



MSc DIGITAL & TECHNOLOGY SOLUTIONS UNIT SUMMARIES

CORE UNITS

Digital Leadership and Transformation

Brief Summary	The aim of this unit is to develop the strategic thinking and leadership skills of students for managing the strategic contribution of digital technologies to organisational success and transformation.
Indicative Content	<ol style="list-style-type: none"> 1. Strategic planning, evaluation and decision making: introduction to concepts, models, frameworks, techniques that can be applied to organisational evaluation and analysis to inform strategic planning and decision making. 2. Leadership: introduction to concepts and theory to aid students' development of leadership styles and strategies in a variety of strategic contexts. 3. Change Management: introduction to approaches and factors to consider to enable improvement and transformation through digital technology implementation. 4. Organisational Learning and Knowledge Management: Critical consideration of approaches, how these can be supported by digital technologies, and how they support improvement and transformation. 5. Entrepreneurship: introduction to approaches that can support the identification and management of change and transformation 6. Innovation: the role of IT in supporting innovation in business.

Information Systems

Brief Summary	Covers professional, ethical and legal issues for IT professionals. Focuses on the interface between information systems and business organisations, covering techniques and issues of information systems management and strategy. Explores the development and management of socio-technical systems.
Indicative Content	<p>Business activities supported and social issues affected by IS: case studies & examples, e Commerce, management information, privacy (20%).</p> <p>The specification, design, representation and management of socio-technical systems with many users and stakeholders, with conflicting goals. (30%).</p>

	The current legal framework of computing, ethical issues and professional bodies in computing.(20%) Information Systems Management & Strategy (30%)
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Reflective Practice in Digital Leadership

Brief Summary	This unit is a work-based learning unit that assesses soft skills demonstrated in the workplace. The skills assessed are specified as part of the Digital & Technology Solutions Specialist apprenticeship standard (1-11) and the QAA Computing Benchmark Standard (12-14). The evidence will be presented in a portfolio.
Indicative Content	<p>The following skills will be assessed:</p> <ol style="list-style-type: none"> 1. Negotiate and agree digital and technology specialism delivery budgets with those with decision-making responsibility 2. Develop and deliver management level presentations which resonate with senior stakeholders, both business and technical 3. Demonstrate self-direction and originality in solving problems, and act autonomously in planning and implementing digital and technology solutions specialist tasks at a professional level 4. Be competent at negotiating and closing techniques in a range of interactions and engagements, both with senior internal and external stakeholders 5. Own employer's business objectives and strategy, its position in the market and how own employer adds value to its clients through the services and/or products they provide 6. Inspire and motivate others to deliver excellent technical solutions and outcomes 7. Establish high levels of performance in digital and technology solutions activities 8. Be results and outcomes driven to achieve high key performance outcomes for digital and technology solutions objectives 9. Promote a high level of cooperation between own work group and other groups to establish a technology change led culture 10. Develop and support others in developing an appropriate balance of leadership and technical skills 11. Create strong positive relationships with team members to produce high performing technical teams 12. An ability to engage in a peer review process that involves the critical review of software and proposals, coupled with positive advice for improvement and innovation 13. Those required for the creation of the lifelong learner, who can set goals and identify resources for the purpose of learning 14. Translational skills which involve the necessary communication between technical and non-technical audiences.

Professional Development

Brief Summary	This is a 30 practice credit, work based practice unit which cements the core skills, knowledge and behaviours (from the level 7 Digital Technology Solutions Specialist standard) through practical experience in the work place.
Indicative Content	Based on practice credits, this unit is entirely based in the workplace putting into practice the core outcomes (defined in the level 7 Apprenticeship standard, see below) in order to cement and apply the skills, knowledge and behaviours in the working environment. All these outcomes will already have been delivered and assessed within taught core units.

SOFTWARE ENGINEERING PATHWAY UNITS

Introduction to Software Engineering

Brief Summary	This is a 15-credit module undertaken by all MSc Software Engineering students covering key software engineering concepts, introducing students to software engineering.
Indicative Content	<p>The module will cover three key phases of problem definition, software development and maintenance. It covers identification, definition, design, analysis, and management of basic requirements, coding, testing, evaluation and quality assurance.</p> <p>The primary goal is to introduce students to the discipline of Software Engineering.</p> <p>The module will cover: Software development models; Agile Software Development; Approaches to system modelling; Software reuse, configuration management, and open-source development; Managing risk in the software development process; Component-Based Software Engineering;</p>

Software Testing and Maintenance

Brief Summary	This is a 15-credit module undertaken by all MSc Software Engineering students covering key software engineering concepts, introducing students to software engineering.
Indicative Content	<p>The module will cover techniques students need to design and implement software testing procedures, conduct software inspections and employ established release and maintenance QA procedures.</p> <p>Indicative Content Software Testing Methods; Software Quality Assurance; Version control systems; Validation and Verification of software; Software Metrics</p>

Cloud Computing

Brief Summary	This is a 15-credit module undertaken by all MSc Software Engineering students covering a comprehensive overview of advances in cloud computing and the possibilities it has unleashed.
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Indicative Content	<p>Advances in computing, networking, and storage technologies which individually and collectively include major hardware and software breakthroughs. These include computer virtualisation, distributed and replicated storage, and software-based networking. Cloud computing motivates further technology advancement and changes how modern IT infrastructures are built and evolved.</p> <p>Indicative Content Cloud architecture and foundations; Building cloud-based infrastructure, services and applications; Existing cloud architecture models; Cloud industry standardisation; Middleware platforms; Cloud provider platforms</p>
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Service Oriented Software Engineering

Brief Summary	This is a 15-credit module undertaken by all MSc Software Engineering students covering high level structures of a software system, the discipline of creating such structures, and the documentation of these structures
Indicative Content	<p>Enterprise applications are about the display, manipulation, and storage of large amounts of often-complex data and the support or automation of business processes with that data. This module is concerned with providing students with knowledge of and skills regarding the design and implementation of Enterprise Applications. The module will examine Traditional and Enterprise Design Patterns - History of patterns, The Patterns Movement and Patterns Catalogues. Software libraries and frameworks, and their use in developing and testing software systems. Use of development frameworks' facilities for project and source-code management, automated testing, refactoring and profiling. Service-Oriented Architecture (SOA), SOA framework, SOA entities & patterns, SOA & Web services.</p> <p>Indicative Content Design Patterns; Creation and analysis of distributed applications in a high level language Web Service Architectures; Software and Service Oriented frameworks current and emerging; Analysis and refactoring of software ; Service Oriented Architecture (SOA)</p>

Synoptic Project : Software Engineering Specialist

Brief Summary	This is a 60-credit, individual project undertaken by Digital and Technology Solutions Specialist Apprentices taking the Software Engineering specialism.
Indicative Content	The project work and report will align with the learning outcomes from the chosen specialism cluster. The project will involve practical system creation or empirical work and will normally undertake some element of development associated with the apprentice's role with their employer. Each apprentice will carry out an individual project involving system creation or experimentation, which will provide him or her with the opportunity to develop independent practical and analytical skills using proven methods and techniques. Students will be able to produce well-substantiated and validated results within the limits imposed by the time constraint. They will be able to demonstrate their investigative ability and be expected to critically examine their work and be able to place it in context.

	<p>Each student will be allocated a project supervisor from the academic staff. The main function of a project supervisor is to offer general advice and guidance to the student. Students will submit a proposal to their project supervisor which will be scrutinised by at least one other academic member of staff.</p> <p>Supporting seminars commencing before the start of the project, will include coverage of</p> <ul style="list-style-type: none"> • Skills and techniques, including risk consideration, required for successful planning, design and execution of research • Experimental Design • Time management • Use of research resources • Research presentation • Writing and presentation of the project report • The place of legal, ethical, professional and social issues and cultural issues • Examination of a case study/ project to illustrate issues in research <p>As the project is the most distinctive part of postgraduate study, there will be a strong element of personal development planning, both during the support seminars and also during the supervision sessions with individual project supervisors, as students are invited to reflect on their progress during the project's execution and write-up.</p>
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DATA ANALYTICS PATHWAY UNITS

Computational Statistics, Visualisation and Forecasting

Brief Summary	An intensive course in data analysis primarily for non-mathematics/statistics graduates. Covers fundamentals of descriptive statistics, probability, applications and forecasting.
Indicative Content	<p>Key themes</p> <p>Visualisation is a central theme and is incorporated in all four content sections.</p> <p>Data Visualisation [20%]</p> <p>Methods of sampling. Data representation - pie and bar charts; scatterplots; histograms; cumulative (relative) frequency curves; dot plots; box-whisker plots, stem-and-leaf displays. Measures of central tendency and variability for sample and grouped data.</p> <p>Probability [30%]</p> <p>Definitions and fundamental laws; counting techniques; conditional probability; Bayes' theorem; the concept of a discrete probability distribution; expectations and variance; some standard discrete distributions; Geometric, Binomial, Poisson. The concept of a continuous distribution; the Normal distribution and properties; use of Normal tables. Continuous probability</p>

	<p>distributions and their properties; Expectation and variance. Some standard continuous distributions; normal and related distributions.</p> <p>Statistical Applications [40%]</p> <p>The concept of a sampling distribution; point and interval estimation; hypothesis testing; Type I and Type II errors; p values; determination of sample size; confidence intervals and significance tests for means and for proportions; single, paired and unpaired samples; Normal and t tests. F-test. Normal probability plot. Introduction to one-way Analysis of Variance. Hartley's test, Bartlett's test. Confidence intervals for treatment means and differences between treatment means. Introduction to simple linear regression. ANOVA table. Confidence intervals and prediction intervals. Correlation and rank correlation. Chi-square as a test of association and as a test of model fit.</p> <p>Forecasting [10%]</p> <p>Introduction to simple, linear and seasonal exponential smoothing methods.</p>
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Data Analytics

Brief Summary	<p>The aim of this unit is to develop the students' knowledge in the areas of database system development, business intelligence and data mining.</p>
Indicative Content	<p>Data governance [10%]: legislative data protection; data security standards; legal, social and ethical concerns involved in data management and analysis.</p> <p>Data analytic project lifecycle [10%]; Business data priorities: reactive and proactive; Document and describe data models using appropriate data modelling tools and select appropriate methods to present data and results that support human understanding of complex data sets; devise business opportunities reports on analysis / modelling outcomes suitable for a variety of stakeholders.</p> <p>Data architecture solutions [20%]: Data warehousing / Marts / Data Lakes, methodologies, Data extraction, transformation and loading process; the platform choices available for designing and implementing solutions for data storage, processing and analytics in different data scenarios;</p> <ul style="list-style-type: none"> • Identify and select the business data that needs to be collected and transitioned from a range of data systems; acquire, manage and process complex data sets, including large-scale and real-time data.

	<p>Data analytic production environment [45%]: Data extraction; Data preparation: choosing, configuring and applying basic data reduction techniques and algorithms (e.g., dimensionality reduction, sampling); data cleaning, normalisation; Data Mining, Data visualization; Data manipulation; Transformational operations including extraction and addition of features.</p> <p>Data analysis and Online Analytical Processing (OLAP) [15%]: summarising data (frequency and probability distributions; correlations), introductory aspects of graph analytics (e.g., centrality), representation of multi-dimensional views of data; categories of OLAP tools, analytical queries.</p>
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Synoptic Project : Data Analytics Specialist

Brief Summary	<p>This is a 60-credit, individual project undertaken by Digital and Technology Solutions Specialist Apprentices taking the Data Analytics specialism.</p>
Indicative Content	<p>Each individual project will investigate a challenging but constrained Data Analytics problem. The project will normally address a business problem and should, based on the findings, include recommendations on how to deploy the models and the knowledge obtained from the process into the specific business domain investigated.</p> <p>The core of the project will involve performing an end-to-end data analytics task pipeline including, data collection, formulation of one or more questions to be asked about the data, typical preprocessing steps (e.g. cleaning, transforming and exploring), analysis, modelling, visualization, interpretation and assessment of whether models are meaningful and relevant to the business.</p> <p>Each student will carry out an individual project, involving all stages of the data analytics process, which will provide him/her with the opportunity to develop independent practical, analytical and visualization skills using proven methods and techniques.</p> <p>Students will be able to produce well-substantiated and validated results within the limits imposed by the time constraint. They will be able to demonstrate their investigative ability but will not necessarily be able to produce a complete piece of research or make a significant contribution to knowledge. They will, however, be expected to critically examine their work and be able to place it in context.</p> <p>Each student will be allocated a project supervisor from the academic staff. The main function of a project supervisor is to offer general advice and guidance to the student. Students will submit a proposal to their project</p>

	<p>supervisor which will be scrutinised by at least one other academic member of staff.</p> <p>Supporting seminars commencing before the start of the project, will include coverage of</p> <ul style="list-style-type: none"> • Skills and techniques, including risk consideration, required for successful planning, design and execution of research • Experimental Design • Time management • Use of research resources • Research presentation • Writing and presentation of the project report • The place of legal, ethical, professional and social issues and cultural issues • Examination of a case study/ project to illustrate issues in research <p>As the project is the most distinctive part of postgraduate study, there will be a strong element of personal development planning, both during the support seminars and also during the supervision sessions with individual project supervisors, as students are invited to reflect on their progress during the project's execution and write-up.</p>
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CYBER SECURITY PATHWAY UNITS

Intro. to Cyber Security

Brief Summary	This unit will introduce both computer security and digital forensics concepts.
Indicative Content	<p>Forensic Process [10%]: Types of investigations, role of investigator, processes, forensic analysis, and legal aspects.</p> <p>File System Analysis [30%]: basic file systems structure, data acquisition, volume analysis, write blockers, signatures, file systems artefacts, locating and restoring deleted content.</p> <p>Recent Developments and Advances in Cyber Security Digital Forensics [10%]: Topics such as mobile forensics, memory and volatile data collection and forensics analysis and forensic data mining.</p> <p>Overview of Cyber Security [15%]: The need for security; Types of security; Threats; Security mechanisms and security services.</p> <p>Introduction to Cryptography [10%] : Attacks on conventional and public key cryptography; Integrity (hash functions and message authentication codes).</p> <p>Access control [25%]: Goals of protocols (Authentication and Authorisation; Key distribution and confirmation); Fiat-Shamir protocol; PKI; Digital certificates; Mediated authentication (Needham-Schroeder protocol); Access control lists and capabilities; Multilevel Security; Multilateral Security; Covert channels; Kerberos.</p>

Advanced Network Security

Brief Summary	The aim of this unit is to provide students with the necessary skills to identify threats, conduct vulnerability assessments, and identify and implement appropriate security controls.
Indicative Content	<ul style="list-style-type: none"> • Vulnerability assessments – Carrying out vulnerability assessments against synthetic real-world systems, using industry standard tools and techniques. • Analysis of attack tools – Develop an understanding of the taxonomy of attack tools employed by attackers. • Remediation and security enhancement – Identify and select appropriate remediation and security enhancement techniques and procedures. • Analysis of attack techniques and threat modelling – Analyse trends in attack technique and perform threat modelling for a hypothetical scenario. • Security controls and policy – Identify and categorise a wide range of security controls and policies. • Human factor analysis e.g. types of actor, motivation, capability – Analyse various human factors associated with cyber security. • Ethical hacking tool selection and use – Utilise a range of ethical hacking tools and techniques in a controlled environment. • Application of countermeasures e.g. firewalls – Deploy countermeasures to mitigate threats identified in a vulnerability assessment.

Synoptic Project : Cyber Security Specialist

Brief Summary	This is a 60-credit, individual project undertaken by Digital and Technology Solutions Specialist Apprentices taking the Cyber Security specialism.
Indicative Content	<p>The project work and report will align with the learning outcomes from the chosen specialism cluster. The project will involve practical system creation or empirical work and will normally undertake some element of development associated with the apprentice's role with their employer. Each apprentice will carry out an individual project involving system creation or experimentation, which will provide him or her with the opportunity to develop independent practical and analytical skills using proven methods and techniques. Students will be able to produce well-substantiated and validated results within the limits imposed by the time constraint. They will be able to demonstrate their investigative ability and be expected to critically examine their work and be able to place it in context.</p> <p>Each student will be allocated a project supervisor from the academic staff. The main function of a project supervisor is to offer general advice and guidance to the student. Students will submit a proposal to their project</p>

	<p>supervisor which will be scrutinised by at least one other academic member of staff.</p> <p>Supporting seminars commencing before the start of the project, will include coverage of</p> <ul style="list-style-type: none"> • Skills and techniques, including risk consideration, required for successful planning, design and execution of research • Experimental Design • Time management • Use of research resources • Research presentation • Writing and presentation of the project report • The place of legal, ethical, professional and social issues and cultural issues • Examination of a case study/ project to illustrate issues in research <p>As the project is the most distinctive part of postgraduate study, there will be a strong element of personal development planning, both during the support seminars and also during the supervision sessions with individual project supervisors, as students are invited to reflect on their progress during the project's execution and write-up.</p>
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IT STRATEGY

Data Management

Brief Summary	<p>This unit aims to introduce students to the fundamentals of data management in organisations. Since data is one of the most valuable resources in organisations, the main objective of this unit is to develop the awareness and skills necessary to optimise storage and use of data resources for both operational and strategic purposes.</p>
Indicative Content	<p>The following are the main themes covered in the unit.</p> <ul style="list-style-type: none"> • Introduction to data management in organisations: an introduction to the general aspects of organisational data management and IT architecture. The aim here is to develop a good understanding of the usefulness of data and how these should be managed in organisations in order to improve the effectiveness of data utilisation. • Principles of database modelling and design: this is a more practical part of the unit where students learn database design and application. Lab-based sessions are run to allow students to develop technical skills. • Strategic planning for data management, including data and information policies: this part of the unit aims to develop an awareness of the strategic aspects of data management. This includes an in-depth understanding of data acquisition techniques as well as information extraction for strategic planning purposes. • Introduction to big data management and organisational issues in data-intensive environments: this part introduces students to the latest developments in the area of big data, and aims to develop an understanding

	of how the new wave of data intensive environments need to manage big data for improving firms' performance.
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IT Consultancy

Brief Summary	The aim of this unit is to provide a conceptual and practical foundation for the core aspects of the consultancy process, and the various stages of engagement with clients and other stakeholders. The unit's focus is consultancy in the context of IT projects and change initiatives. The process of consultancy is now of much wider relevance than just to those employed in specific role of independent or external 'consultant' commissioned for a specific project. Organisational members also need to engage more and more with their colleagues in a consultancy fashion in the context of both bounded projects and wider/longer-term change initiatives. The roles of manager and consultant have therefore been increasingly converging.
Indicative Content	<p>The consulting process: nature of management consulting; the role of consultant; reasons for consultancy; methods and good practice; factors to consider for deciding process to adopt (e.g. purpose; contextual factors; resources; knowledge and skills).</p> <p>The consulting life-cycle: negotiating entry; planning; contracting; research; presenting findings; managing endings; evaluation.</p> <p>Research: using frameworks for business analysis; clarifying the problem and its domain; developing an understanding of the 'client' situation; forming the working hypothesis; applying research methods; data collection and data analysis.</p> <p>Personal skills: client-consultant relationship; consultancy roles; understanding change; personal impact and presence; body language; presentation skills; conducting meetings; listening skills; persuasion skills; negotiating skills; facilitation skills.</p> <p>Professionalism: managing oneself in the role of a consultant; professional standards; the Ethics of Consultancy; professional bodies and trade associations; the procurement of consultants.</p>

Managing Enterprise Systems

Brief Summary	This unit aims to introduce students to Enterprise Systems in organisations and their application in operations, planning and control.
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Indicative Content	<p>The following themes are covered in the unit:</p> <ul style="list-style-type: none"> • Introduction to enterprise systems: development, implementation, and use of these systems in the context of operations, planning and control. • Business intelligence: the extraction and use of information from integrated business processes. This part of the unit focuses on analysing the information flow in organisations that have implemented enterprise systems, and introduces students to the concepts of business intelligence in integrated business processes. • Practical introduction to Enterprise Systems Use: hands-on sessions with the aim of providing students with experience of an enterprise scale commercial package.
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Synoptic Project : IT Strategy Specialist

Brief Summary	This is a 60-credit, individual project undertaken by Digital and Technology Solutions Specialist Apprentices taking the IT Project Management specialism.
Indicative Content	<p>Each individual project will investigate how IT strategy is working in practice in supporting the business needs of a chosen area of the host organisation. The synoptic project will normally involve making recommendations for change or improvement to address the challenges identified in the investigation.</p> <p>Each student will carry out an individual piece of consultancy work that is written up as a project report.</p> <p>Each student will be allocated a project supervisor from the academic staff. The main function of a project supervisor is to offer advice and guidance to the student about scope, planning and presentation. Students will submit a proposal to their project supervisor which will be scrutinised by at least one other academic member of staff.</p> <p>Supporting seminars commencing before the start of the project, will include coverage of</p> <ul style="list-style-type: none"> • Skills and techniques, including risk consideration, required for successful planning, design and execution of the synoptic project • Scoping, planning and delivering a successful synoptic project • Time management • Use of research resources • Research presentation • Writing and presentation of the project report • The place of legal, ethical, professional, social issues and cultural issues • Examination of a case study/ project to illustrate issues in work-based research <p>As the project is the most distinctive part of postgraduate study, there will be a strong element of personal development planning, both during the support seminars and also during the supervision sessions with individual project supervisors, as students are invited to reflect on their progress during the project's execution and write-up.</p>

IT PROJECT MANAGEMENT PATHWAY UNITS

Environments and Approaches

Brief Summary	The aim of this unit is to help apprentices understand how IT projects in larger organisations are approved and funded, how they are managed according to company standards and how they deliver value and benefits. It then considers different ways to achieve an IT solution.
Indicative Content	Environments & Approaches: how IT drives changes; how IT decisions are made - strategic planning, budgets and organisational structures; quality management systems, IT & project governance; codes of conduct, PMO, benefits and value management. Approaches to IT solutions: in-house development (SDLCs) - remote teams, international teams; procurement; outsourcing.

Methodologies and Techniques

Brief Summary	The aim of this unit is to teach apprentices about the range of approaches used to manage projects and provide them with opportunities to use this knowledge in making decisions. They will also learn when and how to use a number of core techniques used widely in project management.
Indicative Content	A range of project management approaches will be introduced ranging from very formal through to very agile (linear, incremental, iterative, extreme) using examples such as Prince 2, APM, SCRUM, XP. Apprentices will apply a range of specific techniques that support the IT project manager in the management of: scope, schedules, resources, risks, budgets, quality, communication management, stakeholder management, team-working & team management.

Synoptic Project : IT Project Management Specialist

Brief Summary	This is a 60-credit, individual project undertaken by Digital and Technology Solutions Specialist Apprentices taking the IT Project Management specialism.
Indicative Content	Each individual project will investigate the Project Management of a challenging but constrained IT problem. The synoptic project will normally involve managing or supporting the management of an IT project inside the employer's organisation but may involve providing consultative advice on some aspect of project management for the employer's projects. Each student will carry out an individual piece of work that is written up as a project report.

Each student will be allocated a project supervisor from the academic staff. The main function of a project supervisor is to offer advice and guidance to the student about scope, planning and presentation. Students will submit a proposal to their project supervisor which will be scrutinised by at least one other academic member of staff.

Supporting seminars commencing before the start of the project, will include coverage of

- Skills and techniques, including risk consideration, required for successful planning, design and execution of the synoptic project
- Scoping, planning and delivering a successful synoptic project
- Time management
- Use of research resources
- Research presentation
- Writing and presentation of the project report
- The place of legal, ethical, professional, social issues and cultural issues
- Examination of a case study/ project to illustrate issues in work-based research

As the project is the most distinctive part of postgraduate study, there will be a strong element of personal development planning, both during the support seminars and also during the supervision sessions with individual project supervisors, as students are invited to reflect on their progress during the project's execution and write-up.