# ETC International College

## Programme Specification: University Foundation Programme Technology

January 2020

**Awarding Organisation:** ETC International College

**Teaching Institution:** ETC International College

**Credits awarded upon successful completion:** 120

The ETC Level 3 University Foundation Programme in Engineering and Technology is aimed at students wishing to enter a UK university. The course prepares students for entry to the first year of a degree or equivalent qualification at RQF level 4.

## 1. Course Aims & Learning Outcomes

**Course Aims:**

The programme is intended to;

- Equip individuals with the knowledge, understanding and skills required in a UK university in either engineering or computing fields.
- Provide opportunities for specialist study relevant to individual vocations.
- Enable entry to higher education in the fields of engineering or computing.
- Provide the opportunity for international students to develop general & technical English language skills related to their chosen field.
- Develop a range of skills and techniques, personal qualities and attributes essential for successful performance in higher education and working life.

## 2. Units

**Units of Work:** Each award comprises the following taught units:

**UFP Technology – 120 credits at level 3**

| Unit Title | Credits | Unit Type | Guided Learning Hours |
|---|---|---|---|
| **Maths & Engineering Principles** | 20 | **Mandatory** | **120** |
| **Principles of Computer Science** | 20 | **Mandatory** | **120** |
| **Design & Development Project** | 10 | **Mandatory** | **60** |
| **Health & Safety in the Workplace** | 10 | **Mandatory** | **60** |
| **IT Systems Security and Encryption** | 10 | **Mandatory** | **60** |
| **Computer Architecture** | 10 | **Mandatory** | **60** |
| **Electronic Devices and Circuits** | 10 | **Mandatory** | **60** |
| **English** | 20 | **Mandatory** | **120** |
| **One optional unit to be chosen from:** | 10 | **Option** | **60** |
| **a) Mechanical Behaviour of Metallic Materials** | | | |
| **b) Relational Database Development** | | | |
| **Total** | **120** | | |

Mandatory units are taken to cover 110 credits (including English at 20 credits). The remaining 10 credits are made up of an option; either a computing or engineering unit, depending on the student's specialism.

The total credits at the end of the course equals 120, made up of mandatory units (90 credits) + English (20 credits) + one optional unit (10 credits).

**NOTE:** This course follows the structure and content of the BTEC Level 3 Engineering RQF and BTEC Level 3 Computing RQF specifications, although the centre does not currently support BTEC certification of this course.

## 3. Course Structure, Delivery and Assessment

**Course Description & Duration:**

- 8 modules + English modules (as necessary), spread over 36 teaching weeks (3 terms of 12 weeks)
- Total of 120 credits

(**NOTE:** In the situation where a student fails to successfully complete all units, credits will be awarded per unit passed and a relevant certificate issued).

**Entry Requirements:**

- **Qualifications:** RQF level 2 or equivalent (AS-levels / High School Diploma)
- **English:** 4.5 IELTS or equivalent

- **Minimum Age:** 17 + years

**Weekly Hours:** Between 26 and 32 contact hours, dependant on individual requirements for additional English lessons.

**Number of Lessons:** Between 25 and 30 lessons per week (nominally 50 minutes per lesson; some lessons may be extended, depending on students' needs). In addition, students will be set independent learning tasks, research, project and assignment work. For this reason, timetabled contact hours may not add up to Guided Learning Hours on all cases.

**Teaching Hours:** With the exception of 'Principles of Computer Science' and 'Engineering Principles' (which are double units, and therefore 20 credits each and proportionally more taught hours), 10-credit units are nominally 45 Guided Learning Hours and 62 Total Qualification Time.

**Typical Timetable:**

| | MON | TUES | WEDS | THURS | FRI |
|---|---|---|---|---|---|
| **9:00** | Comp Sci Principles GM | Comp Sci Principles GM | Comp Sci Principles GM | Comp Sci Principles GM | Comp Sci Principles GM |
| **10:00** | Eng Prin (Maths) PB | Eng Prin (Maths) PB | Eng Prin (Mech) PB | Eng Prin (Mech) PB | Design & Development Project PB |
| **11:00** | Eng Prin (Electronics) PB | Eng Prin (Electronics) PB | Eng Prin (Electronics) PB | Eng Prin (Electronics) PB | Design & Development Project PB |
| **12:00** | LUNCH | LUNCH | LUNCH | LUNCH | LUNCH |
| **13:00** | Systems Security & Encryption SM | Systems Security & Encryption SM | Systems Security & Encryption SM | Systems Security & Encryption SM | Systems Security & Encryption SM |
| **14:00** | Computer Architecture SM | Computer Architecture SM | Computer Architecture SM | Computer Architecture SM | Computer Architecture SM |
| **15:00** | Language Support JK | Language Support JK | Language Support JK | Language Support JK | Language Support JK |

**Independent Work:** Students are encouraged to complete project work, revision, research, flipped learning and consolidation tasks, and to develop robust study skills.

**Guided Learning Hours:** Guided learning hours may be provided as lectures, seminars or tutorials. Some lessons may be delivered online.

**Tutorials:** Tutorials are completed periodically to monitor & support students in all areas of their studies. This includes attendance, progress and engagement.

**Methodology:** Learners will experience a wide range of teaching methodologies covering lectures, presentations, seminars, classroom discussions, field trips, team work, projects, quizzes, case studies, audio-visual materials.

**Assessment:** Assessment may take the form of individual and team based projects and presentations / seminars, tests, personal learning journals, exams, continuous assessment, portfolios, mind maps and organising events, which are all based on the college fair assessment policy.

**Resubmissions:** If a student is unable to pass an assessment the first time, (s)he will be given constructive feedback on how to improve and offered a viva / resit or resubmission of work, according to the College Fair Assessment policy.

**Certificates and Transcripts:** Certificates will only be issued to students who have attended 80% or more of lessons or of each module, and achieved all relevant assessment tasks. Transcripts will record only the grades of modules that a student has successfully passed.

**General Level/Experience of Staff:** Staff hold a relevant qualification at least one level above the subject level they are teaching and hold a relevant teaching qualification.

Staff come from a range of backgrounds, including academic and industry specialisms. From time to time we may invite guest lecturers or subject specific specialists to take lectures / seminars.

Staff teaching English modules hold a CELTA or CertTESOL qualification.

**Entry Points:** There are 2 entry points each year; September and January. Students may be individually assessed for entry at other times of the year, depending on prior education, but the overall requirements for credits and guided learning hours must be preserved to achieve the overall award.

**Minimum No. of students per class:** Nominally 4.

**NOTE:** This course follows the structure and content of the BTEC Level 3 Engineering RQF and BTEC Level 3 Computing RQF specifications, although the centre does not currently support BTEC certification of this course.

## 4. Delivery Staff

| | |
|---|---|
| **Praveena Bhattiprolu**<br>Teacher (Engineering) | **Nadia Ghwedar**<br>Admin Support Officer |
| **Praneeta Phadke**<br>Teacher (Engineering) | **Geetha Mariappan**<br>Teacher (Computing) |
| **Amedeo Angiolini**<br>Teacher (Engineering) | **Sasi Priya Mummini**<br>Teacher (Computing) |
| **John Kay**<br>Language Support & Study Skills | |

Please note, Language Support lessons will be taught by our qualified English teachers in our General English department.

All staff can be contacted via the College reception or the FEHE Office (Room 51 in Durley Road building), or through the course / FEHE email accounts.

Other specialist teachers, industry representatives or visitors may be used to teach learning outcomes or topics, as required.

# 5. APPENDIX 1: Unit Specifications

Details of learning outcomes and assessment criteria for each unit are given in individual unit induction booklets, available on the college VLE (Virtual Learning Environment).

Learning Outcomes and Assessment Criteria and methods are detailed in individual ETC Unit Handbooks. Content of specific units is largely in line with BTEC Level 3 syllabus contents, although currently ETC do not offer BTEC certification with this course.

Depending on the cohort of students, progression aspirations and previous experience, non-mandatory units may change, within the practical constraints of timetabling, staffing and student groupings.

## UFP Engineering & Technology Units

## Engineering Principles:

The unit enables you to analyse information, use mathematical and scientific knowledge and apply engineering principles to solve problems in an engineering context. Problems include static, dynamic and fluid systems in mechanical engineering and static and direct current (DC) electricity, DC circuit theory and networks, magnetism and single-phase alternating current theory in electrical and electronic engineering.

**Assessment Outcomes:**

**AO1** Recall basic engineering principles and mathematical methods and formulae. Command words: calculate, describe, explain, identify, name.

**AO2** Perform mathematical procedures to solve engineering problems. Command words: calculate, convert, find, solve.

**AO3** Demonstrate an understanding of electrical, electronic and mechanical principles to solve engineering problems. Command words: find, calculate, describe, draw, explain.

**AO4** Analyse information and systems to solve engineering problems. Command words: calculate, draw.

**AO5** Integrate and apply electrical, electronic and mechanical principles to develop an engineering solution. Command words: calculate, draw, explain.

**Learning Aims:**

**A. Algebraic and trigonometric mathematical methods**
Application of appropriate units

A1 Algebraic methods
A2 Trigonometric Methods

**B. Static engineering systems**
Application of appropriate units

B1 Static engineering systems
B2 Loaded components

**C. Dynamic engineering Systems**
Application of appropriate units.

C1 Dynamic engineering systems

**D. Fluid engineering systems**

D1 Fluid systems

**E. Static and direct current electricity and circuits**

E1 Static and direct current electricity
E2 Direct current circuit theory
E3 Direct current networks

**F. Magnetism and electromagnetic induction**

F1 Magnetism

**G. Single-phase alternating current**

G1 Single-phase alternating current theory

## Principles of Computer Science

Covering the principles underpinning each area of computer science, this unit will enable you to solve problems by applying computational-thinking skills acquired throughout the unit.

You will solve problems by understanding the structured and logical ways data is processed by computer systems to develop programmes, processes and systems for problem solving. You will acquire the necessary skills to break down problems, analyse, develop and evaluate computer code and algorithms and design, evaluate and apply solutions to ensure computer systems are fit for purpose.

**Assessment Outcomes:**

**AO1** Demonstrate knowledge and understanding of computing facts, terms, standards, concepts and processes Command words: complete, draw, give, identify, name, state.

**AO2** Apply knowledge and understanding to communicate understanding of computing facts, terms, standards, concepts and processes Command words: calculate, complete, demonstrate, describe, draw, explain, produce.

**AO3** Select and use computing technologies and procedures to explore outcomes and find solutions to problems in context Command words: calculate, demonstrate, develop, explain, produce.

**AO4** Analyse data and information related to computer science in order to predict outcomes and present solutions Command words: analyse, demonstrate, discuss, produce, write.

**AO5** Evaluate technologies, procedures, outcomes and solutions to make reasoned judgements and make decisions Command words: evaluate, produce, write.

**Learning Aims:**

**A: Computational thinking.** Application of the thinking skills involved in analysing problems and processes, to identify solutions that can be developed into computer programs.

A1. Decomposition
A2. Pattern recognition
A3. Pattern generalisation and abstraction
A4. Algorithm design

**B: Standard methods and techniques used to develop algorithms. Techniques used to design solutions to problems.**

B1. Structured English (pseudocode)
B2. Flowcharts using standard symbols

**C: Programming paradigms.** Use of standard structures and conventions to build and develop accurate, efficient and effective computer code to fulfil identified criteria and solve problems.

C1. Handling data within a program
C2. Arithmetic operations
C3. Built-in functions
C4. Validating data
C5. Control structures
C6. Data structures
C7. Common/standard algorithms

**D: Types of programming and mark-up languages.** The features, applications, impact and implications of using different programming paradigms to develop code to solve problems.

D1. Procedural programming
D2. Object-orientated programming
D3. Event driven programming
D4. Coding for the web
D5. Translation

## Health and Safety in the Workplace

This unit will help you to apply learning and knowledge from the Principles of Engineering unit and undertake projects and lead teams safely, with health and safety as a priority, with the ability to assess and manage risks. You will learn about engineering processes, how health and safety legislation applies and how performance of both teams and individuals can be affected by human factors.

Working as a team, you will safely manufacture an engineering product or service using practical engineering processes and use principles of 2D computer aided drawing, also covered in this unit to produce an orthographic projection and circuit diagram.

**Learning Aims:**

**A: Examine common engineering processes to create products or deliver services safely and effectively as a team**

A1. Common engineering processes
A2. Health and safety requirements
A3. Human factors affecting the performance of engineering processes

**B: Develop two-dimensional computer-aided drawings that can be used in engineering processes**

B1. Principles of engineering drawing
B2. 2D computer-aided drawing

**C: Carry out engineering processes safely to manufacture a product or to deliver a service effectively as a team**

C1. Principles of effective teams
C2. Team set-up and organisation
C3. Health and safety risk assessment
C4. Preparation activities for batch manufacture or batch service delivery
C5. Delivery of manufacturing or service engineering processes

**Assessment Criteria:**

<table>
<tr><th colspan="3">Learning Outcomes and Assessment Criteria</th></tr>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">A. Examine common engineering processes to create products or deliver services safely and effectively as a team</td><td rowspan="2">A.D1 Evaluate, using high-quality written language, the effectiveness of using different engineering processes to manufacture a product or to deliver a service and how human factors, as an individual and as a team, affect the performance of engineering processes.</td></tr>
<tr><td>A.P1 Explain how three engineering processes are used safely when manufacturing a given product or when delivering a given service.<br>A. P2 Explain how human factors, as in individual or as a team, affect the performance of engineering processes.</td><td>A.M1 Analyse why three engineering processes are used to manufacture a product or to deliver a service and how human factors, as an individual and as a team, affect the performance of engineering processes.</td></tr>
<tr><td colspan="2">B. Develop two-dimensional computer aided drawings that can be used in engineering processes</td><td rowspan="2">B.D2 Refine, using layers, an accurate orthographic projection of a component containing at least three different common feature types and a circuit diagram containing at least six different component types to an international standard.</td></tr>
<tr><td>B.P3 create an orthographic projection of a given component containing at least three different feature types.<br><br>B.P4 Create a diagram of a given electronic circuit containing at least six different component types.</td><td>B.M2 Produce, using layers, an accurate orthographic projection of a component containing at least three different feature types and a circuit diagram containing at least six different component types that mostly meet an international standard.</td></tr>
<tr><td colspan="2">C. Carry out engineering processes safely to manufacture a product or to deliver a service effectively as a team</td><td rowspan="2">C.D3 Consistently manage own contributions effectively using feedback from peers, as a team member and as a team leader, to set up, organise and manufacture a product or deliver a service safely, demonstrating forward thinking, adaptability or initiative.</td></tr>
<tr><td>C.P5 Manage own contributions to set up and organise a team in order to manufacture a product or deliver a service.<br><br>C.P6 Produce, as an individual team member, a risk assessment of at least one engineering process.<br><br>C.P7 Set up, as an individual team member, at least one process safely by interpreting technical documentation.<br><br>C.P8 Manage own contributions safely, as a team member and as a team leader, to manufacture a batch of an engineered product or to deliver a batch of an engineering service</td><td>C.M3 Manage own contributions safely and effectively using feedback from peers, as a team member and as a team leader, to manufacture a product or to deliver a service.</td></tr>
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## IT Systems Security and Encryption

Learn the complexities of configuring and supporting networks and systems, investigate types of attacks on security and explore various protection techniques that can help defend an organisation from security threats. The practical elements of the unit will take you through the planning, application and testing of protection for an IT system, evaluating its efficiency.

**Learning Aims:**

**A: Understand current IT security threats, information security and the legal requirements affecting the security of IT systems**

A1. Threat types
A2. Computer network-based threats
A3. Information security
A4. Legal requirements
A5. Impact of security breaches

**B: Investigate cryptographic techniques and processes used to protect data**

B1. Cryptographic principles
B2. Cryptography methods
B3. Applications of cryptography

**C: Examine the techniques used to protect an IT system from security threats**

C1. Physical security
C2. Policies and procedures
C3. Software-based protection

**D: Implement strategies to protect an IT system from security threats**

D1. Group policies
D2. Anti-malware protection
D3. Firewall configuration
D4. Wireless security
D5. Access control
D6. Testing and reviewing protection applied to an IT system
D7. Skills, knowledge and behaviours

**Assessment Criteria:**

| **Learning Outcomes and Assessment Criteria** | | |
|---|---|---|
| **Pass** | **Merit** | **Distinction** |

<table>
<tr><td colspan="2">Learning aim A: Understand current IT security threats, information security and the legal requirements affecting the security of IT systems</td><td rowspan="2">AB.D1 Evaluate the effectiveness of the techniques used to protect organisations from security threats while taking account of the principles of information security and legal requirements</td></tr>
<tr><td>A.P1 Explain the different security threats that can affect the IT systems of organisations.<br>A.P2 Explain the principles of information security when protecting the IT systems of organisations.<br>A.P3 Explain why organisations must adhere to legal requirements when considering IT systems security</td><td>A.M1 Assess the impact that IT security threats can have on organisations' IT systems and business while taking account of the principles of information security and legal requirements.</td></tr>
<tr><td colspan="2">Learning aim B: Investigate cryptographic techniques and processes used to protect data</td><td rowspan="2">B.D2 Produce and evaluate a technical specification for the chosen solution</td></tr>
<tr><td>B.P4 Explain the principles and uses of cryptography to secure and protect data</td><td>B.M2 Analyse how the principles and uses of cryptography impact the security and protection of data.</td></tr>
<tr><td colspan="2">Learning aim C: Examine the techniques used to protect an IT system from security threats</td><td rowspan="4">CD.D2 Evaluate the plan and the effectiveness of the protected IT system against requirements.<br>CD.D3 Demonstrate individual responsibility and effective self-management in the planning and protection of an IT system.</td></tr>
<tr><td>C.P5 Explain how protection techniques can help defend an organisation from security threats.<br>C.P6 Produce a plan to protect an IT system that meets organisational and legislative requirements</td><td>C.M3 Justify the choice of protection techniques used to defend the IT systems of an organisation, showing how its IT system will be protected from security threats.</td></tr>
<tr><td colspan="2">Learning aim D: Implement strategies to protect an IT system from security threats</td></tr>
<tr><td>D.P7 Perform tasks to protect the IT system to meet requirements given in the plan.<br>D.P8 Review the extent to which the organisation's IT system has been protected.</td><td>D.M4 Enhance the protection of the IT system to meet requirements given in the plan.</td></tr>
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## Design & Development Project

In this unit you will learn about the lifecycle of a project from the generation of ideas to delivery. You will need to problem solve taking into account risk and contingency and evaluate possible solutions to effectively run your own project from start to finish, exploring communication methods to present your project to a target audience.

**Learning Aim A: Project management concepts**
The key factors, processes and stages that make up a typical project.

A1 Project Lifecycle, Project idea generation and solution
A2 Feasibility study of solutions, Costs and Timescales
A3 Quality deliverables, Risks

**Learning Aim B: Investigate an engineering/computing project in a relevant specialist area**
Choosing a specific engineering or computing project topic, gathering the key information needed, for the project kick-off.

B1 Reason for the project, Stakeholders
B2 Creating a Project Proposal

**Learning Aim C: Project Planning & Development**
The process of creating and updating the plans to ensure that the project is completed on time, in budget and to specification.

**C1 Scheduling and Milestones**

- Work breakdown structure.
- Gantt charts or similar planning and progress tracking tool.
- Project Diary or similar

**C2 Resources and budgeting**

- Resource requirements and allocation - people and their work allocation, equipment and materials, budgeting

**C3 Risk Management strategy**

- Risk analysis process
- Contingency planning for major risks if any
- Technical Specification

**Learning Aim D: Executing, Monitoring and Closure of a Project**
Running the project, keeping track of progress and dealing with problems or changes to the project.

D1. Undertake and test the project
D2. Monitoring and tracking progress
D3. Managing issues, summarising lessons learned
D4. Recommendations for the future

**Learning Aim E: Communications**
Identification of appropriate communication methods and choosing the best method to present your project

E1. Methods for project team communication - meetings and one-to-one discussions, memos and notices, telephone conversations and video conferences, emails and instant messaging
E2. Target audience, Communication and presentation requirements.

**Assessment Criteria:**

<table>
<tr><th colspan="3">Learning Outcomes and Assessment Criteria</th></tr>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">A Project management concepts - The key factors, processes and stages that make up a typical project.</td><td rowspan="2">A.D1 Analyse the key benefits of a project to establish a measurement for success.</td></tr>
<tr><td>A.P1 Discuss the project lifecycle to start, plan, manage and deliver a project<br>A.P2 Outlay the project outcomes by using SMART objectives</td><td>A.M1 Evaluate the feasibility study and risks associated with different projects</td></tr>
<tr><td colspan="2">B Investigate an engineering/computing project in a relevant specialist area - Choosing a specific engineering or computing project topic, gathering the key information needed, for the project kick-off.</td><td rowspan="2">B.D2 Produce and evaluate a technical specification for the chosen solution</td></tr>
<tr><td>B.P3 Research an engineering / computing problem based on a given theme and find at least two different solutions<br>B.P4 Select one solution for the problem by producing the specification and specify reasons for selection</td><td>B.M2 Based on the chosen solution, produce a project proposal identifying key areas of the project</td></tr>
<tr><td colspan="2">C Project Planning & Development - The process of creating and updating the plans to ensure that the project is completed on time, in budget and to specification.</td><td rowspan="2">C.D3 Independently manage the project development process, seeking support and guidance where necessary</td></tr>
<tr><td>C.P5 Assess different milestones involved in the process by using suitable planning tools<br>C.P6 Prepare and maintain project records</td><td>C.M3 Evaluate the project plan by implementing the resource requirements and allocation</td></tr>
<tr><td colspan="2">D Executing and Monitoring a Project - Running the project, keeping track of progress and dealing with problems or changes to the project.</td><td>D.D4 Evaluate the whole project development process,</td></tr>
</table>

| | | |
|---|---|---|
| **D.P6** Test the project and produce design documentation to detail the solution<br>**D.P7** Monitor and record achievement over the life cycle of the project | **D.M4** Anaylse the project solution managing issues and summarising lessons learned during the whole process | making recommendations for improvements. |
| **E Communications -** Identification of appropriate communication methods and choosing the best method to present your project | | **E.D5** Optimise the project process that is fit for the audience, while anticipating and resolving risks and issues, demonstrating behaviours to a professional standard |
| **E.P8** Discuss various communication methods to present your project<br>**E.P9** Present your project to a target audience | **E.M5** Produce and present a project solution that is fit for the audience, demonstrating effective communication skills and behaviours | |

## Electronic Devices and Circuits

Build, test and evaluate digital and analogue circuits using electronic devices, simulation using software and practical activities.

**Learning Aims:**

**A: Explore the safe operation and applications of analogue devices and circuits that form the building blocks of commercial circuits.**

A1. Safe electronic working practices
A2. Diode devices and diode-based circuits
A3. Transistor devices and transistor-based circuits
A4. Operational amplifier circuits
A5. Schematic capture and simulation of analogue circuits
A6. Testing physical analogue circuits

**B: Explore the safe operation and applications of digital logic devices and circuits that form the building blocks of commercial circuits**

B1. Logic gates and Boolean algebra
B2. Combinational logic circuits
B3. Sequential logic circuits
B4. Schematic capture and simulation of digital circuits
B5. Testing physical digital circuits

**C: Review the development of analogue and digital electronic circuits and reflect on own performance.**

C1. Lessons learned from exploring electronic devices and circuits
C2. Personal performance while exploring electronic devices and circuits

**Assessment Criteria:**

| **Learning Outcomes and Assessment Criteria** | | |
|---|---|---|
| **Pass** specific | **Merit** | **Distinction** |
| **Learning aim A: Explore the safe operation and applications of analogue devices and circuits that form the building blocks of commercial circuits** | | |
| **A.P1** 1 Simulate, using captured schematics, the correct operation of at least one diode, transistor and operational amplifier circuit.<br>**A.P2** Build at least one diode, transistor and operational amplifier circuit safely and test the characteristics of each one.<br>**A.P3** Explain, using the simulation and test results, the operation of at least one diode, transistor and operational amplifier circuit. | **A.M1** Simulate, using accurately captured schematics, the correct operation of at least one diode, transistor and operational amplifier circuit.<br>**A.M2** Build at least one diode, transistor and operational amplifier circuit safely and test the characteristics of each one accurately.<br>**A.M3** Analyse, using the simulation and test results, the operation of at least one diode, transistor and operational amplifier circuit. | **A.D1** Evaluate, using language that is technically correct and of a high standard, the operation of at least one diode, transistor and operational amplifier circuit, comparing the results from safely and accurately conducted simulations and tests. |
| **Learning aim B: Explore the safe operation and applications of digital logic devices and circuits that form the building blocks of commercial circuits** | | |
| **B.P4** Simulate, using captured schematics, the correct operation of at least one combinational logic circuit and two sequential logic circuits. B.P5 Build at least one combinational logic circuit and two sequential logic circuits safely and test the characteristics of each one. B.P6 Explain, using the simulation and test results, the operation of at least three logic circuits. | **B.M4** Simulate, using accurately captured schematics, the correct operation of at least one combinational logic circuit minimising the gates and at least two sequential bidirectional logic circuits.<br>**B.M5** Build at least one combinational logic circuit minimising the gates and at least two sequential bidirectional logic circuits and test the characteristics of each one accurately.<br>**B.M6** Analyse, using the simulation and test results, the operation of at least three logic circuits. | **B.D2** Evaluate the operation of at least one combinational logic circuit minimising the gates and two sequential bidirectional logic circuits, comparing the results from safely and accurately conducted simulations and tests. |
| **Learning aim C: Review the development of analogue and digital electronic circuits and reflect on own performance** | | **C.D3** Demonstrate consistently good technical understanding and analysis of the electronic circuits, including the application of |
| **C.P7** Explain how health and safety, electronic and general engineering skills | **C.M7** Recommend improvements to the development of the | |

| | | |
|---|---|---|
| were effectively applied during the development of the circuits.<br>**C.P8** Explain how relevant behaviours were effectively applied during the development of the circuits. | electronic circuits and to the relevant behaviours applied. | relevant behaviours and general engineering skills to a professional standard. |

## **Unit 25 E Mechanical Behaviour of Metallic Materials** (optional unit)

Experiment using destructive and non-destructive methods to test ferrous and non-ferrous metallic materials. Apply your findings from the results to consider the properties of the materials and their uses in mechanical engineering.

Using your knowledge of the capabilities of metallic materials, you will assess failed components in service and suggest design improvements to prevent failure.

**Learning Aims:**

**A: Investigate the microstructures of metallic materials, the effects of processing on them and how these effects influence their mechanical properties**

A1. 1 Types of ferrous metals and alloys
A2. Types of non-ferrous metals and alloys
A3. Mechanical properties of metallic materials
A4. Grain structure of metallic materials
A5. Effects of processing on the mechanical properties of metallic materials A6 Microstructure investigation of metallic materials

**B: Explore safely the mechanical properties of metallic materials and the impact on their in-service requirements**

B1. In-service requirements of metallic materials
B2. Destructive test procedures
B3. Non-destructive test procedures

**C: Explore the in-service failure of metallic components and consider improvements to their design.**

C1. Ductile and brittle fracture
C2. Creep failure
C3. Fatigue failure
C4. Corrosion mechanisms
C5. Design considerations to help prevent component failure

**Assessment Criteria:**

<table>
<tr><th colspan="3">Learning Outcomes and Assessment Criteria</th></tr>
<tr><th>Pass specific</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Investigate the microstructures of metallic materials, the effects of processing on them and how these effects influence their mechanical properties</td><td rowspan="2">A.D1 Evaluate, using an accredited data source, the microstructures of non-processed and processed metallic materials to correctly identify the material, including how the processing history, impurities and grain boundaries affect the mechanical properties of the materials.</td></tr>
<tr><td>A.P1 Explain how the microstructures of non-processed metallic materials affects the mechanical properties of the materials.<br>A.P2 Explain how the microstructures of processed metallic materials affects the mechanical properties of the materials.</td><td>A.M1 Analyse, using an accredited data source, the microstructures of non-processed and processed metallic materials to correctly identify the material, including how the processing history affects the mechanical properties of the materials.</td></tr>
<tr><td colspan="2">Learning aim B: Explore safely the mechanical properties of metallic materials and the impact on their in-service requirements</td><td rowspan="2">B.D2 Evaluate, using the results from safely conducted tests and an accredited data source, how the mechanical properties of processed and non-processed metallic materials affect their behaviour and suitability for different realistic applications, justifying the validity of the test methods used.</td></tr>
<tr><td>B.P3 Conduct destructive tests safely on different non-processed and processed metallic samples.<br>B.P4 Conduct one type of non-destructive test safely on one non-processed and one processed metallic sample.<br>B.P5 Explain, using the test results, how the mechanical properties of metallic materials affect their behaviour and suggest an application</td><td>B.M2 Conduct destructive and non-destructive tests accurately on different non-processed and processed metallic samples.<br>B.M3 Analyse, using the test results and an accredited data source, how the mechanical properties of metallic materials affect their behaviour and suggest a realistic application.</td></tr>
<tr><td colspan="2">Learning aim C: Explore the in-service failure of metallic components and consider improvements to their design</td><td rowspan="2">C.D3 Evaluate, using language that is technically correct and of a high standard, the results from safely conducted and accurate checks and tests to establish how components failed in service, recommending a design solution from a range of alternatives.</td></tr>
<tr><td>C.P6 Conduct a visual inspection check and at least one test safely on components that have failed in service.<br>C.P7 Explain, using the results, how each component failed and how each component’s design could be improved.</td><td>C.M4 Conduct a visual inspection check and at least one test safely and accurately on components that have failed in service.<br>C.M5 Analyse, using the results, how each component failed and justify how each component’s design could be improved.</td></tr>
</table>

## Relational Database Development

Using your knowledge of data structures and designed gained in this unit, you will build a database to specification within a DBMS (Database Management System)

**Learning Aims:**

**A: Examine the purpose and structure of data storage in relational database management systems.**

- **A1.** Relational database management systems
- **A2**. Manipulating data structures and data in relational databases
- **A3**. Normalisation

**B: Design a relational database solution to meet client requirement.**

- **B1.** Relational database design techniques and processes
- **B2.** Design documentation
- **B3.** Reviewing and refining designs

**C: Develop a relational database solution to meet client requirements**

- **C1.** Producing a database solution
- **C2.** Testing the database solution
- **C3**. Reviewing the database solution
- **C4**. Optimising the database solution
- **C5**. Reviewing own skills, knowledge and behaviours

**Assessment Criteria:**

<table>
<tr><th colspan="3">Learning Outcomes and Assessment Criteria</th></tr>
<tr><th>Pass specific</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Examine the purpose and structure of data storage in relational database management systems</td><td rowspan="2">A.M1 Analyse the principles of relational database models, the importance of normalisation and how they can provide reliable and efficient data structures.</td></tr>
<tr><td>A.P1 Explain the principles of relational database models and how they are used to provide reliable data structures.<br>A.P2 Explain the process of normalisation within a relational database</td><td>A.M1 Analyse the principles of relational database models, the importance of normalisation and how they can provide reliable and efficient data structures.</td></tr>
<tr><td colspan="2">Learning aim B: Design a relational database solution to meet client requirements</td><td rowspan="4">BC.D2 Evaluate the design and optimised database solution against client requirements.<br>BC.D3 Demonstrate individual responsibility, creativity, and effective self-management in the design, development and review of a database solution</td></tr>
<tr><td>B.P3 Produce a design for a relational database solution that meets client requirements.<br>B.P4 Review the design with others to identify and inform refinements.</td><td>B.M2 Justify design decisions made, showing how the design will meet client requirements.</td></tr>
<tr><td colspan="2">Learning aim C: Design a relational database solution to meet client requirements</td></tr>
<tr><td>C.P5 Produce a database solution to meet client requirements.<br>C.P6 Test a relational database for functionality and performance.<br>C.P7 Review the extent to which the database solution meets client requirements</td><td>C.M3 Optimise a database solution to meet client requirements</td></tr>
</table>

# English

This module prepares students for the academic part of the programme, through assignment-writing, report-writing, understanding lectures, note-taking, summarising, expressing own ideas, preparing and delivering presentations.

**Reading**

- Preparing for lectures
- Reading and understanding handouts / books / internet quotes / newspapers
- Identifying main points of text paragraphs
- Developing opinions on the text
- Using text information for referencing/building a bibliography

**Listening**

- Note taking
- Identifying key points in lectures/videos
- Following lines of discussion
- Listening for detail
- Identifying different opinions
- Adding own opinions
- Using auditory source information for referencing/building a bibliography

**Speaking**

- Working in teams
- Prioritising
- Resource Management
- Time Management
- Stress Management
- Discussion Skills
- Making presentations
- Participation in group discussions
- Formatting Slides
- Speaking from notes
- Developing an original style

**Writing**

- Structuring assignments
- Writing a literature review
- Designing questionnaires
- Presenting graphs and tables
- Conducting primary/secondary research
- Analysing and interpreting data
- Developing cohesive arguments
- Referencing and Bibliography skills

- Using examples to support ideas
- Adding own opinion
- Introductions and conclusions
- Research skills
- Process writing – drafting and redrafting

**Vocabulary**

- Decoding text - auditory and written
- Recycling new vocabulary
- Identifying register / range / genre
- Word / sentence transformations

**Language**

- Grammar rules / forms / patterns
- Collocations
- Phonemes
- Fluency
- Stress / rhythm / intonation
- Ellipsis / elision / contractions / accents