regardless of their role.		
Unit level	5		
Unit code	F/651/0150		
GLH	60		
Credit value	15		
Unit grading structure	Pass, Merit and Distinction		
Assessment guidance	<p>There are no special software requirements to support the delivery or assessment of this unit. Learners should, however, have access to the internet. You could find a range of local and global examples of how digital transformation has benefitted organisations and individuals.</p> <p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. For a Merit, all pass and all merit criteria must be met. For a Distinction, all pass, all merit and all distinction criteria must be met.</p>		
Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	Pass	Merit	Distinction
1. Understand opportunities and drivers for digital transformation	1.1 Identify and explain a range of opportunities for digital transformation 1.2 Give examples of how digital transformation can enable organisations to reduce their carbon footprint 1.3 Explain the benefits of digital transformation to a non-technical audience	1M1 Recommend digital assets to support a digital transformation	1D1 Evaluate your choice of digital assets to support a digital transformation

<p>2. Understand risks associated with digital transformation</p>	<p>2.1 Identify and explain the skills needed to support a digital transformation</p> <p>2.2 Explain the costs associated with digital transformation</p> <p>2.3 Explain why staff can be resistant to change</p>	<p>2M1 Analyse the importance of realistic timescales in the implementation of a digital transformation</p>	<p>3D1 Evaluate how the identification and mitigation of risk increases the likelihood of success in a digital transformation</p>
<p>3. Understand how risks associated with digital transformation are mitigated</p>	<p>3.1 Explain the role that communication plays in managing how staff perceive change resulting from digital transformation</p> <p>3.2 Explain the importance of ROI (return on investment) and why ROI might not be immediate</p> <p>3.3 Describe how data will need to be prepared to accommodate digital transformation</p>	<p>3M1 Analyse how a range of risks associated with digital transformation can be mitigated</p>	

Indicative Content

1 Understand opportunities and drivers for digital transformation

- Opportunities for digital transformation
 - Automation
 - e.g., industrial machinery, home automation, vehicle automation and logistics, programmed kitchen appliances and consumer electronics, agricultural processes such as automated ploughing, irrigation systems and harvesting
 - Development of products
 - e.g., technology used in design, prototyping, simulation
 - Accessing new markets and customers
 - e.g., building or re-energising a brand
 - Taking advantage of emerging technologies
 - e.g., having an awareness of emerging technologies and their capabilities and how these could be used by organisations
 - Futureproofing (upskilling staff and developing a staff base that is ready for the future demands of the organisation)
 - Leveraging connected technologies
 - e.g., automated social media posting, personalised marketing, using assistive devices to generate sales (such as re-ordering reminders)
 - Modernising IT infrastructure

- e.g. what are the benefits of modernisation such as scalability, responsiveness, greater capacity
- Modernising operational practices
 - e.g. simplification, improved workflow, improved capabilities (the ability to do more)
- Digitising documentation
 - e.g., better storage, better organisation, improved access, more availability for analysis to support decision making
- Improvement in the customer experience
 - e.g., more responsive to customer needs, use of chatbots, remote patient or customer management, online help
- Re-engagement of staff
 - e.g., improved communication and information sharing, better collaboration across teams, provides wider access to resources, potential for remote working, better work-life balance, developing a digital culture that is recognised and appreciated
- Becoming greener
 - e.g., embracing sustainability, reduction of carbon footprint, better relationships with local community
- Accessibility to education and training
 - e.g., more efficient access to education and training (access to remote learning and training), greater choice of training and educational programmes
- Enhanced collaboration with external partners
 - e.g., easier access to meetings without excessive travel
- Drivers for digital transformation
 - Regulatory compliance and ethical responsibility
 - e.g., using technology to help organisations meet legislative requirements and demonstrate ethical responsibility
 - Cost reduction
 - e.g., this does not necessarily mean reducing staff, it could be using satellite technologies to find better delivery routes, online meetings to avoid attending in person
 - Improved efficiency
 - e.g., improved workflow, creating an organisation that can respond to continuous change, reduction in process bottlenecks
 - Meeting evolving customer expectations
 - e.g., responsiveness, accountability, agility
 - Obsolescence of existing technology
 - e.g., technology for which parts are no longer available, software is no longer supported or updated (causing an operational and security risk)
 - To drive innovation
 - e.g., support initiatives for growth, access to data for research and development
 - Greater access to a wider talent pool
 - e.g., using digital technologies to enable a wider pool of skills and abilities to be available for work (such as carers and those who are housebound), being able to outsource to reduce costs by employing less expensive labour.
 - Maintain competitiveness
 - e.g., having access to more information about competitors and their activities

2 Understand risks associated with digital transformation

- Lack of appropriate skills in existing workforce to support a digital transformation
 - technical skills
 - people management skills
 - project management
- Costs
 - initial outlay for hardware and software upgrades
 - hidden costs (such as the costs of training, downtime when staff are being trained)
 - ongoing maintenance costs
 - ongoing support costs
 - ROI (return on investment)
 - costs of software licenses
 - managing cost increases caused by scope creep
- Lack of real understanding about the technologies being implemented
 - what the technology can do
 - what the technology cannot do
 - over-promising what digital transformation can offer
 - lack of appreciation about the extent of change and what will really be impacted
- Risks to staff
 - staff burnout due to
 - expectation that staff can manage more work
 - expectation that staff can work more quickly
 - staff can feel that there is a greater expectation that they are accessible 24/7
 - isolation during long periods where they are working from home
- Staff fear of change and resistance to change
 - fears, including job loss, requirements to do more work or to work more quickly
 - assumption that staff will buy in to transformation
 - staff who lack understanding
- Managing large volumes of digital data
 - many organisations work with multiple systems which often means data duplication
 - data may need to be cleaned and prepared
 - data may need to be kept within certain locations due to security concerns or legislation
- Timescales
 - digital transformation should be carefully planned
 - underestimating the impact from the changeover from one way of working to another
 - adopting new technologies without sufficient testing
 - high volumes of users
 - wireless capacity (number of connected users)
 - underestimating problems that could emerge during transformation
 - costs over-running
 - scope creep
- New cyber security risks
 - the introduction of new digital assets that need to be risk assessed and managed before being added to the existing infrastructure
- Disaster recovery
 - updated policies for disaster management to reflect digital transformation
 - updated policies for business recovery to reflect digital transformation

3 Understand how risks associated with digital transformation are mitigated

- Managing change and the risks associated with digital transformation
 - Upskilling

- providing necessary training
 - buying in expertise (which increases costs)
- Costs
 - finding project capital
 - creating a budget for operational and support costs
 - calculating ROI (return on investment)
- Lack of real understanding about the technologies being implemented
 - be clear about what will and will not be possible after digital transformation
 - share the facts with staff so that they feel informed
 - ask staff to contribute to the estimates of how the transformation will impact on their ability to work
 - keep staff informed about how the transformation will affect them
- Risks to staff
 - create operational policies and set out expectations of staff
 - ensure that remote staff have regular contact with their manager and team
- Staff fear of change and resistance to change
 - assumption that staff will buy in to transformation
 - staff who lack understanding of technology
- Managing large volumes of digital data
 - many organisations work with multiple systems which often means data duplication
 - data may need to be cleaned and prepared (e.g. removal of duplicated data, data may need to be reorganised)
 - requirements in relation to data sovereignty should be observed
- Timescales
 - should be realistic
 - should be agreed with staff
 - should be shared with all stakeholders
- New cyber security risks
 - cyber specialists should be involved in the selection and preparation of technologies
- Importance of taking stakeholders with you on a digital transformation journey

Suggested Resources

Lardi, K., 2022, *The Human Side of Digital Business Transformation*, Wiley

Weiss, A., 2022, *The Practical Guide to Digital Transformation: Quickly Master the Essentials with Tips, Case Studies and Actionable Advice*, Kogan Page

Porter, M.E., et al., 2021, *HBR's 10 Must Reads on Leading Digital Transformation* (with bonus article "How Apple Is Organized for Innovation" by Joel M. Podolny and Morten T. Hansen), Harvard Business Review Press

Rogers, D., 2023, *The Digital Transformation Roadmap: Rebuild Your Organization for Continuous Change*, Columbia University Press

Websites

www.skillsyouneed.com

www.coursera.org

[Digital Transformation: What is it? 10 Successful Big Brand Examples](#)

Unit 2 Professional Development and Business Communication			
Unit aims	<p>This unit builds on the professional practice content first introduced in Level 4's Unit 21 (Synoptic Project and Professional Best Practice) where learners considered team behaviours that contribute to effective working, written and oral communication and wider considerations such as ethical practice and an understanding of relevant legislation.</p> <p>Because the IT industry is fast moving, practitioners should understand that working in this sector will necessitate continuous professional development (CPD), often including the updating of technical skills as well as the development of professional skills as practitioners are promoted.</p>		
Unit level	5		
Unit code	H/651/0151		
GLH	60		
Credit value	15		
Unit grading structure	Pass, Merit and Distinction		
Assessment guidance	<p>There are no special software requirements to support the delivery or assessment of this unit. Learners should, however, have access to the internet. Learners should be encouraged to watch professional development videos on streaming services such as YouTube that relate to their preferred pathway.</p> <p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. For a Merit, all pass and all merit criteria must be met. For a Distinction, all pass, all merit and all distinction criteria must be met.</p>		
Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	Pass	Merit	Distinction
1. Understand the role of Continuous Professional Development (CPD) in the professional development of IT practitioners	1.1 Explain the purpose and importance of CPD 1.2 Describe the types of CPD and a range of typical activities that contribute to CPD 1.3 Explain the importance of formally recording CPD activity		

<p>2. Understand the factors that contribute to different types of communication and the reputational impact of good business communication</p>	<p>2.1 Explain a range of factors that contribute to successful business communication</p> <p>2.2 Explain how the way you communicate impacts on how others perceive you, your department and your organisation</p> <p>2.3 Describe, with examples, how organisations should use different communication channels</p>	<p>2M1 Analyse the importance of understanding the reputational impact of different communication methods</p>	<p>2D1 Justify a chosen approach to business communication in a given context</p>
<p>3. Understand how to communicate at a level that is appropriate to the target audience, particularly with senior management</p>	<p>3.1 Describe the importance of identifying and understanding a target audience</p> <p>3.2 Explain how you could better prepare to facilitate good communication</p> <p>3.3 Explain why SLAs are necessary to manage expectations within organisations</p>	<p>3M1 Differentiate between the differing needs of internal and external audiences</p>	<p>4D1 Evaluate the success of a business communication and identify CPD tasks you could undertake to improve your business communication</p>
<p>4. Understand how barriers to communication can be overcome to support users as customers</p>	<p>4.1 Explain barriers to communication</p> <p>4.2 Describe how barriers to communication can be overcome</p>	<p>4M1 Analyse how fear of change becomes a barrier to communication</p>	

Indicative Content

1 Understand the role of Continuous Professional Development (CPD) in the professional development of IT practitioners

- Purpose of CPD (e.g. short, medium and long term career planning)
- Types of CPD (e.g. structured activity, formal unstructured activity, informal unstructured activity, reflective practice)
- Activities that contribute to CPD (e.g. certificated courses, in-house training, job shadowing, workshops and seminars, online learning, networking events and conferences)
- CPD process (e.g. performance review: analysing personal contributions over period being reviewed, identifying job and personal goals, target setting)
- Formally recording CPD (e.g. CPD log, copies of certificates, feedback from informal training)
- Importance of CPD (e.g. preparing to meet the needs of the organisation, meeting the needs and aspirations of the practitioner)

2 Understand the factors that contribute to different types of communication and the reputational impact of good business communication

- Types of communication (e.g. verbal, written)
- Factors that contribute to business communication (e.g. body language, facial expressions, tone of voice, use of technical jargon, use of listening skills, use of appropriate images: awareness of image copyright)
- Reputational impact (e.g. understanding that in a business context practitioners are representing themselves, their departments, and their organisations)
- Appropriate use of communication channels (e.g. social media, email, verbal communication channels like Microsoft Teams, presentations, written reports)
- Public and private communication channels (e.g. when to use)

3 Understand how to communicate at a level that is appropriate to the target audience, particularly with senior management

- Types of target audience (e.g. technical, non-technical)
- Internal audience (e.g. colleagues, subordinates, senior managers)
- The importance of understanding internal users of IT services as customers (e.g. why it is necessary to have SLAs (Service Level Agreements) and why it is necessary to set and manage expectations)
- External audience (e.g. customers, suppliers, stakeholders, business partners)
- Target audience differentiators (e.g. lifestyle, attitudes and beliefs, gender, ethnicity, culture or sub-culture, specific age-groups, needs and motivations, aspirations, location, economic group, seniority (particularly in a business context), level of education, occupation, technical proficiency)
- Importance of understanding different audiences so that you speak their language, not IT e.g.
 - to enable you to find common ground between you and your audience
 - to enable you to adapt your message to suit their needs
 - to enable your audience to engage
 - to avoid the potential for miscommunication
 - to help you build a business relationship
- How to understand your audience:
 - Spend time trying to get to know your audience (e.g. with customers – what do they usually buy and how often, whether they are buying from your competitors and what your competitors offer; with senior managers – understand their role within the

organisation and the needs of their area of responsibility; with subordinates – know how the message you are sharing will impact them and their day to day activities)

4 Understand how barriers to communication can be overcome to support users as customers

- Technical (e.g. having no understanding of computing, IT or individual technologies and relevant terminology, having no understanding of the time that may be needed to investigate and correct faults in systems and devices or time needed to develop a solution)
 - How to overcome: use simple language, avoid using technical terminology and try to only explain the key points that customers need to know, be realistic about time needed to develop systems or solutions, or to investigate and correct faults.
- Physical (e.g. distance, time zones, technical issues, noise and other distractions)
 - How to overcome: leverage technology, be prepared to be flexible, plan ahead and find a suitable time, test technology in advance, find a quiet environment
- Language (e.g. different languages, specialised language and technical jargon, regional dialects, colloquialisms)
 - How to overcome: use simple language, where possible avoid jargon, limit the amount of information being shared, be unambiguous, spend as much time listening as talking
- Culture (e.g. social customs, cultural norms and values, values and belief systems, stereotypes)
 - How to overcome: learn about other cultures, ask questions if unsure, demonstrate respect, be positive
- Physiological (e.g. physical disability that prevents travel, visual impairment, hearing impairment, dyslexia)
 - How to overcome: where practitioners are aware of a physiological challenge they should make suitable adjustments, organisations should also help employees make adjustments
- Psychological (e.g. fear of change creates a psychological barrier, due to: personal insecurity, lack of trust in management, assumption that change will be bad, fear of job loss, fear of loss of control, previous experience of change)
 - How to overcome:
 - share the nature of change, timescales and the expected benefits
 - give an audience time to absorb the information and ask questions
 - demonstrate emotional intelligence, do not assume everyone will be on your page

Suggested Resources

Fishpool, Bernie and Fishpool, Mark, 2022, Software Development in Practice, BCS (The Chartered Institute for IT)

Heller, Daniel, 2020, Building a Career in Software Development: A comprehensive Guide to Success in the Software Industry, Apress

Edited by Rasmussen, Rune, 2019, Data Analyst: Careers in Data Analysis, BCS (The Chartered Institute for IT)

Barker, Jessica, 2020, Confident Cyber Security: How to Get Started in Cyber Security and Futureproof Your Career (Kogan Page)

Pontus, M.J., 2021, Management for Beginners: The Ultimate Guide for First Time Managers, Self-published

Websites

www.lucidchart.com/blog/communicate-with-senior-management

www.prnewsonline.com/water-cooler/2015/02/27/10-tips-for-smart-communications-with-upper-management

www.grammarly.com/business/learn/types-of-business-communication/

www.highspeedtraining.co.uk/hub/what-is-cpd/

www.makingbusinessmatter.co.uk/barriers-to-effective-communication/

Unit 3 Innovative Technologies and Connected Devices			
Unit aims	This unit aims to equip you with an e understanding of innovative technologies like AI, IoT, Blockchain, AR, VR, and the world of connected devices. You will explore their applications, understand their working principles, and learn about their implementation and ethical challenges. This knowledge and skill set will prepare you to navigate the ever-evolving digital landscape.		
Unit level	5		
Unit code	J/651/0152		
GLH	60		
Credit value	15		
Unit grading structure	Pass, Merit and Distinction		
Assessment guidance	In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. For a Merit, all pass and all merit criteria must be met. For a Distinction, all pass, all merit and all distinction criteria must be met.		
Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	Pass	Merit	Distinction
1. Understand innovative developments in technology	1.1 Define innovative technologies and their importance in today's digital world 1.2 Explore various innovative technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Blockchain, Augmented Reality (AR), Virtual Reality (VR), etc 1.3 Discuss the applications and implications of these technologies in different sectors	1M1 Analyse a range of innovative developments in technology and make recommendations to address particular scenarios	
2. Understand the impact of technological innovations on the computer industry	2.1 Explain impacts of technological innovation on the way computer systems are used and supported	2M1 Choose a recommendation made in 1M1 and assess the pros and cons of the recommendation	2D1 Reflect on the ethical argument that possessing the ability to use technology to carry out an action

	<p>2.2 Describe ethical issues relating to technological innovation in computing</p> <p>2.3 Describe the impact of legislation on technological innovation in computing</p>		always means we should use it
3. Understand the impact of technological innovations on society	<p>3.1 Describe the impact of innovations in technology on society</p> <p>3.2 Explain ethical issues relating to the use of technological innovation in society</p> <p>3.3 Describe the impact of legislation on technological innovation in society</p>	3M1 Analyse innovative technologies and connected devices in a range of scenarios and recommend an ethical course of action	3D1 Evaluate the impact on society of a chosen scenario

Indicative Content

1 Understand innovative developments in technology

- Identify current developments
 - Virtual Reality and Augmented Reality
 - Quantum Computing
 - Artificial Intelligence
 - Chat GPT
 - Surveillance, smart cities, etc.
 - Smartphones, 5G and beyond
 - Big data
 - Blockchain
 - Cloud
 - Ubiquitous computing
 - Wearables
 - IoT – smart homes
 - ‘Smart’ cars – software updates
 - Driverless cars
 - Streaming music and films
 - ‘Smart’ utility meters
 - Crypto currencies
 - Facial recognition

- Identify environments that utilise innovative technologies
 - Government
 - Business
 - Social media
 - Education, knowledge society
 - Health
 - Health & Safety

- Finance
- Entertainment
- Security
- Assess the dependency of environments on future developments
 - Sustainability – increased recycling of equipment
 - Energy use – equipment growth needs energy
 - Data security, data sovereignty

2 Understand the impact of technological innovations on the computer industry

- Impacts of technological innovation on the way computer systems are used and supported
 - Increased dependency on large datacentres
 - Increased data storage requirement
 - Increased bandwidth to the user
 - Increased use of wireless network connectivity
 - Increased security concerns
 - Increased need for staff training and continuous development
- Ethical issues relating to technological innovation in computing
 - Does the ability to do something justify doing it?
 - When new technology creates new capabilities, do existing ethics still apply?
 - Use of personal data
 - Security versus privacy
 - Smartphones 24/7 calling home – reporting location, etc.
- Impact of legislation on technological innovation in computing
 - US Patriot Act 2001
 - UK Online Privacy Bill 2023
 - GDPR
 - IPR and copyright

3 Understand the impact of technological innovations on society

- Pros and cons of adopting technological innovations
 - Increased dependency on large datacentres
 - Increased data storage requirements
 - Increased use of wireless network
 - Increased security concerns
 - Increased need for staff training and CPD
 - Pros for business and staff (e.g.)
 - Faster decision making
 - Better productivity
 - Better access to learning
 - Automation of repetitive tasks
 - Better work-life balance
 - Streamlining communication
 - Overcoming geographical barriers
 - Access to wider talent pool
 - Improves global understanding
 - Convenience
 - Cons for businesses and staff (e.g.)
 - Social isolation

- Set up costs
 - Loss of skills
 - Privacy
 - Expectation of staff being available 24/7
 - Reduction in interpersonal skills if everything is text based
 - Risk of a sedentary lifestyle
 - Being remotely monitored (affecting morale)
- Analyse the impact of innovations in technology on society
 - Behavioural changes
 - Working from home
 - Online banking, online commerce, pay by phone
 - Personal data online – Facebook, X, et al
 - Dependence on using apps, e.g. ChatGPT
 - Smart homes
 - Alarms, locks, appliances, utility meters, etc.
 - Dynamic energy tariffs
 - Alexa, Hive, etc. monitoring occupant behaviour and activities
 - Smart cities
 - Traffic management, smart roads, clean air zones, CCTV vehicle tracking, instant fines
 - Population flow monitoring, phone GPS, CCTV facial recognition, no-smoking zones, instant fines
 - Improved services or erosion of civil liberties?
 - Smart city apps
- Evaluate ethical issues relating to the use of technological innovation in society
 - Monitoring social media – is it justified?
 - Employers monitoring staff activities
 - Police monitoring for personal views
 - Artificial intelligence / algorithms monitoring and filtering all online activity
 - Privacy of personal information online, e.g. medical records, criminal record, credit rating, etc.
 - How much information is really necessary for the purpose?
 - Who does the data belong to?
 - Who should have access to the data?
 - Who is responsible for data security and accuracy?
 - Surveillance
 - CCTV vehicle tracking, instant fines
 - CCTV facial recognition, instant fines
 - Improved services or erosion of civil liberties?
 - ‘Smart’ cars – subscription services, software updates, self-driving – who is responsible if an update goes wrong?
- Energy use and carbon footprint
 - Greater user demand for more and more, faster and faster, online services drives IT energy use up
 - Where are the savings made to reduce energy use?
 - Where are the savings made to reduce the carbon footprint?
 - Are the savings real or do ethics become subject to cognitive dissonance?

- Evaluate the impact of legislation on technological innovation in society
 - UK Online Safety Bill – safety or censorship
 - Low Emission Zones
 - Clean air zones

Suggested Resources

Steff Reuben et al., (2022), *Emerging Technologies and International Security: Machines, the State, the War* (Routledge Studies in Conflict, Security and Technology), Routledge Press

Pink, Sarah, (2022), *Emerging Technologies / Life at the Edge of the Future*, Routledge Press

Kampakis, Stylianos et al., (2022), *Business Models in Emerging Technologies: Data Science, AI, and Blockchain*, Business Expert Press

Amami, Mokhtar, (2021), *Emerging Technologies and Supply Chain Digitalization*, Self Publication

Khan Fawad, A., and Anderson, Jason M., (2021), *Digital Transformation using Emerging Technologies: A CxO's Guide to Transform your Organisation*, Self Publication

Websites

Internet of Things

<https://www.ibm.com/topics/internet-of-things>

<https://www.weforum.org/agenda/2021/03/what-is-the-internet-of-things/>

<https://aws.amazon.com/what-is/iot/>

<https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-the-internet-of-things>

<https://www.intel.com/content/www/us/en/tech-tips-and-tricks/virtual-reality-vs-augmented-reality.html>

<https://edu.gcfglobal.org/en/thenow/understanding-virtual-reality-and-augmented-reality/1/>

<https://aws.amazon.com/what-is/blockchain/>

<https://www.forbes.com/advisor/investing/cryptocurrency/what-is-cryptocurrency/>

SmartCities

<https://www.smartcitiesworld.net/>

<https://www.aboutsmartcities.com/>

<https://www.youtube.com/watch?v=HBMIQZeXMiA&pp=ygUac21hcnQgY2I0aWVzIG9mIHRoZSBmdXR1cmU%3D>

<https://www.youtube.com/watch?v=d1DndVz9dAs>

Unit 4 Information Systems			
Unit aims	<p>When working in industry, IT practitioners must be able to see the bigger picture, drawing on all of their knowledge and previous experiences to find the best and most viable solutions to the problem. This is particularly important when working with non-technical managers who may not understand the technologies that they need to be able to perform their role. Practitioners must be able to share their knowledge and understanding in an appropriate way to promote the use of data and information systems to support modern business and enterprise.</p> <p>This unit enables learners to examine a wide range of information systems that they will find in industry.</p>		
Unit level	5		
Unit code	K/651/0153		
GLH	60		
Credit value	15		
Unit grading structure	Pass, Merit and Distinction		
Assessment guidance	<p>No specialist resources are needed to deliver and assess this unit.</p> <p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. For a Merit, all pass and all merit criteria must be met. For a Distinction, all pass, all merit and all distinction criteria must be met.</p>		
Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	Pass	Merit	Distinction
1. Understand different types of information systems that are used in an organisation	1.1 Explain different types of information system with examples of their application 1.2 Describe the components of an information system 1.3 Explain the characteristics of information systems	1M1 Choose and recommend an information system in a business context	1D1 Justify your choice of information systems in a business context
2. Understand the principal uses, advantages and disadvantages of	2.1 Explain the principal uses of information systems 2.2 Describe the advantages of		

information systems	information systems and how they can be used by organisations 2.3 Describe the reasons why information systems can fail		3D1 Evaluate the importance of testing different scenarios by changing variables within projection models
3. Understand how organisations use information systems to support strategic and operational decisions	3.1 Examine, with examples, how information systems are used to support strategic decisions 3.2 Examine, with examples, how information systems are used to support operational decisions 3.3 Present your arguments to a non-technical audience	3M1 Analyse the key benefits of information systems in how they are used to support strategic and operational decision making, ensuring that data is used ethically and within regulatory and legislative constraints	

Indicative Content

1 Understand different types of information systems that are used in an organisation

- Types of information systems:
 - Expert Systems (ES) (e.g. used in health, science, engineering)
 - Knowledge Systems (KS) (e.g. helpdesk and support systems)
 - Knowledge Work Systems (KWS) (e.g. Computer Aided Design (CAD), Virtual Reality (VR))
 - Transaction Processing Systems (TPS) (e.g. payroll, booking, stock control, point of sale (POS), supply chain management, automated ordering)
 - Management information (MIS) (e.g. Human Resource (HR), budgeting, sales management, customer relationship management systems (CRM), crime and fraud detection, terrorism detection using Artificial Intelligence (AI))
 - Decision support (DSS) (e.g. financial planning systems, logistics and transportation systems)
 - Executive support systems (ESS) (drawing data from DSS and MIS systems)
 - Online Analytical Processing (OLAP) (e.g. used in marketing, forecasting, process management)
 - Office Automation Systems (OAS) (e.g. word processing, email)
 - Process control (PCS) (e.g. used in water purification, desalination plants, sewage management, food manufacturing and processing, chemical processing and refining, vehicle manufacturing, nuclear power)

- Components of information systems:
 - Sources of data
 - Databases
 - Data Warehouses
 - Hardware (input and output devices)
 - Software
 - Networks
 - Human resources
 - Defined policies and procedures
- Characteristics of information systems:
 - Collecting data
 - Processing data
 - Storing data
 - Distributing information

2 Understand the principal uses, advantages and disadvantages of information systems

- Principle uses of information systems:
 - Automate operational processes
 - Production of information that is reliable and up to date
 - Manage internal data
 - Organise data
 - Manage change
 - Control organisational activities
- Advantages of information systems
 - Reduction in time taken to achieve routine tasks
 - Reduced labour costs
 - Finding ways to realise competitive advantage
 - Finding ways to make optimal use of organisational resources
 - Production of real time data
 - Reduction of errors
 - Faster response
 - Greater variety of ways to present information
- Disadvantages of information systems
 - Poor initial design
 - Incorrect setup (GIGO principles – Garbage In, Garbage Out)
 - Systems can fail (e.g. data loss, processing errors, hardware failure, software fault, power outages, disaster including sabotage, natural disaster, user error due to poor training)

3. Understand how organisations use information systems to support strategic and operational decisions

- Applications of information systems – strategic
 - Analysis of trends
 - Analysis of competitors
 - Carry out cost-benefit analysis
 - Financial forecasting

- Set and manage future budgets
- Reduction of costs
- Create competitive advantage
- Create new products
- Improve products
- Improve services
- Establish future goals and aspirations
- Planning improvements
- Key benefits of information systems in supporting strategic decision making:
 - having the right information to support long-term decision making
 - having the ability to test different scenarios by changing variables within projection models
- Applications of information systems – operational
 - Day to day management of staff
 - Day to day management of resources
 - Production planning
 - Logistics planning
 - Providing e-learning/training
 - Booking management
 - Communication (e.g. video conferencing, Teams channels, remote working)
 - Key benefits of information systems in supporting operational decision making:
 - faster responses
 - better customer service
 - better control of resources
- Identifying business objectives and aligning a data strategy to support objectives (e.g. data in the right format, unbiased data, sufficient data)
- Identifying long-term strategic objectives and planning a data strategy to support objectives
- Ensuring that data is used in a way that is ethical and is within relevant regulatory and legislative constraints

Suggested Resources

Benyon-Davies, Paul, (2019), Business Information Systems, Red Globe Press

Stair, Ralph et al., (2020), Principles of Business Information Systems, Cengage Learning EMEA

Cadle, James, (2014), Developing Information Systems: Practical guidance for IT

Peppard, Joe et al., (2016), The Strategic Management of Information Systems: Building a Digital Strategy

Laudon, Kenneth and Jane, (2021), Management Information Systems: Managing the Digital Firm

Websites

<https://opentextbook.site/informationssystem2019/chapter/chapter-1-what-is-an-information-system-information-systems-introduction/>

Unit 8 Data Analytics and Machine Learning			
Unit aims	This unit will introduce machine learning algorithms from an implementational point of view. It will present a few of the popular algorithms without delving into the statistical behaviour or mathematical theory behind them. It will also introduce methods to evaluate and document their performance.		
Unit level	5		
Unit code	T/651/0157		
GLH	60		
Credit value	15		
Unit grading structure	Pass, Merit and Distinction		
Assessment guidance	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. For a Merit, all pass and all merit criteria must be met. For a Distinction, all pass, all merit and all distinction criteria must be met.</p> <p>Learners may need tutor support with identifying publicly available datasets and algorithms appropriate for Task 3.</p>		
Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	Pass	Merit	Distinction
1. Understand how machines learn from data	1.1 Describe the advantages and disadvantages of data mining in modern enterprises 1.2 Describe which types of models are used for different types of data 1.3 Explain why and how data preprocessing is done	1M1 Analyse why models typically require flattened and denormalised data	
2. Understand ways to evaluate the performance of models	2.1 Explain why and how to use separate training and validation datasets 2.2 Explain how a confusion matrix is constructed and what it shows	2M1 Discuss the dangers of overfitting a model	2D1 Evaluate how numeric performance metrics can enable automatic selection of models amongst multiple candidates

3. Understand and can apply popular machine learning algorithms	3.1 Describe the characteristics of a typical machine learning algorithm 3.2 Describe the type of data that the model uses, including any conditions on the data 3.3 Apply a typical machine learning algorithm to a data set	3M1 Analyse the performance of a machine learning algorithm	3D1 Evaluate the strengths and weaknesses of a machine learning algorithm
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Indicative Content

1. Understand how machines learn from data

- Data mining
 - Extracting information/patterns from large data sets
 - Integrate techniques from database/data warehouse, maths/stats, machine learning/artificial intelligence and many more
 - Statistical methods
 - Based on proven mathematical theory
 - Regression analysis, statistical summaries
 - Machine learning
 - Pragmatic results driven approach
 - Supervised and unsupervised algorithms
 - Reinforcement learning
 - Artificial intelligence
 - Inspired by biological processes, e.g. brain neurons, genetic selection or insect swarms
 - Advantages: better informed business knowledge, finding “golden nuggets” of knowledge, competitive advantage etc.
 - Disadvantages: privacy/safety issues, needing expensive experts, risks of data dredging etc.
- Learning from different types of data
 - Relational data
 - Often requires data to be denormalization
 - Object-oriented data
 - Often requires data to be flattened
 - Transactional and time-series data
 - Speech or text documents
 - Require natural language processing techniques, such as sentiment analysis, named entity recognition, document retrieval/querying, answering questions in natural languages etc.
 - Aggregated data, e.g. data warehouse marts
 - Transient/streaming data
- Steps to train models
 - Data preprocessing
 - The need for preprocessing

- Benefits of using reconciled data (e.g. data warehouses) vs raw data (e.g. data lakes)
- Descriptive statistics; central tendency, dispersion, graphic displays
- Data cleaning; missing values and noisy data
- Data integration and transformation
- Data reduction; aggregation, attribute selection, dimensionality reduction, sampling
- Model selection and creation
 - Considering multiple models
- Model training
- Model evaluation

2. Understand ways to evaluate the performance of models

- The importance of splitting input data or using separate data sets for:
 - Training data
 - Testing data
 - Validation data
- The importance of evaluating individual models
- Simple graphs of the model output
- Bias vs variance
 - Underfitting; imposing inappropriate restrictions on underlying data structures
 - Overfitting; not appropriately restricting the model complexity
- Regression accuracy
 - Residual error graphs; independent and identically distributed
 - Explained variance, mean squared error, R squared
- Classification and prediction accuracy
 - True positive, true negative, type I error, type II error
 - Specificity and sensitivity
 - Accuracy, precision and recall, ROC curve and Gini coefficient
 - Confusion matrixes for models with more than 2 target classes
 - Chi-squared test

3. Understand and apply popular machine learning algorithms

- Typical machine learning algorithms, possible examples:
 - Classification and prediction (choose a maximum of 3)
 - Regression; linear, non-linear
 - Decision trees
 - Bayesian classification
 - Rule-based classification
 - Neural networks; backpropagation, deep learning
 - Support vector machines
 - K-Nearest-neighbour classifiers
 - Genetic algorithms
 - Cluster analysis
 - K-Means clustering
 - Time-series mining
 - Recurrent neural networks

- Graph mining
 - PageRank algorithm
- Text mining
 - Natural Language Processing
- The characteristics for each algorithm
 - What type of data the algorithm uses
 - The format of the data; tabular, graphs
 - The data type of columns; binary/categorical, continuous etc.
 - Restrictions on relationships between observations/data points
 - What parameters the algorithm takes, if any
 - The type of model learning; supervised, unsupervised
 - What the algorithm produces
 - Classification, regression, prediction, recommendations, annotations
 - The model strengths and weaknesses
 - How to evaluate the model performance
 - The graphs to use and what they show
 - The metrics to use, what they tell and whether they should be maximised or minimised

Suggested Resources

Müeller, A. C. and Guido, S., (2016), *Introduction to Machine Learning in Python*, O'Reilly

Deisenroth, M. P., (2020), *Mathematics for Machine Learning*, Cambridge University Press

Han, J. and Kamber, M., (2006), *Data Mining: Concepts and Techniques*, Morgan Kaufmann

Smolyakov, V., (2023), *Machine Learning Algorithms in Depth*, Manning

Websites

<https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/>

<https://www.simplilearn.com/10-algorithms-machine-learning-engineers-need-to-know-article>

<https://machinelearningmastery.com/a-tour-of-machine-learning-algorithms/>

https://www.w3schools.com/python/python_ml_getting_started.asp

<https://www.coursera.org/learn/machine-learning-with-python>

Unit 10 Client and Server Technologies	
Unit aims	<p>This unit enables learners to understand how data can be transmitted between different client and server technologies in both unsecured and secured states.</p> <p>UDP and TCP based connections are the very heart of the transport layer of the ISO OSI 7-layer model, providing a way for commercial applications to transfer data between a range of client and server-oriented technologies.</p> <p>Although not intended as a networking unit as such, any aspiring software developer should have both an appreciation and technical understanding of the processes required to achieve this type of application connectivity in a commercially oriented programming language.</p>
Unit level	5
Unit code	A/651/0159
GLH	60
Credit value	15
Unit grading structure	Pass, Merit and Distinction
Assessment guidance	<p>Socket-based communication between client and server technologies using either UDP or TCP transport layer protocols can be implemented in several different programming languages, including C, C++, Python and Rust. Learners may select any available language and can, if they choose, use a combination of two different languages to demonstrate the standardisation of communication methods via the Sockets library.</p> <p>Data may be transmitted using a simple client/server set-up using the loopback address with packets captured through available tools, e.g. Wireshark etc. The operating system is equally the centre's choice, but a Linux distribution is recommended for ease of development and its abundant native tools.</p> <p>The number of Merit and Distinction criteria for this unit are higher than in other units, but this reflects technical skills needed rather than a significant requirement of evidence. Many of the criteria can be evidenced through annotated screenshots.</p> <p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. For a Merit, all pass and all merit criteria must be met. For a Distinction, all pass, all merit and all distinction criteria must be met.</p>

Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	Pass	Merit	Distinction
1. Understand transport layer protocols used in computer networks	1.1 Describe the concept, features and functionality of a network socket 1.2 Describe the purpose of a transport layer protocol 1.3 Explain why different transport layer protocols are implemented 1.4 Explain the role of the Berkeley Sockets API	1M1 Compare and contrast UDP and TCP transport layer protocols	
2. Can implement UDP communication between client and server	2.1 Code a working software application for a UDP client in a selected programming language 2.2 Code a working software application for a UDP server in a selected programming language	2M1 Transmit data between client and socket using a UDP connectionless protocol	2D1 Use network protocol analysis tools to capture and confirm network transmission between client and server
3. Can implement TCP communication between client and server	3.1 Code a working software application for a TCP client in a selected programming language 3.2 Code a working software application for a TCP server in a selected programming language	3M1 Transmit data between client and socket using a TCP connection-oriented protocol	3D1 Use network protocol analysis tools to capture and confirm network transmission between client and server
4. Can use SSL or TLS protocols to create secure communication between client and server technologies	4.1 Describe the role of SSL and TLS 4.2 Explain the role and significance of the OpenSSL cryptographic library	4M1 Transmit data programmatically between client and socket using a UDP connectionless protocol with	4D1 Use network protocol analysis tools to capture and confirm encrypted network transmission

	for secure communication 4.3 Explain the functions, features and role of packet capturing tools	SSL cryptographic implementation	between client and server
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1 Understand transport layer protocols used in computer networks

What is a network socket?

- Description of a socket as a programming interface that provides a communication endpoint for processes on a network
- Socket components: IP address (V4, V6); Port Number
- Concept of reserved and ethereal port numbers
- Socket types:
 - Stream Sockets (TCP)
 - Datagram Sockets (UDP)
- Traditional socket lifecycle: create, configure, use and close
- Blocking vs. Non-blocking operations; send, receive etc.
- Inter-process Communication (IPC)

Transport layer protocol

- Transport layer with respect to ISO OSI 7-layer model
- Role of the Transport Layer to facilitate communication between devices using end-to-end communication
- Key aspects:
 - Segmentation and reassembly of messages and segments
 - Establishment, maintenance, and termination of connections between devices
 - Error detection and correction
 - Congestion control via flow control
 - Multiplexing and demultiplexing
- Implemented Transport Layer protocols include (but not limited to):
 - Transmission Control Protocol (TCP)
 - User Datagram Protocol (UDP)

Why do UDP and TCP both exist?

- Different approaches to communication between network devices, e.g. client, server etc. is required; typical use cases, e.g. videogame vs. chat system, network file backup etc.
- Considerations include:
 - Reliability vs. Speed
 - Ordered vs. Unordered Delivery of data
 - Connection-oriented vs. Connectionless
 - Resource usage
 - Network suitability
 - Requirement for multicast and broadcast
 - Software application requirements

What is Berkeley Sockets?

- Role as an API (Application Programming Interface) for network communication
- Origin
- Set of structures and functions for creating, configuring and managing network sockets
- Enables network communication between devices on a network etc.
- Support in different programming languages, e.g. C, C++, Python, Rust etc.
- Key features:
 - Creation of socket (UDP, TCP)
 - Concept of binding socket with address and port
 - Establishing a connection; listening and accept on server
 - Transmission of data; send and receive
 - Terminating connection; close
 - Error handling; human-readable error message for socket issues
 - IPv4 and IPv6 support
 - Portability across different platforms (UNIX, Linux, MacOS, Microsoft Windows via Winsock etc.)

2 Can implement UDP communication between client and server

- Steps required to create a UDP client in target programming language using a Berkeley Sockets (or compatible) library
- Appropriate error handling
- Testing
- Analysis of data using appropriate network protocol analyser tool, e.g. Wireshark

3 Can implement TCP communication between client and server

- Steps required to create a TCP client in target programming language using a Berkeley Sockets (or compatible) library
- Appropriate error handling
- Testing
- Analysis of data using appropriate network protocol analyser tool, e.g. Wireshark

4 Can use SSL or TLS protocols to create secure communication between client and server technologies

- Cryptographic protocols that provide secure network communication, e.g.
 - Secure Sockets Layer (SSL)
 - Transport Layer Security (TLS)
- History, “Handshake” concept flaws, evolution/versions, and interoperability
- OpenSSL as an open-source library; a set of cryptographic functions and protocols
- Use in the industry, e.g. web servers, email servers, custom network applications etc.
- Key features including:
 - Cross-platform support
 - Algorithms (AES, ECC, hashing functions etc.)
 - SSL/TLS protocol support
 - X.509 digital certificate creation and management
 - Public Key Infrastructure (PKI) key pairs, certificate signing requests (CSRs) etc.
 - Command line tools
 - Libraries for programming languages
- How to implement SSL for UDP connection etc.

- Network protocol analysis tools; configuration, use and searching/filtering packets etc.

Suggested Resources

Van Winkle, Lewis, 2019, Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code, Packt Publishing

Silaghi, Marius, 2021, Network Programming with Laboratory Work in C, C++ and Java, Self-published

Donahoo, Michael J., & Calvert, Kenneth L., 2009, TCP/IP Sockets in C: Practical Guide for programmers (TCP/IP Sockets in C Bundle), Morgan Kaufmann

Websites

www.skillsyouneed.com

www.coursera.org

www.geeksforgeeks.org/socket-in-computer-network/

www.techtarget.com/searchnetworking/feature/How-to-get-started-with-socket-programming-for-beginners

www.geeksforgeeks.org/transport-layer-protocols/

www.includehelp.com/computer-networks/functions-of-transport-layer-in-the-osi-model.aspx

www.freecodecamp.org/news/tcp-and-udp-protocols/

www.freecodecamp.org/news/tcp-vs-udp/

www.csparks.org/teaching/2007-2008/networked-systems/lecture04.pdf

www.geeksforgeeks.org/berkeleys-algorithm/

www.geeksforgeeks.org/udp-server-client-implementation-c/

www.geeksforgeeks.org/tcp-server-client-implementation-in-c/

Unit 16 Network and Cloud Design and Configuration			
Unit aims	This unit aims to develop the skills required to be a network engineer with advanced problem-solving and troubleshooting skills. It involves exploration of cloud infrastructure architecture to design and provision cloud-based solutions, providing the opportunity to discuss, apply and analyse network and cloud infrastructure security measures.		
Unit level	5		
Unit code	R/651/0165		
GLH	60		
Credit value	15		
Unit grading structure	Pass, Merit and Distinction		
Assessment guidance	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. For a Merit, all pass and all merit criteria must be met. For a Distinction, all pass, all merit, and all distinction criteria must be met.</p> <p>Learners will need to select an appropriate organisation where they have access to suitable materials.</p>		
Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	Pass	Merit	Distinction
1. Understand advanced problem-solving of network infrastructure	1.1 Gather information to replicate or diagnose the issue 1.2 Identify access and security criteria 1.3 Align with the correct framework		
2. Can research, plan and document a migration to integrate existing systems into the cloud	2.1 Research and document the steps required for a migration into a datacentre 2.2 Document the deployment and configuration of the clusters and applications	2M1 Report on system migration and a chosen management method	2D1 Deploy a SAN cluster system

3. Can apply security measures to cloud infrastructure and networks	3.1 Explain current security management frameworks 3.2 Conduct risk assessment 3.3 Explain cloud security principles	3M1 Make recommendations on the deployment and management of the security measures in relation to a specific scenario	3D1 Configure security around the deployed SAN cluster
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Indicative Content

1. Understand advanced problem-solving of network infrastructure

- Diagnosis tools and techniques
 - Test networks or sandbox
 - Artificial Neural Networks using multilayer perceptron (MLP) architecture
 - Adaptive fault diagnosis of data replication
 - Transfer relation network (TRN)
 - Model based fault detection
 - Spectral analysis
 - Parameter Estimation of autoregressive moving average models
 - State estimation
 - Parity equation approaches
 - Knowledge based fault detection
 - Expert systems
 - Knowledge graphs
 - Historical monitoring data
 - Data-Driven methods
 - Fischer discriminant analysis
 - Partial least squares
 - Principle component analysis
 - Independent component analysis
 - Deep learning methods
 - Automatic deep encoder/decoder
 - Deep belief network
 - Generative adversarial network
 - Capsule network
 - Graph neural network
 - Automatic fault diagnosis
- Access and security criteria
 - Access control, including biometric devices
 - Identify and access management (IAM) software
 - Forefront identify manager
 - Microsoft Azure
 - Okata identity management
 - Physical security measures
 - Telecommunication infrastructure standard for data centers (TIA-942)
- Frameworks
 - Fault tolerance mechanisms

- Data centre Infrastructure management (DCIM) software
 - Serverfarm
 - Sunbird
 - Netzoom
 - Siemens
 - Panduit
- Problem solving frameworks
 - Root cause analysis
 - Pheonix checklist
 - CIRCLES method
 - DMAIC model

2. Can research, plan and document a migration to integrate existing systems into the cloud

- Datacentre migration planning
 - Establish roles
 - Choose level of integration
 - Shallow
 - Deep
 - Single or multi-cloud
 - Create a data migration plan
 - Establish KPI's
 - Establish baselines(pre-migration)
 - Prioritise components
 - Identify service connections
- Configuration of clusters and applications
 - Size and purchase clusters
 - Cluster deployments
 - Kubernetes
 - Docker
 - Rancher
 - K9s
 - Nutanix OS
 - Configuration infrastructure
 - SUSE Linux enterprise high availability extension
 - Oracle real application cluster
 - Red Hat cluster suite
 - Ubuntu
 - VMware vSphere
 - Windows server failover clustering
 - IBM PowerHA system mirror
 - Application migration
 - Prism software
 - AWS server and application migration services
 - Cisco AppDynamics
 - Azure Migrate
- Migration monitoring and management
 - Single interface management
 - Datadog
 - SolarWinds data centre management solutions
 - AWS database migration service

- IBM lift (for IBM cloud)

3. Can apply security measures to cloud infrastructure and networks

- Security management frameworks
 - Physical security measures
 - Layered security
 - Defence in depth
 - USA
 - NIST SP 800-53
 - NIST 800-39
 - NIST 800-37
 - NIST 800-30CIS Critical Security Controls
 - RoW
 - ISO27001
 - ISO20000
 - ISAE3402
 - UK
 - National technical authority for physical and personnel protective security (NPSA) guidelines
- Risk assessment and mitigation
 - ISO9001
 - Prioritise assets
 - Pen testing
 - IT Audits
 - IT Risk assessment
 - Vulnerability Assessment
- Security principles
 - Methods of monitoring and reviewing remote access
 - Education of employees for security awareness
 - Employee screening
 - Data encryption (end to end encryption E2EE)
 - Network segmentation
 - Firewall and VPN configuration
 - Resilience for communication methods, power supply, supply chain
 - Standards:
 - EN50600
 - TIA942
 - Uptime Tiers

Suggested Resources

Davis, Cornelia, 2019, Cloud Native Patterns: Designing Change-Tolerant Software, Manning Publications

Erl, Thomas et al., 2023, Cloud Computing: Concepts, Technology, Security, and Architecture, Pearson Publishing

Ruparelia, Nayan B., 2023, Cloud Computing, revised and updated edition, MIT Press

Limoncelli, Thomas A. et al., 2014, The Practice of Cloud System Administration: Designing and Operating Large Distributed Systems, Volume 2, Addison-Wesley Professional

Websites

<https://www.npsa.gov.uk/data-centre-security>

<https://learn.microsoft.com/en-us/azure/architecture/>

<https://www.comptia.org/content/guides/cloud-network-setup-guide>

<https://www.cisco.com/c/en/us/solutions/collateral/enterprise/design-zone-security/zt-network-cloud-dg.html>

<https://docs.aws.amazon.com/whitepapers/latest/establishing-your-cloud-foundation-on-aws/network-designing-and-planning.html>

https://www.ipSPACE.net/Designing_a_Private_Cloud_Network_Infrastructure

Cloud Diagrams and supporting blogs:

<https://www.gliffy.com/resources/cloud-architecture-diagrams>

<https://cloud.google.com/blog/topics/developers-practitioners/10-considerations-help-you-design-cloud-networks>

Unit 17 Advanced Project			
Unit aims	This unit is designed to enable learners from any pathway to resolve a business problem or show how a business opportunity could be pursued using appropriate tools and technologies. The project should be a suitable match to their study pathway and should make use of the knowledge and skills gained when studying the other units making up their qualification.		
Unit level	5		
Unit code	T/651/0166		
GLH	60		
Credit value	15		
Unit grading structure	Pass, Merit and Distinction		
Assessment guidance	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. For a Merit, all pass and all merit criteria must be met. For a Distinction, all pass, all merit, and all distinction criteria must be met.</p> <p>The assessment will be made against the planning of the project, the use of project management tools, including the creation of a risk register, and a plan that outlines how the project should be reviewed so that valuable lessons are learned. Learners may implement their project/solution if they choose. However, the implementation of the project is not required for assessment purposes.</p> <p>This is the synoptic unit for the qualification and should be delivered as the final unit for learners in their qualification.</p>		
Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	Pass	Merit	Distinction
1. Understand the tools and techniques of IT project management	1.1 Identify and define a problem or opportunity that would benefit from a computing solution, defining its scope and its key stakeholders 1.2 Choose appropriate stakeholder engagement channels and explain the reasons why good stakeholder management is important	1M1 Justify your choice of stakeholder engagement channels	1D1 Evaluate how stakeholder engagement should be managed

	1.3 Use project management tools to plan a project		
2. Understand risk and risk mitigation in relation to IT projects	2.1 Create a risk register 2.2 Identify the risks associated with the project		2D1 Recommend and justify mitigations to manage the risks identified in the risk register
3. Understand how and why projects are reviewed and how learning from project reviews is embedded into future practice	3.1 Plan a post-project review 3.2 Explain who should be included in the review process and why 3.3 Explain why projects are reviewed and how the outcomes of reviews are used to inform future practice	3M1 Analyse the impact that a lack of involvement and commitment by stakeholders/users will make on the project	

Indicative Content

1. Understand the tools and techniques of IT project management

- Project management tools
 - Project management software
 - Risk register
- Planning and implementing projects (managing workflow)
 - Plan project activities including timescales
 - Plan regular reviews to look at: progress, budget, stakeholder/user feedback
 - Risk register
 - Implementing the project against the plan
- Stakeholder engagement
 - Identifying key stakeholders and key relationships
 - Identifying key messages and ensuring consistency
 - Identifying appropriate communication channels for different types of stakeholders
 - Importance of good stakeholder engagement:
 - Involve stakeholders in the project
 - Manage expectations
 - Set the tone for the project
 - Ensure that stakeholders have a common understanding of the objectives of the project

2. Understand risk and risk mitigation in relation to IT projects

- Components of a risk register and how to use it (RAG rating, Red Amber Green)
- Key risks to IT projects with mitigations:
 - Costs - know your budget and review it regularly

- Potential scope creep - know the boundaries of the project and be prepared to say no
- Stakeholder/user engagement - know your stakeholders/users and plan the right level of interaction with them; plan when users will be available so that prototypes or completed features or functionality can be shared for feedback
- Data preparation - examine your data needs and any preparation work that must be completed to ensure that the data is in the right format and is available on time
- Deadlines - use software to plan and monitor activity (and make files available to teams); review activity regularly; create an environment where your team will alert you to emerging problems
- Project handover - discuss how the project will be handed over with customers and end users to ensure that their expectations are met
- Testing - ensure that test data is prepared and used, but also that the customer provides enough real data for testing purposes
- The unexpected - try to identify emerging issues quickly; have a disaster recovery plan
- Regulatory/legislative requirements - which regulatory/legislative requirements are relevant
- Ethical considerations - are there any ethical considerations (such as how data is used, how programmed systems are made secure, how the physical systems themselves are protected)

3. Understand how and why projects are reviewed and how learning from project reviews is embedded into future practice

- What to review (e.g.):
 - Each phase of the project lifecycle: feasibility study/systems analysis, design, planning, implementation, testing, handover
 - Involvement and commitment of stakeholders and users
 - Management of timescales
 - Management of costs
- Who to include in a review:
 - Internal: users, teams, departments, business owners, directors, employees, shareholders
 - External: external client or customer and their users, suppliers, the public, government, local community
- Reasons for review:
 - Examining how well project objectives were met
 - Examining any issues such as how well risks were managed
 - Enabling all stakeholders to share their perspectives on the activities and outcomes of a project
 - Identifying good practice so that this can be used in future practice
 - Identifying what went wrong to avoid this happening again
 - Identifying any training or development needs for development and project staff
- Potential impact of stakeholders/users lack of commitment to an IT project (e.g. project delays, product does not have expected functionality, stakeholder/user dissatisfaction in project outcomes, potential litigation for failing to deliver contract)

Suggested Resources

Fishpool, B. and Fishpool, M., 2020, Software Development in Practice, BCS (The Chartered Institute for IT)

Hanke, Daniel, (2022), The 10 most important methods in traditional project management: Rapidly acquire the most important skills to manage your projects successfully, Self-published

Hayden, Jack, 2023, Project Management Mastery: A comprehensive guide to successfully implementing the core principles of project planning and scope management from concept to completion, Self-published

Hughes, Bob, 2019, Project Management for IT-Related Projects: 3rd Edition, BCS (The Chartered Institute for IT)

Websites

https://assets.publishing.service.gov.uk/media/5bc72a97ed915d0ad7db6cd0/Project_Business_Case_2018.pdf

www.capterra.com/resources/mitigate-project-management-risks/

www.asana.com/resources/project-risks

www.stakeholdermap.com/risk/register-common-project-risks.html

www.tractivity.co.uk/blog/managing-stakeholder-relationships

www.consultationmanager.com/7-tactics-to-maintain-positive-stakeholder-relationships/

<https://yourprojectmanager.com.au/managing-costs-project-manager/>