



# Level 5 Extended Diploma in Computer Science

Specification (For Centres)  
Date November 2025

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## About QUALIFI

QUALIFI is recognised and regulated by Ofqual (Office of Qualifications and Examinations Regulator). Our Ofqual reference number is RN5160. Ofqual regulates qualifications, examinations, and assessments in England.

As an Ofqual recognised Awarding Organisation, QUALIFI is required to carry out external quality assurance to ensure that centres approved for the delivery and assessment of QUALIFI's qualifications meet the required standards. This comprises centre approval, qualification approval and ongoing monitoring through our External Quality Assurance and annual centre monitoring processes.

### Why Choose QUALIFI Qualifications?

QUALIFI qualifications aim to support learners to develop the necessary knowledge, skills and understanding to support their professional development within their chosen career and/or to provide opportunities for progression to further study.

Our qualifications provide opportunities for learners to:

- apply analytical and evaluative thinking skills
- develop problem-solving and creativity to tackle problems and challenges
- exercise judgement and take responsibility for their decisions and actions
- develop the ability to recognise and reflect on personal learning and improve their personal, social, and other transferable skills.

### Employer Support for the Qualification Development

During the development of this qualification QUALIFI consulted with a range of employers, providers and existing centres (where applicable) to ensure rigour, validity and demand for the qualification and to ensure that the development considers the potential learner audience for the qualification and assessment methods.

### Equality, Diversity and Inclusion (EDI)

QUALIFI qualifications are developed to be accessible to all learners who are capable of attaining the required standard. QUALIFI promotes equality, diversity and inclusion across all aspects of the qualification process. Centres are required to implement the same standards of EDI and ensure teaching and learning are free from any barriers that may restrict access and progression. For further details please refer to QUALIFI's *Equality, Diversity and Inclusion Policy*.

Learners with any specific learning needs should discuss this in the first instance with their approved centre who will refer to QUALIFI's *Reasonable Adjustment and Special Consideration Policy*.

## Qualification Title and Accreditation Number

This qualification has been accredited to the Regulated Qualification Framework (RQF) and has its own unique Qualification Accreditation Number (QAN). This number will appear on the learner's final certification document. Each unit within the qualification has its own RQF code. The QAN for this qualification is as follows:

**Level 5 Extended Diploma in Computer Science-610/6788/X**

## Qualification Aims and Learning Outcomes

### Aims of the QUALIFI Level 5 Extended Diploma in Computer Science

The aim of the QUALIFI Level 5 Extended Diploma in Computer Science is to provide learners with an understanding of computer science principles, emerging technologies and their role in solving real-world problems. Learners will develop practical skills for a career in software development, systems analysis, cybersecurity, data science, and other evolving areas of the technology sector .

### Learning Outcomes of the QUALIFI Level 5 Extended Diploma in Computer Science

The overall learning outcomes of the qualification are for learners to:

- Identify, analyse, design, develop, implement, verify and document the requirements for a computing environment.
- Diagnose, troubleshoot, document and monitor technical problems using appropriate methodologies and tools.
- Analyse, design, implement and maintain secure computing environments.
- Analyse, develop and maintain robust computing system solutions through validation testing and industry best practices.
- Communicate and collaborate with team members and stakeholders to ensure effective working relationship.
- Select and apply strategies for personal and professional development to enhance work performance.
- Apply project management principles and tools when responding to requirements and monitoring projects within a computing environment.
- Adhere to ethical, social media, legal, regulatory and economic requirements and/or principles in the development and management of the computing solutions and systems.
- Investigate emerging trends to respond to technical challenges.
- Analyse, plan, design, implement and administer computer systems and cloud solutions.

The learning outcomes and assessment criteria for each unit are outlined in the unit specifications.

## Delivering the Qualification

All centres are required to complete an approval process to be recognised as an approved centre. Centres must have the ability to support learners and:

- have in place qualified and experienced assessors. All assessors are required to undertake regular continued professional development (CPD)
- access to the physical resources needed to support the delivery of the qualification and learner achievement.

Centres must commit to working with QUALIFI and its team of External Quality Assurers (EQAs). Approved centres will be monitored by QUALIFI EQAs to ensure compliance with QUALIFI requirements and to ensure that learners are provided with appropriate learning opportunities, guidance, and formative assessment.

QUALIFI, unless otherwise agreed:

- sets all assessments;
- quality assures assessments prior to certification;
- provides the criteria to award the final mark and issues certificates.

## Centre staffing

Staff delivering this qualification should:

- be occupationally competent and/or technically knowledgeable in the area[s] they are assessing,
- have recent relevant experience in the specific area they will be assessing and quality assuring.
- hold, or be working towards, the relevant Assessor/ Internal Quality Assurers (IQAs) qualification (s).

Assessors are assessing learner performance in a range of tasks to ensure the evidence they produce meets the requirements of the unit assessment criteria. To do this effectively assessors need a thorough understanding of assessment and quality assurance practices, as well as in-depth technical understanding related to the qualifications they are assessing.

To support assessors and the centre's internal quality systems, IQAs must have appropriate teaching and vocational skills, knowledge and expertise and be familiar with the occupation and technical content covered within the qualification.

## Continuing professional development (CPD)

Centres are expected to support the CPD of their staff to maintain current and up-to-date knowledge of the occupational area and ensure best practice in delivery, mentoring, training, assessment and quality assurance.

## Quality assurance

Approved Centres must have effective quality assurance systems in place to ensure robust qualification delivery and assessment, which includes internal monitoring and review procedures.

Qualifi will appoint approved External Quality Assurers (EQAs) to monitor the assessment and internal quality assurance carried out by centres and ensure that assessment is valid and reliable. Please see QUALIFI's *External Quality Assurance Policy*.

## Learner Recruitment, Induction and Registration

### Recruitment

Approved Centres are responsible for reviewing and making decisions as to the applicant's ability to complete the learning programme successfully and meet the demands of the qualification. The initial assessment by the centre will need to consider the support that is readily available or can be made available to meet individual learner needs as appropriate.

During recruitment, approved centres need to provide learners with accurate information on the title and focus of the qualification for which they are studying.

The qualification has been designed to be accessible without artificial barriers that restrict access. For this qualification, applicants must be aged 18 or over.

In the case of applicants whose first language is not English, centres may assess learners at the time of entry.

### Entry Criteria

The qualification has been designed to be accessible without artificial barriers that restrict access and progression. Entry to the qualifications will be through centre interview and learners will be expected to hold two passes at A-Levels or equivalents.

Learners without formal school leaving qualifications, can be considered on an individual basis depending their work experience.

### Learner induction

Approved Centres should ensure all learners receive a full induction to their study programme and the requirements of the qualification and its assessment.

All learners should expect to be issued with the course handbook and a timetable and meet with their personal tutor and fellow learners. Centres should assess learners carefully to ensure that they are able to meet the requirements of the qualification and that, if applicable, appropriate pathways or optional units are selected to meet the learner's progression requirements.

Centres should check the qualification structures and unit combinations carefully when advising learners. Centres will need to ensure that learners have access to a full range of information, advice and guidance to support them in making the necessary qualification and unit choices.

All learners must be registered with QUALIFI within the deadlines outlined in the *QUALIFI Registration, Results and Certification Policy and Procedure*.

### **Recognition of Prior Learning**

Qualifi recognises and accepts credit (s) from regulated awarding organisations and/or universities that are at the same level, or higher, and which can be mapped to the units in our qualifications. For our theory-based qualifications we will only accept a maximum of 70% of prior/existing credits and reserve the right to not accept any credit dependent on where it was earned. All claims for RPL must be supported by a certificate or transcript of achievement issued by the awarding organisation or university. No credit will be given without a certificate or transcript from a regulated awarding organisation or university.

There must be a minimum 70% overlap between units or learning outcomes for Qualifi to consider approving the request for exemption.

A maximum of 70% of units in a qualification can be submitted for exemption using this method. The remaining 30% (or more) need to be units completed in full and learning outcomes demonstrated using Qualifi's assessments.

Evidence of learning must be valid and reliable. For full guidance on RPL please refer to QUALIFI's *Recognition of Prior Learning Policy*.

### **Data Protection**

All personal information obtained from learners and other sources in connection with studies will be held securely and will be used during the course and after they leave the course for a variety of purposes and may be made available to our regulators. These should be all explained during the enrolment process at the commencement of learner studies. If learners or centres would like a more detailed explanation of the partner and QUALIFI policies on the use and disclosure of personal information, please contact QUALIFI via email [support@QUALIFI-international.com](mailto:support@QUALIFI-international.com)

### **Learner Voice**

Learners can play an important part in improving the quality through the feedback they give. In addition to the ongoing discussion with the course team throughout the year, centres will have a range of mechanisms for learners to feed back about their experience of teaching and learning.

## Professional Development and Training for Centres

QUALIFI supports its approved centres with training related to our qualifications. This support is available through a choice of training options offered through publications or through customised training at your centre.

The support we offer focuses on a range of issues including:

- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing learner-centred learning and teaching approaches
- building in effective and efficient quality assurance systems.

Please contact us for further information.

## Progression and Links to other QUALIFI Programmes

Completing the **QUALIFI Level 5 Extended Diploma in Computer Science** will enable learners to progress to:

- other QUALIFI qualifications
- HE programmes
- Employment in an associated profession.

## Qualification Structure and Requirements

### Credits and Total Qualification Time (TQT)

The QUALIFI Level 5 Extended Diploma in Computer Science is made up of 240 credits which equates to 2400 hours of TQT.

**Total Qualification Time (TQT):** is an estimate of the total amount of time that could reasonably be expected to be required for a learner to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification.

Examples of activities that can contribute to Total Qualification Time include: guided learning, independent and unsupervised research/learning, unsupervised compilation of a portfolio of work experience, unsupervised e-learning, unsupervised e-assessment, unsupervised coursework, watching a prerecorded podcast or webinar, unsupervised work-based learning.

**Guided Learning Hours (GLH):** are defined as the time when a tutor is present to give specific guidance towards the learning aim being studied on a programme. This definition includes lectures, tutorials and supervised study in, for example, open learning centres and learning workshops, live webinars, telephone tutorials or other forms of e-learning

supervised by a tutor in real time. Guided learning includes any supervised assessment activity; this includes invigilated examination and observed assessment and observed work-based practice.

### **Rules of Combination for QUALIFI Level 5 Extended Diploma in Computer Science**

Learners must complete the 20 mandatory units to a total of 240 credits to achieve the .QUALIFI Level 5 Extended Diploma in Computer Science.

| Unit Number | Mandatory Units                         | Level | Credit | TQT | GLH |
|-------------|-----------------------------------------|-------|--------|-----|-----|
| H/651/8669  | Computer Concepts and Applications      | 5     | 12     | 120 | 60  |
| L/651/8670  | Introduction to Javascript              | 4     | 12     | 120 | 60  |
| M/651/8671  | Ethics in Technology                    | 5     | 12     | 120 | 60  |
| R/651/8672  | Introduction to Networking              | 4     | 12     | 120 | 60  |
| T/651/8673  | Fundamentals of Information Technology  | 4     | 12     | 120 | 60  |
| Y/651/8674  | Introduction to Linux                   | 4     | 12     | 120 | 60  |
| A/651/8675  | Introduction to Java                    | 4     | 12     | 120 | 60  |
| D/651/8676  | Programming in Python                   | 4     | 12     | 120 | 60  |
| F/651/8677  | Introduction to Computing               | 4     | 12     | 120 | 60  |
| H/651/8678  | Programming in C                        | 4     | 12     | 120 | 60  |
| J/651/8679  | Programming in C++                      | 5     | 12     | 120 | 60  |
| M/651/8680  | Data Structure and Algorithms           | 4     | 12     | 120 | 60  |
| R/651/8681  | Network and Systems Security            | 5     | 12     | 120 | 60  |
| T/651/8682  | Cybersecurity                           | 5     | 12     | 120 | 60  |
| Y/651/8683  | Database Fundamentals                   | 4     | 12     | 120 | 60  |
| A/651/8684  | Software Engineering                    | 5     | 12     | 120 | 60  |
| D/651/8685  | Introduction to Operating Systems       | 5     | 12     | 120 | 60  |
| F/651/8686  | Introduction to Artificial Intelligence | 5     | 12     | 120 | 60  |

| Unit Number  | Mandatory Units            | Level | Credit     | TQT         | GLH         |
|--------------|----------------------------|-------|------------|-------------|-------------|
| H/651/8687   | Database Programming       | 5     | 12         | 120         | 60          |
| J/651/8688   | System Analysis and Design | 5     | 12         | 120         | 60          |
| <b>Total</b> |                            |       | <b>240</b> | <b>2400</b> | <b>1200</b> |

### Achievement Requirements

Learners must demonstrate they have met all learning outcomes and assessment criteria for all the required units to achieve this qualification. QUALIFI will issue e-certificates directly to all successful learners registered with an approved QUALIFI centre.

### Awarding Classification/Grading

This qualification grading is: **Pass/Fail**.

All units will be internally assessed through written assignment internally marked by the QUALIFI approved centre and subject to external quality assurance by QUALIFI.

### Assessment Strategy and Methods

QUALIFI will provide written assessment tasks for each unit of this qualification. These tasks will address all learning outcomes and related assessment criteria, all of which must be demonstrated/passed, to achieve the qualification.

The tasks will enable learners to draw on work-related information and/or examples wherever possible. Some assessment tasks will contain a practical assignment which will require observation by an assessor, see Assessment Guidance for further information.

The assessment tasks will require learners to draw on real organisational information or case studies to illustrate their answers. To support this activity during the programme of learning, centres are required to make sure that they include case studies of relevant organisations and, wherever possible, encourage learners to draw on work-place opportunities to undertake research and investigation to support their learning.

QUALIFI provides a user-friendly e-portfolio system for candidates to upload their assessment evidence and assignments for Assessors to mark and IQAs to quality assure. Approved centres should undertake the QUALIFI centre development courses to understand how to use the e-portfolio and the benefits to learners and the centre.

Learner assessments will be internally marked by the approved centre and will be subject to external quality assurance by QUALIFI prior to certification.

All learning outcomes and related assessment criteria must be demonstrated/passed in order to achieve the qualification. To achieve a 'pass' for each of the units, learners must provide evidence to demonstrate that they have fulfilled all the learning outcomes and meet the standards specified by all assessment criteria.

## 1: Formative Assessment

Formative assessment is an integral part of the assessment process, involving both the Tutor/Assessor and the learner about their progress during the course of study. Formative assessment takes place prior to summative assessment and focuses on helping the learner to reflect on their learning and improve their performance and does not confirm achievement of grades/pass-mark, at this stage.

The main function of formative assessment is to provide feedback to enable the learner to make improvements to their work. This feedback should be prompt, so it has meaning and context for the learner and time must be given following the feedback for actions to be complete. Feedback on formative assessment must be constructive and provide clear guidance and actions for improvement. All records should be available for auditing purposes, as QUALIFI may choose to check records of formative assessment as part of our ongoing quality assurance. Formative assessments will not contribute to the overall mark/achievement of the units.

## 2: Summative Assessment

Summative assessment is used to evaluate learner competence and progression at the end of a unit or component. Summative assessment should take place when the assessor deems that the learner is at a stage where competence can be demonstrated.

Learners should be made aware that summative assessment outcomes are subject to confirmation by the Internal Quality Assurer (IQA) and External Quality Assurer (EQA) and thus is provisional and can be overridden. Assessors should annotate on the learner work where the evidence supports their decisions against the assessment criteria. Learners will need to be familiar with the assessment and grading/marking criteria so that they can understand the quality of what is required.

| Formative Assessment                     | Summative Assessment                                                    |
|------------------------------------------|-------------------------------------------------------------------------|
| used during the learning process         | used at the end of the learning process                                 |
| provides feedback on learning-in-process | evaluates achievement against learning outcomes and assessment criteria |
| dialogue-based, ungraded                 | graded Pass / Refer                                                     |

Evidence of both formative and summative assessment **MUST** be made available at the time of external quality assurance – EQA.

## Unit Specifications

### Unit 1: Computer Concepts and Applications

Unit code: H/651/8669

RQF Level: 5

#### Unit Aim

This unit aims to provide learners with a comprehensive understanding of essential concepts in computer science, covering fundamental principles, hardware components, software applications, networking fundamentals, and security considerations. Learners will develop a solid understanding of computer systems, software applications, programming fundamentals, database management, systems development, and security protocols.

#### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                           | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                             |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand the use and functioning of computer, information and telecommunications systems                | 1.1                                                                           | Analyse the historical evolution of computers and their impact on modern society.                                                                                           |
|                                                                    |                                                                                                           | 1.2                                                                           | Compare and contrast various types of computer systems and evaluate their respective functionalities, as well as the influence of computers on different work environments. |
|                                                                    |                                                                                                           | 1.3                                                                           | Explain the differences between information systems and information technology, using practical examples.                                                                   |
|                                                                    |                                                                                                           | 1.4                                                                           | Explain the functioning of telecommunications systems and various network topologies                                                                                        |
|                                                                    |                                                                                                           | 1.5                                                                           | Analyse ethical, legal, and privacy issues related to technology management and usage.                                                                                      |
| 2.                                                                 | Be able to implement appropriate security measures to safeguard systems and data against computer threats | 2.1                                                                           | Implement appropriate security measures to safeguard systems and data against computer threats                                                                              |
| 3.                                                                 | Be able to develop strategies and systems to manage and interpret data                                    | 3.1                                                                           | Design and implement robust database systems, taking into account the intricacies of data types, relational databases, and SQL.                                             |
|                                                                    |                                                                                                           | 3.2                                                                           | Use data science techniques to interpret data, utilising big data analytics and data visualisation tools to derive actionable insights.                                     |
|                                                                    |                                                                                                           | 3.3                                                                           | Construct and manage innovative applications of the Internet of Things (IoT) in various sectors such as healthcare, automotive, and urban development                       |

|   |                                                                                                     |     |                                                                                                            |
|---|-----------------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------------------------------|
| 4 | Be able to design and implement system solutions to resolve hardware, software, and network issues. | 4.1 | Describe the practical application of the components and functions of computer <b>hardware</b>             |
|   |                                                                                                     | 4.2 | Use different <b>software</b> applications for personal, enterprise and workgroup objectives.              |
|   |                                                                                                     | 4.3 | Implement basic troubleshooting techniques to identify and resolve hardware, software, and network issues. |
|   |                                                                                                     | 4.4 | Utilise different file systems and formats for accessing, formatting, and sharing computer files           |
|   |                                                                                                     | 4.5 | Apply systems development methodologies and tools to design and implement software solutions.              |
|   |                                                                                                     | 4.6 | Use effective communication methods to present and discuss technical concepts and solutions.               |

### Indicative Content

- History and evolution of computers
- Computer systems: hardware, software, peripherals, troubleshooting
- Operating systems and file management
- Networking and telecommunications
- Internet evolution and web technologies
- Online communication, netiquette, and digital footprints
- Web browsers and search engines
- Ethical, legal, and societal issues in technology
- Internet security and cyber threats
- Office productivity tools (Word, Excel, PowerPoint, Email)
- Databases and SQL (DBMS, MySQL, Access)
- Programming fundamentals (Python, Java, C++, web languages)
- Systems development and analysis (SDLC, flowcharts)

### Suggested Resources

- UPI Study platform (core notes and materials)
- Campbell-Kelly & Aspray – *Computer: A History of the Information Machine* (2014)
- Tanenbaum & Wetherall – *Computer Networks* (2019)
- Microsoft Office tutorials (Word, Excel, PowerPoint)

- MySQL and Python official documentation

## Unit 2: Introduction to Javascript

Unit code: L/651/8670

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of JavaScript programming essentials and their practical implications in web development. Learners will explore how to navigate through JavaScript syntax, variables, and coding conventions. Learners will have the opportunity to set up tailored development environments and effectively handle errors, debug code, and manage events.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                 | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                          |
|--------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Be able to use JavaScript in a tailored development environment | 1.1                                                                           | Carry out JavaScript basics, including pseudocode, syntax, variables, and coding conventions, to plan and execute programs effectively.  |
|                                                                    |                                                                 | 1.2                                                                           | Set up a development environment tailored for JavaScript coding,                                                                         |
|                                                                    |                                                                 | 1.3                                                                           | Carry out handling errors, debugging techniques, and event handling, ensuring the reliability and robustness of JavaScript applications. |

### Indicative Content

- HTML, CSS, and JavaScript basics (syntax, pseudocode, environment setup)
- Integration of JavaScript with HTML (script tags, external JS, manipulating elements)
- Core programming concepts (variables, data types, operators, regex, scope)
- Conditional logic and iteration (if/else, switch, loops)
- Functions (arguments, return values, arrow functions, recursion)
- Objects and object-oriented programming (OOP, built-in objects, strings, dates)
- Data structures (arrays, maps, sets, string handling)
- Document Object Model (DOM) manipulation (navigating, changing, removing elements, dynamic CSS)
- Forms and JavaScript (form validation, client-server interaction, custom controls)
- Error handling, debugging, and event handling for interactive interfaces

### Suggested Resources

- **UPI Study platform** (core notes and materials)
- Larry Ullman – *Modern JavaScript: Develop and Design* (2012)
- Charles W. Kann III – *Programming for the Web: From Soup to Nuts* (2018, OER)

- MDN Web Docs (JavaScript guides and references)
- JavaScript Wikibooks (open educational resource)

## Unit 3: Ethics in Technology

Unit code: M/651/8671

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of the key concepts and practices in cybersecurity, with a focus on emerging threats and data protection strategies. Covering a broad range of topics, from computer viruses and malware to encryption and network security, learners will develop a well-rounded understanding of the technological and legal aspects of information security. They will explore the evolution of encryption methods, analyse the role of social networks in cybercrime, and examine cybersecurity challenges in cloud computing. They will also study the legal frameworks that govern online security, including intellectual property law, privacy laws, and regulations related to cyberbullying and cybercrime. Learners will gain hands-on experience in securing databases, using encryption techniques, crafting network security policies, and understanding intrusion detection systems.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                                 | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                           |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand cybersecurity, information security and Big Data and the associated security risk and challenges     | 1.1                                                                           | Assess foundational concepts in cybersecurity, information security and Big Data, including key definitions and their roles in protecting digital assets. |
|                                                                    |                                                                                                                 | 1.2                                                                           | Evaluate privacy challenges, security risks, and legal frameworks related to cybercrime,                                                                  |
|                                                                    |                                                                                                                 | 1.3                                                                           | Evaluate data breaches, and digital rights across sectors like e-commerce and cloud computing.                                                            |
|                                                                    |                                                                                                                 | 1.4                                                                           | Analyse cybercrime cases, using laws related to cyberstalking, cyberbullying, and digital espionage                                                       |
|                                                                    |                                                                                                                 | 1.5                                                                           | Analyse network security mechanisms, encryption methods, and database security principles, and how to secure sensitive information                        |
| 2                                                                  | Understand the impact of emerging technologies on privacy and security and the associated mitigation strategies | 2.1                                                                           | Evaluate the impact of emerging technologies such as AI, IoT, and biotechnology on privacy, security, and legal regulations,                              |
|                                                                    |                                                                                                                 | 2.2                                                                           | Propose mitigation strategies relating to emerging technologies for real world scenarios                                                                  |
|                                                                    |                                                                                                                 | 2.3                                                                           | Analyse the evolution of encryption technologies and their application in modern cybersecurity practices, emphasising AES and DES standards.              |
| 3                                                                  | Understand how cybersecurity breaches occur and how to secure sensitive information                             | 3.1                                                                           | Apply data mining techniques and Big Data analytics to real-world problems, ensuring ethical data handling and understanding of security risks.           |

|  |  |     |                                                                                                                                     |
|--|--|-----|-------------------------------------------------------------------------------------------------------------------------------------|
|  |  | 3.2 | Analyse network security mechanisms, encryption methods, and database security principles, and how to secure sensitive information. |
|  |  | 3.3 | Analyse the role of human error, malware, phishing, and social engineering in cybersecurity breaches                                |

### Indicative Content

- Basics of cybersecurity (CIA triad, threats, safeguards)
- Privacy in cyberspace (data collection, social media, surveillance, privacy laws)
- Big Data, data mining, and related privacy/security concerns
- National cybersecurity threats (cyber war, terrorism, hacking, regulations)
- Data security (DBMS, cloud security, IDS, data breach laws)
- Viruses and malware (types, evolution, detection, defenses)
- Network security (mechanisms, VPNs, firewalls, policies)
- Legal issues in cyberspace (IP law, privacy law, cyberbullying, cyberstalking)
- Cybercrime (digital espionage, vandalism, theft, internet threats)
- Encryption (symmetric/asymmetric, AES, DES)
- Emerging technologies and ethics (AI, IoT, biotechnology)

### Suggested Resources

- **UPI Study platform** (core notes and materials)
- Sven Nyholm – *This is Technology Ethics: An Introduction* (2023)
- Juan Enriquez – *Right/Wrong: How Technology Transforms Our Ethics* (2020)
- Mark Coeckelbergh – *AI Ethics* (2020)
- José Flahaux, Brian Green, and Ann Gregg Skeet – *Ethics in the Age of Disruptive Technologies* (2021)

## Unit 4: Introduction to Networking

Unit code: R/651/8672

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of computer networks and their practical applications in modern technological landscapes. Learners will analyse, design, and implement network infrastructures to meet diverse organisational needs. They will explore topics such as network types, architectures, and protocols and develop essential skills in configuring and troubleshooting network devices, ensuring seamless communication and data transmission.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                       | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                                                        |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand computer networking technologies and their role and application in different organisations | 1.1                                                                           | Analyse computer networks, of different types and characteristics, and their integral role in contemporary society.                                                                                    |
|                                                                    |                                                                                                       | 1.2                                                                           | Evaluate the key components of telecommunications systems and how they facilitate efficient data transmission and network management.                                                                  |
|                                                                    |                                                                                                       | 1.3                                                                           | Assess the suitability of different network architectures, including hierarchical and peer-to-peer models, for different organisational needs and objectives.                                          |
|                                                                    |                                                                                                       | 1.4                                                                           | Distinguish between various network types, such as LANs, WANs, WLANs, MANs, SANs, PANs, EPNs, and VPNs, and their respective functionalities and applications                                          |
|                                                                    |                                                                                                       | 1.5                                                                           | Explain the functions and significance of Internet Service Providers (ISPs) and the essential aspects of the Internet, including IP addresses, URLs, DNS, and the historical development from ARPANET. |
|                                                                    |                                                                                                       | 1.6                                                                           | Explore potential future trends and advancements in networking technologies, and the implications for future network infrastructures and digital connectivity.                                         |

### Indicative Content

- Basics of networking (types, architectures, client-server, ISPs, ARPANET)
- Networking standards & OSI model (layers, protocols, standardization bodies)
- Transmission fundamentals (digital vs. analog, channels, bandwidth, latency)
- TCP/IP (IPv4/IPv6, DNS, routing, subnetting, address translation)

- Mail services & diagnostics (SMTP, POP, IMAP, tools)
- Network structures (topologies, Ethernet, switching)
- Infrastructure & devices (servers, NICs, routers, switches, VLANs, IoT)
- WAN fundamentals (methods, topologies, DSL, cable)
- Wireless technologies (Bluetooth, Wi-Fi, ZigBee, 5G)
- Virtualized networks (VLANs, VPNs, SSH, cloud computing)
- Network security (threats, firewalls, WPA/WEK, DoS, best practices)
- Unified communications (VoIP, Video-over-IP, QoS)

### **Suggested Resources**

- UPI Study platform (core notes)
- Kurose & Ross – *Computer Networking: A Top-Down Approach* (2021)
- Bonaventure – *Computer Networking: Principles, Protocols and Practice* (2016)
- Cisco Networking Academy (online labs)

## Unit 5: Fundamentals of Information Technology

Unit code: T/651/8673

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive introduction to the essential aspects of information systems and computer technology. Learners will explore the types, functions, and roles of information systems in business environments and the components and operations of computer systems. They will also examine the socio-economic impact of information technology and career opportunities within the field.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                              | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                 |
|--------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand computer system fundamentals                                      | 1.1                                                                           | Identify key concepts, components, and types of information systems in business.                |
|                                                                    |                                                                              | 1.2                                                                           | Describe computer system fundamentals, including hardware, memory, and data storage.            |
|                                                                    |                                                                              | 1.3                                                                           | Explain the binary language of computers and the role of input/output devices.                  |
|                                                                    |                                                                              | 1.4                                                                           | Evaluate data storage technologies and their historical evolution.                              |
|                                                                    |                                                                              | 1.5                                                                           | Examine the functions of operating systems and differentiate between software types.            |
| 2                                                                  | Be able to carry out database design and implement network security measures | 2.1                                                                           | Design relational databases and perform SQL queries for business intelligence.                  |
|                                                                    |                                                                              | 2.2                                                                           | Describe computer networks, internet components, and cloud computing.                           |
|                                                                    |                                                                              | 2.3                                                                           | Implement network security measures and predict future networking trends.                       |
|                                                                    |                                                                              | 2.4                                                                           | Analyse e-commerce models and how to manage infrastructure and specialised information systems. |

### Indicative Content

- Information systems: components, roles, and business applications
- Computer hardware and binary systems (CPU, memory, storage, input/output)
- Software types: system, application, enterprise-level
- Data, databases, DBMS, and SQL for business intelligence
- Networking and communication (Internet history, LANs, WANs, wireless)
- Information systems security (CIA triad, firewalls, blockchain, policies)
- Strategic role of IT in business (productivity, competitive advantage)
- Business processes (BPM, BPR)

- People in information systems (analysts, developers, IT managers, careers)
- Systems development (Waterfall, Agile, DevOps, tools, build vs. buy)
- Globalization and the digital divide
- Ethical and legal issues (intellectual property, privacy, data protection, GDPR)
- Trends in IT (cloud computing, AI, big data, mobile, personalization)

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Hansen – *Freedom of Information and Protection of Privacy* (2017, CC License)
- Watt – *Database Design – 2nd Edition* (OER)
- Bourgeois et al. – *Information Systems for Business and Beyond* (2019, OER)
- Reynolds – *Information Systems for Modern Management* (2018)

## Unit 6: Introduction to Linux

Unit code: Y/651/8674

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of Linux operating systems, equipping learners with the knowledge and skills necessary to excel in diverse computing environments. Learners will explore Linux fundamentals, including historical progression, legal and ethical considerations, and the significance of open-source software. Learners will install and configure Linux systems, user account management, and shell scripting.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                    | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                                          |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand the use and impact of Linux in system setup and configuration.          | 1.1                                                                           | Analyse the historical progression of operating systems, identifying significant milestones,                                                                                             |
|                                                                    |                                                                                    | 1.2                                                                           | Explain the factors driving the evolution of operating systems, and evaluate their impact on modern computing paradigms.                                                                 |
|                                                                    |                                                                                    | 1.3                                                                           | Explore the fundamentals of Linux, including its origins, development process, and features, and its significance and applications in various industries.                                |
|                                                                    |                                                                                    | 1.4                                                                           | Analyse entrepreneurial opportunities and professional paths in open-source software                                                                                                     |
|                                                                    |                                                                                    | 1.5                                                                           | Evaluate the process of selecting appropriate Linux distributions for installation on various systems to make informed decisions in system setup and configuration.                      |
| 2.                                                                 | Be able to install and manage Linux in line with data confidentiality requirements | 2.1                                                                           | Carry out the installation procedure for Fedora Linux on local machines and virtual environments and apply troubleshooting techniques and best practices to ensure seamless integration. |
|                                                                    |                                                                                    | 2.2                                                                           | Manage Linux user accounts, implementing security measures, and controlling user permissions                                                                                             |
|                                                                    |                                                                                    | 2.3                                                                           | Evaluate system integrity and ensure data confidentiality for effective system administration.                                                                                           |
|                                                                    |                                                                                    | 2.4                                                                           | Interpret core concepts of shell, terminal, bash, and kernel in Linux                                                                                                                    |
|                                                                    |                                                                                    | 2.5                                                                           | Apply basic commands to navigate the system and perform essential tasks, enabling efficient command-line interaction and automation                                                      |

## Indicative Content

- History, philosophy, and community of Linux (open-source model, distributions)
- Linux boot process, kernel, and filesystems (installation and configuration)
- Working with Linux desktop environments and basic operations
- System configuration and software management (network setup, package managers)
- Essential Linux applications (office tools, multimedia, development utilities)
- Command line basics (navigation, file/directory management, pipes, redirection)
- Documentation and help resources (man pages, info, online resources)
- Process management (monitoring, scheduling, performance tools)
- Filesystems and data management (mounting, backups, compression, NFS)
- Text editors (nano, vi, emacs, VS Code)
- User and system management (accounts, groups, permissions, environment variables)
- Text processing and file manipulation (grep, sed, awk, sort, regex)
- Networking and data transfer (IP, DNS, ssh, scp, wget, curl)
- Shell scripting (fundamentals, loops, conditionals, debugging)
- Printing, document management, and Linux security practices

## Suggested Resources

- **UPI Study platform** (core notes and materials)
- Ahmed Alkabary – *Learn Linux Quickly* (2020)
- Christopher Negus – *Linux Bible* (2019)
- Brian Ward – *How Linux Works* (2021)
- William Shotts – *The Linux Command Line* (2019)

## Unit 7: Introduction to Java

Unit code: A/651/8675

RQF Level: 4

### Unit Aim

This unit aims to provide learners with an introduction into computer programming with Java tailored for beginners. Learners will cover essential programming concepts, Java syntax, and problem-solving techniques through practical coding exercises. The unit focuses on debugging, testing, and comprehending the software development process and includes object-oriented programming principles, data structures, algorithms, and GUI development.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                    | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                                |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand the key concepts of Java and algorithm analysis                                         | 1.1                                                                           | Analyse foundational programming concepts and Java syntax                                                                                                                      |
|                                                                    |                                                                                                    | 1.2                                                                           | Analyse conditional statements, loops, and object-oriented programming principles to enable modular and reusable code design                                                   |
|                                                                    |                                                                                                    | 1.3                                                                           | Analyse Algorithm analysis, sorting algorithms, and data structures such as arrays, linked lists, and trees                                                                    |
| 2                                                                  | Be able to set up Java applications and environments and respond to complex programming challenges | 2.1                                                                           | Based on user requirement-gathering techniques, set up a Java coding environment control structures and arrays in Java, enhancing their ability to manipulate data efficiently |
|                                                                    |                                                                                                    | 2.2                                                                           | Create user-friendly Java application input/output handling methods, including GUI development                                                                                 |
|                                                                    |                                                                                                    | 2.3                                                                           | Carry out complex programming challenges such as exception handling, recursion, and event-driven programming                                                                   |

### Indicative Content

- Basics of programming and Java environment setup (coding, testing, debugging)
- Java syntax and built-in data types (variables, operators, strings, arrays)
- Control structures and loops (if/else, switch, for, while, do-while)
- Arrays, multidimensional arrays, and ArrayLists
- Input/output handling and GUI basics (JFrame, JLabel, event-driven programming)
- Functions, modular programming, recursion, static vs. non-static methods

- Object-Oriented Programming (classes, objects, constructors, inheritance, polymorphism, interfaces)
- Exception handling and method overloading/overriding
- Algorithm analysis (Big-O, sorting, searching)
- Data structures (stacks, queues, linked lists, trees, graphs)
- Maps, hash tables, and practical implementations in Java

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- John Smith – *Java Programming for Beginners* (2022)
- Emily Brown – *Object-Oriented Programming with Java* (2023)
- Oracle Java Documentation (official online resource)

## Unit 8: Programming in Python

Unit code: D/651/8676

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of Python programming concepts and their practical applications in real-world scenarios. Learners will develop a foundational knowledge in Python programming, covering essential topics such as data types and constructs for precise data manipulation. They will set up Python environments and handle input/output operations to facilitate efficient coding workflows. Learners will explore advanced topics such as object-oriented programming (OOP), graphical visualisation, functions, and standard modules. They will also examine algorithm design and data analysis, exploring fundamental search algorithms, recursion, sorting techniques, and practical applications like the Towers of Hanoi problem.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                             | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Be able to carry out effective data manipulation                                                            | 1.1                                                                           | Manipulate data types and constructs to enable precise data manipulation.                                                                                                                                                                    |
|                                                                    |                                                                                                             | 1.2                                                                           | Configure Python environments effectively, seamlessly handling input/output operations.                                                                                                                                                      |
|                                                                    |                                                                                                             | 1.3                                                                           | Execute arithmetic operations and design algorithms, including computing with numbers                                                                                                                                                        |
|                                                                    |                                                                                                             | 1.4                                                                           | Use data handling skills, including string manipulation, list management, dictionary usage, and file handling, to address diverse data manipulation tasks.                                                                                   |
| 2.                                                                 | Use Python topics and algorithm design and data analysis techniques to solve complex programming challenges | 2.1                                                                           | Apply advanced Python topics, such as object-oriented programming, graphical visualisation, functions, and standard modules to solve complex programming challenges.                                                                         |
|                                                                    |                                                                                                             | 2.2                                                                           | Implement decision structures and loop structures proficiently, ensuring effective programming logic and control flow in python code.                                                                                                        |
|                                                                    |                                                                                                             | 2.3                                                                           | Use algorithm design and data analysis techniques, including fundamental search algorithms, recursion, sorting techniques and practical applications like the towers of Hanoi problem, to analyse and solve real-world problems effectively. |

### Indicative Content

- Python setup, coding environment, and “Hello World” basics

- Data types, variables, strings, type conversion
- Operators, expressions, and control structures (if/elif/else, loops)
- Functions, scope, recursion, and modular programming
- Errors, exceptions, debugging, and code quality
- Core data structures (lists, tuples, dictionaries)
- Modules, libraries, and environments (NumPy, Pandas)
- File handling (read, write, error handling)
- Object-Oriented Programming (classes, inheritance, polymorphism)
- Algorithms (sorting, searching, recursion, Towers of Hanoi)
- Data analysis and visualization techniques

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Eric Matthes – *Python Crash Course* (2022)
- Udayan Das et al. – *Introduction to Python Programming* (OpenStax, 2024)
- Abhijit Dasgupta – *Introduction to Data Science using Python* (2020)

## Unit 9: Introduction to Computing

Unit code: F/651/8677

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of the essential principles and applications of software, systems, and programming in the modern digital environment. It is designed to give learners a robust understanding of how various technologies work together to support organisational and individual needs, spanning topics from the foundational elements of application software and systems development to advanced programming paradigms and telecommunications networks.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                       | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                  | Understand the components of different systems software and the implications of emerging technologies | 1.1                                                                           | Critically assess the features and limitations of word processing, presentation tools, databases, and multimedia applications. |
|                                                                    |                                                                                                       | 1.2                                                                           | Critically assess the historical evolution of computers and their economic impact                                              |
|                                                                    |                                                                                                       | 1.3                                                                           | Analyse future social, privacy, and economic implications of emerging technologies.                                            |
|                                                                    |                                                                                                       | 1.4                                                                           | Describe key components of systems software, such as operating systems and security protocols, and compare different systems.  |
| 2                                                                  | Be able to design system solutions and propose improvements for future development                    | 2.1                                                                           | Apply the functionalities of application software to practical scenarios                                                       |
|                                                                    |                                                                                                       | 2.2                                                                           | Design and optimise hardware systems by integrating and troubleshooting components                                             |
|                                                                    |                                                                                                       | 2.3                                                                           | Critically evaluate their performance and interdependencies to propose innovations that enhance system efficiency.             |
|                                                                    |                                                                                                       | 2.4                                                                           | Create innovative solutions for network and data communication challenges using case studies                                   |
|                                                                    |                                                                                                       | 2.5                                                                           | Critically evaluate evolving software development methodologies to propose improvements for next-generation network systems.   |

### Indicative Content

- Application software (word processing, spreadsheets, presentations, multimedia, macros, licensing, HTML)
- Systems software (CLI, operating systems, file systems, extensions, system security)

- Computer systems (binary representation, input/output devices, memory, storage, RAID)
- History and social impacts of computing (IT evolution, globalization, careers, privacy, MIS, IP, open source)
- Data communications (databases, DBMS, data structures, administration, cloud computing)
- Internet and WWW (history, connectivity, client/server scripting, search engines, infrastructure, security)
- Networks (telecom components, LAN, WAN, wireless, topologies, distributed computing)
- Software development (SDLC, methods, tools, application design/testing)
- Programming methodology (procedural, OOP, functional, pseudocode, Boolean logic, algorithms, debugging)

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- William Stallings – *Computer Organization and Architecture* (2020)
- Kenneth C. Laudon & Jane P. Laudon – *Management Information Systems: Managing the Digital Firm* (2020)

## Unit 10: Programming in C

Unit code: H/651/8678

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of programming in the C language. Beginning with foundational principles, learners explore programming fundamentals, including syntax, algorithmic thinking, and effective program development processes. Learners develop their understanding of ANSI standards, coding environments, and program styling techniques, building a strong groundwork for their programming journey. Learners will explore numeric data types, variables, relational operators, selection and loop structures, functions, recursion, and iteration, empowering students to tackle complex programming challenges. They will develop skills in handling arrays, characters, strings, pointers, and data files, while exploring essential data structures like single structures, arrays, linked lists, stacks, queues, and dynamically linked lists.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                         | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                                                           |
|--------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Be able to carry out effective program development in C | 1.1                                                                           | Carry out effective program development, including design, implementation, and maintenance of software systems.                                                                                           |
|                                                                    |                                                         | 1.2                                                                           | Write, test, and debug programs proficiently, ensuring code reliability and efficiency.                                                                                                                   |
|                                                                    |                                                         | 1.3                                                                           | Apply ANSI standards and coding environments in C programming to create robust programs.                                                                                                                  |
|                                                                    |                                                         | 1.4                                                                           | Utilise numeric data types, variables, and relational operators effectively in various programming scenarios.                                                                                             |
|                                                                    |                                                         | 1.5                                                                           | Implement selection structures and loop structures for efficient and logical program control flow.                                                                                                        |
|                                                                    |                                                         | 1.6                                                                           | Apply recursion and iteration for advanced problem-solving, enhancing algorithmic thinking.                                                                                                               |
|                                                                    |                                                         | 1.7                                                                           | Optimise program performance using pointers for efficient memory management and advanced programming techniques.                                                                                          |
|                                                                    |                                                         | 1.8                                                                           | Implement and manage essential data structures, such as single structures, arrays, linked lists, stacks, queues, and dynamically linked lists, for efficient data management and algorithm implementation |

### Indicative Content

- Basics of programming (logic, syntax, algorithms, pseudocode, debugging)
- ANSI C standards, coding environment setup, program styling

- Data types, variables, operators, input/output, simple programs
- Control structures (if/else, switch, relational & logical operators)
- Loops (while, for, do-while, loop control statements, nesting)
- Functions (parameters, scope, recursion, iteration, passing by value/reference)
- Arrays, characters, and strings (1D, multi-D arrays, string handling, libraries)
- Pointers and memory management (arrays of pointers, addresses, string manipulation)
- File handling (streams, text files, binary files, random access)
- Data structures (structures, unions, linked lists, stacks, queues, dynamic memory)

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Kernighan & Ritchie – *The C Programming Language* (1988)
- Ben Klemens – *21st Century C* (2014)

## Unit 11: Programming in C++

Unit code: J/651/8679

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of fundamental programming concepts and practical skills for software development. Learners will explore essential programming elements, including variables, control structures, and functions, and develop their skills in algorithmic problem-solving using pseudocode. The unit covers the application of C++ programming language, covering data types, loops, arrays, and object-oriented programming principles such as classes, inheritance, and polymorphism.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                           | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                             |
|--------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Be able to carry out effective program development in C++ | 1.1                                                                           | Analyse variables, control structures, and functions and the critical role of algorithms in computational problem-solving.                  |
|                                                                    |                                                           | 1.2                                                                           | Carry out pseudocode for mapping out algorithmic processes                                                                                  |
|                                                                    |                                                           | 1.3                                                                           | Explore essential elements of C++ programming, such as data types, loops, and arrays.                                                       |
|                                                                    |                                                           | 1.4                                                                           | Apply object-oriented programming principles, to create modular and reusable code structures through classes, inheritance, and polymorphism |

### Indicative Content

- Fundamentals of programming (variables, data types, control structures, functions, pseudocode, algorithms)
- C++ basics and environment setup (evolution from C, OOP principles, syntax, input/output, projects)
- Branching and decision-making (if/else, switch, logical operators, decision trees)
- Iteration and loops (for, while, do-while, nesting, loop control)
- Arrays and vectors (1D, multi-D arrays, vectors, passing arrays, applications)
- Strings and text handling (character arrays, string class, input validation, formatting)
- Functions (parameters, scope, recursion, iteration, overloading, libraries)
- Object-Oriented Programming (classes, objects, constructors, encapsulation, inheritance, polymorphism)
- Pointers and memory management (dynamic allocation, memory leaks, linked lists)
- File handling (streams, text and binary files, sequential and random access)
- Advanced C++ concepts (virtual functions, modular design, reusable code structures)

## Suggested Resources

- **UPI Study platform** (core notes and materials)
- Stanley B. Lippman et al. – *C++ Primer* (2012)
- Bjarne Stroustrup – *The C++ Programming Language* (2013)

## Unit 12: Data Structure and Algorithms

Unit code: M/651/8680

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of Java programming, tailored for beginners and progressing to more advanced topics. Learners will develop a robust understanding of Java programming, encompassing setup, syntax, control structures, object-oriented programming, data structures, and algorithm analysis.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                         | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                                                                            |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Be able to carry out Java programming and handle diverse programming challenges in Java | 1.1                                                                           | Carry out Java programming to <ul style="list-style-type: none"><li>• configure their coding environment</li><li>• construct Java statements</li><li>• implement loops</li><li>• effectively debug Java programs</li></ul> |
|                                                                    |                                                                                         | 1.2                                                                           | Apply object-oriented design principles, including inheritance, polymorphism, and encapsulation to design and implement complex Java programs                                                                              |
|                                                                    |                                                                                         | 1.3                                                                           | Implement data structures such as arrays, linked lists, trees, and queue them efficiently in Java                                                                                                                          |
|                                                                    |                                                                                         | 1.4                                                                           | Use text processing, graph data structures, memory management, and external memory techniques, to handle diverse programming challenges in Java                                                                            |
| 2                                                                  | Be able to apply algorithms to solve real-world problems                                | 2.1                                                                           | Analyse algorithms, including recursion and sorting algorithms, and their performance                                                                                                                                      |
|                                                                    |                                                                                         | 2.2                                                                           | Apply algorithms, including recursion and sorting algorithms, to solve real-world problems                                                                                                                                 |

### Indicative Content

- Java programming foundations (setup, syntax, debugging, pseudocode, comments)
- Object-Oriented Design (encapsulation, inheritance, polymorphism, abstraction, interfaces, exceptions)
- Core data structures (arrays, multidimensional arrays, linked lists)
- Algorithm analysis (complexity, Big-O, justification techniques)
- Recursion (methods, applications, binary search, sequential & exponential search)
- Stacks, queues, deques, and their applications
- Lists, iterators, and the Java Collections Framework
- Trees (binary trees, AVL, red-black, multiway trees, traversal, applications)
- Priority queues and heaps (heapify, heap sort)

- Maps and hash tables (hashing methods, chaining, collision resolution)
- Sorting algorithms (bubble, selection, merge, quick, insertion, comparisons)
- Text processing (string searching, tries, Huffman coding)
- Graph data structures (graphs, traversal, Dijkstra's algorithm, applications)
- Memory management (heap, garbage collection, B-trees, external sorting)

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Robert Lafore – *Data Structures and Algorithms in Java* (2002)
- Robert Sedgewick & Kevin Wayne – *Algorithms* (2011)

## Unit 13: Network and Systems Security

Unit code: R/651/8681

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of network security principles and practices, alongside proficiency in implementing effective security measures in diverse technological environments. Learners will develop the skills necessary to analyse, evaluate, and manage network security systems, ensuring the protection of digital assets and sensitive information. They will explore foundational concepts such as encryption techniques, authentication protocols, and network architecture design, gaining a solid grounding in security fundamentals. Learners will develop practical skills in configuring security devices, conducting security audits, and devising comprehensive security strategies tailored to organizational needs.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                                             | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Be able to devise security strategies and manage network security devices and protocols to enable robust security measures. | 1.1                                                                           | Evaluate fundamental concepts and core principles underlying network security, encryption techniques, and authentication protocols to discern and address diverse security threats effectively.                                          |
|                                                                    |                                                                                                                             | 1.2                                                                           | Evaluate different types of network security measures, including firewalls, intrusion detection/prevention systems, and encryption methods, and their significance in fortifying network infrastructure and safeguarding sensitive data. |
|                                                                    |                                                                                                                             | 1.3                                                                           | Configure and manage network security devices and protocols to implement robust security measures.                                                                                                                                       |
|                                                                    |                                                                                                                             | 1.4                                                                           | Investigate advanced concepts such as security architecture design, risk assessment methodologies, and security policy frameworks,                                                                                                       |
|                                                                    |                                                                                                                             | 1.5                                                                           | Devise comprehensive security strategies tailored to organisational needs and compliance requirements based on advance concepts                                                                                                          |
| 2.                                                                 | Be able to uphold network integrity and resilience against cyber threats.                                                   | 2.1                                                                           | Explore emerging technologies and trends in network security, such as wireless network security protocols, web application security, and continuous improvement practices                                                                |
|                                                                    |                                                                                                                             | 2.2                                                                           | Identify and mitigate security vulnerabilities                                                                                                                                                                                           |

|  |  |     |                                                                    |
|--|--|-----|--------------------------------------------------------------------|
|  |  | 2.3 | Conduct security audits and implement incident response procedures |
|--|--|-----|--------------------------------------------------------------------|

### Indicative Content

- Fundamentals of network security (concepts, threats, policies, risk evaluation, zero-day vulnerabilities)
- Information security principles (measures, ISMS, policies, incident response)
- Encryption (cryptography, AES, DES, RSA, symmetric/asymmetric methods, SSL, IPsec, WPA/WEP)
- Firewalls & network protection (functions, TCP/IP, spoofing, OSI model, SSH tunnels)
- Wireless network security (WEP, WPA/WPA2, Bluetooth, ZigBee, Wi-Fi, WLANs, RFID)
- Web application security (HTTP, SMTP, POP, IMAP, FTP, SOA, client-server, DoS, mobile security)
- Authentication & access control (biometrics, smart cards, Kerberos, VPNs, intranet/extranet, disaster recovery)
- Network auditing & configuration management (Cisco ASA, IDS/IPS, auditing tools, IT governance, continual improvement)

### Suggested Resources

- **UPI Study platform** (core notes and materials)
- James F. Kurose & Keith W. Ross – *Computer Networking: A Top-Down Approach* (2021)
- Kaufman, Perlman & Speciner – *Network Security: Private Communication in a Public World* (2022)
- Cheswick, Bellovin & Rubin – *Firewalls and Internet Security* (2003)

## Unit 14: Cybersecurity

Unit code: T/651/8682

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of cybersecurity principles and their practical applications in addressing real-world challenges. Learners will examine diverse threats across data, software, and network domains, along with effective defense mechanisms. They will explore ethical dilemmas and value conflicts, equipping them with the skills to apply systematic frameworks for resolving complex cybersecurity challenges. The unit covers advanced topics such as post-quantum cryptography, blockchain security, and anti-ransomware solutions. Learners will also investigate the security of critical infrastructure, the ethical implications of IoT and emerging technologies, and strategies to combat misinformation, fake news, and propaganda. The unit incorporates advanced experimental methodologies, allowing learners to evaluate the effectiveness of cybersecurity tools and frameworks in dynamic, real-world scenarios.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                                               | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                   |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand the core principles of cybersecurity and cyber threats and how to protect sensitive information                    | 1.1                                                                           | Evaluate the core principles of cybersecurity and design frameworks for protecting sensitive information across various industries and sectors.   |
|                                                                    |                                                                                                                               | 1.2                                                                           | Classify and assess different types of cyber threats,                                                                                             |
|                                                                    |                                                                                                                               | 1.3                                                                           | Examine the impact of digital communication on security and suggest measures to address vulnerabilities created by digital platforms.             |
|                                                                    |                                                                                                                               | 1.3                                                                           | Create robust security strategies to implement effective prevention and mitigation measures.                                                      |
|                                                                    |                                                                                                                               | 1.4                                                                           | Develop comprehensive security policies that address both human error and malicious intent.                                                       |
|                                                                    |                                                                                                                               | 1.5                                                                           | Design practical solutions for preventing and responding to digital crimes, utilising advanced cybersecurity tools                                |
| 2                                                                  | Be able to use secure software development practices to secure information and enable effective recovery from cyber incidents | 2.1                                                                           | Integrate cryptographic techniques to secure information and develop countermeasures against malware and viruses                                  |
|                                                                    |                                                                                                                               | 2.2                                                                           | Design network security systems using secure software development practices, ensuring inherent security measures from initial development stages. |

|  |  |     |                                                                                                                                                           |
|--|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | 2.3 | Implement disaster recovery strategies that enable organisations to recover effectively from breaches or cyberattacks, minimizing downtime and data loss. |
|--|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------|

### Indicative Content

- Introduction to cybersecurity (CIA triad, principles, careers, ethical hacking vs. cybercrime)
- Networking basics for security (LAN/WAN, IP addressing, TCP/IP, protocols, firewalls, VPNs, proxies, TOR)
- Cyber threats & attacks (malware, phishing, DoS/DDoS, MITM, insider threats, AI & deepfakes, quantum risks)
- Operating system security (Windows, Linux, MacOS, OS hardening, secure file systems)
- Cryptography & secure communications (symmetric/asymmetric, hashing, TLS/SSL, PKI, secure email, cryptanalysis)
- Web and application security (SQL injection, XSS, CSRF, OWASP Top 10, API security, secure coding)
- Cloud security (models, threats, IAM, compliance, Zero Trust, best practices)
- Identity & Access Management (authentication vs. authorization, MFA, SSO, RBAC, biometrics)
- Security operations & incident response (SOC, SIEM, log analysis, forensics, IR lifecycle, case studies)
- Governance, risk & compliance (NIST, ISO 27001, GDPR, HIPAA, PCI-DSS, audits, policies)
- Ethical hacking & penetration testing (footprinting, scanning, exploitation, post-exploitation, reporting)
- Emerging trends (AI in cybersecurity, quantum computing, blockchain, IoT, cyberwarfare, career roadmap)

### Suggested Resources

- **UPI Study platform** (core notes and materials)
- Markus Christen et al. – *The Ethics of Cybersecurity* (2020)
- Leandros Maglaras et al. – *Cyber Security of Critical Infrastructures* (2020)

## Unit 15: Database Fundamentals

Unit code: Y/651/8683

RQF Level: 4

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of the fundamentals of databases, relational database models, and structured query language (SQL). Learners will develop skills in designing and implementing relational databases, understanding entity-relationship models, and executing advanced SQL commands for efficient data manipulation. They will explore various data types, SQL variations, and relational data modeling techniques, enabling them to create robust database solutions. The unit also covers database administration, security measures, and distributed databases, ensuring learners are equipped to manage databases effectively in diverse environments. Learners will explore business intelligence, big data, and non-relational databases, broadening their understanding of contemporary data management practices.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                                      | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                              |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand fundamental database components and their relationships to database management principles and strategies. | 1.1                                                                           | Classify various types of data, such as numerical, textual, and multimedia data, and explain their respective sources and definitions.                                       |
|                                                                    |                                                                                                                      | 1.2                                                                           | Differentiate between relational, hierarchical, and object-oriented databases using real world examples.                                                                     |
|                                                                    |                                                                                                                      | 1.3                                                                           | Explain the roles of fundamental database components, including tables, records, and fields, within database structures.                                                     |
|                                                                    |                                                                                                                      | 1.4                                                                           | Communicate database concepts clearly using terminologies like schema, query, and normalisation                                                                              |
|                                                                    |                                                                                                                      | 1.5                                                                           | Analyse the significance of database records and fields, recognising their crucial role in organising data.                                                                  |
|                                                                    |                                                                                                                      | 1.6                                                                           | Evaluate the purpose and functions of Database Management Systems (DBMS) and compare various DBMS models in relation to their alignment with database management principles. |
|                                                                    |                                                                                                                      | 1.7                                                                           | Assess the advantages offered by DBMS, such as data integrity, security, and scalability, to make informed decisions regarding database management strategies.               |

### Indicative Content

- Evolution from file-based to database systems; advantages of DBMS
- Core database concepts (tables, records, schema, queries, normalization)

- Database models (relational, hierarchical, object-oriented, ER modeling)
- DBMS features, functions, planning, and design frameworks
- Relational data model (keys, relationships, relational algebra)
- Data integrity, constraints, and normalization (1NF–BCNF, decomposition)
- SQL basics (DDL, DML, joins, functions, subqueries)
- Advanced SQL (sorting, grouping, set operations)
- Database administration (security, recovery, concurrency, data dictionaries)
- Distributed databases (client/server models, data distribution, recovery)
- Personal computer database systems (challenges, applications)
- Advanced data structures (linked lists, inverted lists, B-trees for efficiency)

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Adrienne Watt – *Database Design – 2nd Edition* (OER)
- Michael SmithJohnson – *Database Fundamentals: An Introduction to Databases and SQL* (2022)
- Sarah Adams – *Relational Database Design and Implementation* (2023)

## Unit 16: Software Engineering

Unit code: A/651/8684

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of software development principles, methodologies, and emerging technologies essential for success in the field. Learners will acquire an in-depth understanding of software engineering fundamentals, including system analysis, object-oriented analysis and design, and various software development life cycles. They will apply industry best practices to enhance software project outcomes, challenging common myths and misconceptions in the field.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                                    | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                               |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand the essential elements and defining features of software engineering                                    | 1.1                                                                           | Critically evaluate the essential elements and defining features of computer software across various fields, assessing their significance and applications in modern society. |
|                                                                    |                                                                                                                    | 1.2                                                                           | Evaluate the foundational concepts, processes, and techniques in software engineering, applying them to real-world scenarios                                                  |
|                                                                    |                                                                                                                    | 1.3                                                                           | Critically analyse methodologies of system analysis within software engineering                                                                                               |
|                                                                    |                                                                                                                    | 1.4                                                                           | Propose solutions to complex system issues and the related actions.                                                                                                           |
| 2.                                                                 | Be able to organise and optimise software and adapt systems development life cycles to meet specific project needs | 2.1                                                                           | Evaluate object-oriented analysis and design methodologies                                                                                                                    |
|                                                                    |                                                                                                                    | 2.2                                                                           | Design improved approaches for organizing software around data to enhance modularity and maintainability.                                                                     |
|                                                                    |                                                                                                                    | 2.3                                                                           | Synthesise the crucial steps in the software engineering process                                                                                                              |
|                                                                    |                                                                                                                    | 2.4                                                                           | Create frameworks incorporating best practices to optimise software project outcomes.                                                                                         |
|                                                                    |                                                                                                                    | 2.5                                                                           | Adapt various systems development life cycles to design customised methodologies tailored to specific project needs and evaluate their effectiveness                          |

### Indicative Content

- Fundamentals of software engineering (principles, myths, system analysis, OOAD, SDLC)

- Software process models (Waterfall, Iterative, Incremental, Spiral, Unified Process, CBSE, formal methods)
- Advanced methods (Agile, RAD, JAD, Stage-Gate, testing, software evolution, refactoring)
- Agile methodologies (Scrum, XP, scaling Agile, Agile lifecycle)
- Requirements engineering (prototyping, UML, scenario-based, data & class modeling)
- Requirements techniques (DFDs, control flow, use cases, context & behavioral models, sequence diagrams)
- Software design & reuse (design process, OOD principles, UML deployment)
- Software architecture (styles, archetypes, transform mapping, system architecture diagrams)
- Component-level design (class-based design, modularity, reuse)
- User interface design (HCI principles, usability, UI for web & mobile, analysis, evaluation)
- Verification, validation & security (testing, dependability, reliability engineering, information security, network security)
- Software project management (risk management, planning, team roles, Agile planning, W5HH principle, configuration management)
- Advanced topics (CBSE, distributed computing, middleware, SaaS, SOA, SoS, sociotechnical systems)

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Pressman & Maxim – *Software Engineering: A Practitioner's Approach* (2023)
- Mike Cohn – *Agile Estimating and Planning* (2006)

## Unit 17: Introduction to Operating Systems

Unit code: D/651/8685

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of operating systems, focusing on their core functions, roles, and the intricate mechanisms that ensure efficient and secure management of computer resources. Learners will gain a comprehensive understanding of the structure and functionality of operating systems, including process management, memory management, file systems, networking, security, and virtualisation.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                              | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                         |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand the different operating system categories and how they operate                                    | 1.1                                                                           | Explain the core functions of operating systems, including security, resource management, and communication facilitation.                               |
|                                                                    |                                                                                                              | 1.2                                                                           | Classify different operating system categories with their features                                                                                      |
|                                                                    |                                                                                                              | 1.3                                                                           | Describe how operating systems manage hardware and software resources efficiently                                                                       |
| 2.                                                                 | Understand graphical user interfaces and apply the concept of virtualisation to install VirtualBox and Linux | 2.1                                                                           | Explore graphical user interfaces, command line interfaces, batch files, and the boot process;                                                          |
|                                                                    |                                                                                                              | 2.2                                                                           | Review job scheduling, memory management, and various memory allocation schemes including virtual and cache memory.                                     |
|                                                                    |                                                                                                              | 2.3                                                                           | Discuss peripheral devices, data storage technologies, file systems, networking concepts, and computer security risks along with mitigation strategies. |
|                                                                    |                                                                                                              | 2.4                                                                           | Select and use the concept of virtualization to install VirtualBox and Linux                                                                            |
|                                                                    |                                                                                                              | 2.5                                                                           | Explore the functionalities of the Java Virtual Machine                                                                                                 |

### Indicative Content

- OS basics: roles, types, GUIs, CLIs, boot process
- Processes & threads: multitasking, scheduling, synchronization, deadlocks
- Memory: virtual memory, paging, cache, allocation, garbage collection
- I/O & storage: devices, buses, RAID, access methods
- File systems: structure, allocation, extensions, access control
- Networking: OSI, TCP/IP, sockets, network OS
- Security: viruses, policies, OS security features, user access

- Virtualization: VMs, VirtualBox, Linux, JVM

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Anderson & Dahlin – *Operating Systems: Principles and Practice* (2014)
- Bryant & O'Hallaron – *Computer Systems: A Programmer's Perspective* (2016)

## Unit 18: Introduction to Artificial Intelligence

Unit code: F/651/8686

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of Artificial Intelligence (AI), covering its foundational theories, types, and applications across various sectors. Learners will explore the workings of intelligent agents, machine learning techniques, logic-based AI, and the latest advancements in AI technologies. The unit includes theoretical learning and practical applications, ensuring learners gain a holistic understanding of AI and its implications for the future.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                             | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                            |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand AI concepts, types and models and the ethical implications of AI | 1.1                                                                           | Explore key AI concepts and the distinctions between AI types and models,                                                  |
|                                                                    |                                                                             | 1.2                                                                           | Classify various AI systems in real-world contexts.                                                                        |
|                                                                    |                                                                             | 1.3                                                                           | Analyse the ethical implications of AI                                                                                     |
|                                                                    |                                                                             | 1.4                                                                           | Analyse algorithms and intelligent agents,                                                                                 |
|                                                                    |                                                                             | 1.5                                                                           | Compare and contrast machine learning and AI                                                                               |
| 2                                                                  | Be able to develop AI solutions                                             | 2.1                                                                           | Interpret logarithmic functions and probability theories in AI and evaluate data accuracy and precision.                   |
|                                                                    |                                                                             | 2.2                                                                           | Develop AI-driven solutions and implement AI programming languages like LISP and Prolog                                    |
|                                                                    |                                                                             | 2.3                                                                           | Design intelligent agents                                                                                                  |
|                                                                    |                                                                             | 2.4                                                                           | Manage AI projects using advanced functionalities, and predict future AI technology directions and their societal impacts. |

### Indicative Content

- Essentials of AI: history, types (narrow vs. general), intelligent agents, algorithms, probability, data evaluation
- Intelligent agents: reflex, model-based, goal-based, utility-based, learning agents

- Search techniques: pseudocode, algorithms, compilers, heuristic/uninformed/adversarial search, game theory
- Constraint satisfaction & logic: Bayesian networks, neural networks, decision trees, Markov decision processes, SLAM, LISP
- Logical reasoning: propositional & first-order logic, knowledge engineering, rule-based systems, Prolog
- Machine learning: supervised & unsupervised learning, NLP, deep learning, SVMs, probabilistic reasoning, chatbots
- Applications: speech recognition, image classification, robotics, healthcare, industry, daily life
- Ethics & future: bias, accountability, privacy, governance, AI's economic and societal impacts

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Russell & Norvig – *Artificial Intelligence: A Modern Approach* (2020)
- Poole & Mackworth – *Artificial Intelligence: Foundations of Computational Agents* (2023)
- Lee & Qiufan – *AI 2041: Ten Visions for Our Future* (2021)

## Unit 19: Database Programming

Unit code: H/651/8687

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of the fundamental principles and practical applications of relational database management systems (RDBMS). Learners will develop skills in designing, managing, and manipulating databases using SQL. The unit covers essential topics such as database schema design, normalization techniques, data querying, and data manipulation. Learners will also explore advanced concepts including joins, subqueries, views, indexes, and database security.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                     | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                    |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Be able to design effective database schema and install database management systems | 1.1                                                                           | Evaluate the impact and significance of database applications across various industries.                                                           |
|                                                                    |                                                                                     | 1.2                                                                           | Explain the strategic role of databases in business decision-making and operational efficiency.                                                    |
|                                                                    |                                                                                     | 1.3                                                                           | Design and implement effective database schemas based on key design principles and requirements.                                                   |
|                                                                    |                                                                                     | 1.4                                                                           | Apply normalisation rules to enhance database integrity and performance.                                                                           |
|                                                                    |                                                                                     | 1.5                                                                           | Develop and optimise complex SQL queries using advanced techniques for effective data manipulation and retrieval.                                  |
|                                                                    |                                                                                     | 1.6                                                                           | Apply the syntax and use of SQL commands including data definition, manipulation, and control to manage database systems efficiently.              |
|                                                                    |                                                                                     | 1.7                                                                           | Install and configure database management systems like MySQL and SQL Server, tailoring them to specific organisational needs.                      |
|                                                                    |                                                                                     | 1.8                                                                           | Utilise SQL to perform detailed data analysis and generate insightful reports.                                                                     |
|                                                                    |                                                                                     | 1.9                                                                           | Implement robust security measures in database systems to safeguard sensitive information against threats.                                         |
|                                                                    |                                                                                     | 1.10                                                                          | Troubleshoot common database issues and enhance system performance through targeted optimization techniques such as indexing and query refinement; |

## Indicative Content

- Introduction to RDBMS, database applications, schema design, normalization (1NF, 3NF)
- SQL basics: DDL, DML, DCL, data types, constraints
- Creating & managing tables: primary/foreign keys, schema design
- Populating & retrieving data: queries, functions, sorting, grouping
- Data manipulation: UPDATE, DELETE, TRUNCATE, transactions
- Joins (inner, outer, cross, self) and subqueries (correlated, EXISTS, NOT EXISTS)
- Views & indexes for optimization
- Modifying tables and large datasets (UNION, PIVOT, multi-table inserts)
- Regular expressions in SQL/MySQL/SQL Server
- Database security: SQL injection prevention, encryption, auditing

## Suggested Resources

- **UPI Study platform** (core notes and materials)
- C. J. Date – *An Introduction to Database Systems* (2003)
- Rod Stephens – *MySQL 8 Cookbook* (2018)

## Unit 20: System Analysis and Design

Unit code: J/651/8688

RQF Level: 5

### Unit Aim

This unit aims to provide learners with a comprehensive understanding of the principles and practices involved in analysing and designing complex systems, particularly within the realms of software engineering and business domains. Learners will develop skills in identifying, defining, and addressing problems through systematic analysis, recognising the iterative nature of systems analysis, and designing lifecycles. Learners use various methodologies and tools used in systems development, including Agile methodology's integration into the systems development life cycle, and gain insights into risk management, security management, and fundamental project management components.

### Learning Outcomes, and Assessment Criteria

| Learning Outcomes. To achieve this unit a learner must be able to: |                                                                                                  | Assessment Criteria: Assessment of these outcomes demonstrates a learner can: |                                                                                                                                                                              |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                 | Understand and apply systems analysis and design principles in the system development life cycle | 1.1                                                                           | Apply systems analysis and design principles, including their application in software engineering and business domains.                                                      |
|                                                                    |                                                                                                  | 1.2                                                                           | Analyse problems systematically, recognising the iterative nature of systems analysis and design lifecycles.                                                                 |
|                                                                    |                                                                                                  | 1.3                                                                           | Assess the roles of systems analysts and the utilisation of tools for effective business analysis.                                                                           |
|                                                                    |                                                                                                  | 1.4                                                                           | Assess various methodologies and tools used in systems development, including the integration of Agile methodology into the systems development lifecycle.                   |
|                                                                    |                                                                                                  | 1.5                                                                           | Explore system development processes, including system design phases, risk management, security management, and fundamental project management components and methodologies. |
|                                                                    |                                                                                                  | 1.6                                                                           | Apply the key concepts of project management in project execution within the systems analysis and design framework.                                                          |

### Indicative Content

- Fundamentals of systems analysis & design (principles, lifecycle, analyst roles, tools)
- Systems development process (methodologies, Agile vs. traditional models, requirement gathering, flowcharts)

- System modeling (JAD, RAD, BPM, prototyping, UML, DFDs, OOAD, use case diagrams)
- System design & architecture (UI/UX, GUI design, service-oriented vs. client-server, ERM, normalization, BI tools)
- Implementation & SDLC (coding, documentation, debugging, testing methods, dry runs, maintenance)
- Systems support, risk management & security (firewalls, encryption, biometrics, data center/cloud security)
- Project management (planning, scheduling, feasibility studies, Gantt charts, risk/quality/capacity management)

### **Suggested Resources**

- **UPI Study platform** (core notes and materials)
- Alan Dennis, Barbara Haley Wixom & Roberta M. Roth – *Systems Analysis and Design* (2009)
- Roger Pressman & Bruce Maxim – *Software Engineering: A Practitioner's Approach* (2023)

## Assessment Guidance

Sample assessments and marking scheme are available on request as part of the Qualification Specification supplied to centres.

QUALIFI has an assessment policy and procedure documents that are available to all centres delivering this qualification.

## Special Considerations and Reasonable Adjustments

This qualification and its assessments have been designed to best support accessibility and inclusion for all learners. In the design and development of qualifications and assessment Qualifi complies with the requirements of the Equality Act 2010 and the appropriate Ofqual general conditions of regulation. In some instances individuals will have diverse learning needs and need reasonable adjustments to be able fully participate in the qualification and have fair access to assessment. Reasonable adjustments, including additional time or alternative evidence formats, are intended to enable learners with individual needs to demonstrate their skills and knowledge without changing the demands of the assessment. Centres are responsible for making sure that learners can access the requirements of the qualification at the start of a programme of learning.

Special consideration can be given after an assessment has taken place for learners who have been affected by adverse circumstances, such as illness. Special considerations can be in relation to the amount of time given for evidence to be provided or the format of the assessment as long as this is equally valid. However, centres must not agree to the use of alternative forms of evidence to those stipulated in a unit, or to the omission of any assessment criteria when judging attainment.

For further details please see QUALIFI's *Reasonable Adjustment and Special Consideration Policy* and *Access to Fair Assessment Policy and Procedure*.

## Malpractice and Maladministration

Centre or learner malpractice undermines the integrity and validity of assessment and/or the certification of qualifications and can arise or be suspected in relation to any unit or type of assessment within the qualification.

Centres are required to take steps to prevent malpractice and to investigate instances of suspected malpractice. Centres will investigate the allegation in compliance with their own published and QUALIFI approved policy and procedures.

Incidents of maladministration, unintentional errors in the delivery or assessment of QUALIFI qualifications that may affect the assessment of learners, should also be reported in the same way.

QUALIFI may conduct an investigation if we believe that internal assessment and/or internal quality assurance is not being carried out in line with our policies. QUALIFI reserves the right to withhold the issuing of results and/or certificates while an investigation is in progress.

For further details regarding malpractice and how to report suspected malpractice please see QUALIF's *Malpractice and Maladministration Policy* and *Plagiarism, Collusion and Cheating Policy*.

Where centres have concerns about learner use of Artificial Intelligence (AI) please refer to the *QUALIFI Guidance statement to centres on the risk of AI*.

## Contact Details

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