UNIVERSITY OF LINCOLN

Foundation Degree and Degree Apprenticeship

In Food Engineering

Introduction

The Foundation Degree and Degree Apprenticeships in food engineering have been designed by employers to facilitate growth and development of talent within existing workforces as well as attract new recruits to companies through the joint offer of a career and completion of an academic qualification.

Who is it aimed at?

The programme is tailored to the needs of individuals aged 18 and over that are commencing an engineering career within the food industry or those presently working in the industry, looking to advance their engineering qualifications.

The level 5 apprenticeship standard has two streams, electrical and mechanical. Typical roles associated with this standard include Food and Drink Mechanical Engineer, Food and Drink Electrical Engineer, Continuous Improvement Food and Drink Engineer and Food and Drink Reliability Engineer.

The level 6 programme has three streams in line with the standard, with foci in mechanical, automation or production. Typical job roles associated with this standard are managers within various areas of food engineering.

Industry Recognised Qualifications

Students successfully completing a level 5 apprenticeship will attain a Foundation Degree in Food Engineering, whilst level 6 completion results in a BEng (Hons) in Food Engineering. These qualifications are endorsed by the National Skills Academy for Food and Drink (NSAFD).

For those students already holding some relevant qualifications, a level 6 top-up programme is also in development for launch shortly.

Method of Delivery

The Foundation Degree programme is normally a three-year period of study, followed by the apprenticeship end point assessment period.

The Degree programme is normally a four-year period of study, followed by the apprenticeship end point assessment.

Delivery is via blended learning, combining distance learning over 3 x 10 week periods utilising a range of delivery and assessment methods as appropriate to the content being explored and supported by online interactive tutorials with academic tutors. This online delivery is supported by 3 x 1 weeks on campus through the year to consolidate learning and offer collaborative and interactive aspects to reinforce the content from the online modules.

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Additional to this, contact via Skype call or equivalent, workplace visits and progress review meetings are carried out regularly as part of the programme.

Start dates for the Foundation degree are January and September from January 2019.

Start dates for the Degree are September and January from September 2018.

Typical modules covered are displayed below.

Year 1 All: Level 4	Year 2 All: Level 4/5	Year 3 BEng: Level 5/6 Foundation Degree: Level 5 and EPA	Year 4 BEng: Level 6 and EPA
Food Components and Materials for Food Engineers	Introduction to Robotics	Food Packaging Systems and Machinery	Engineering Management and Lean Manufacturing
Health & Safety, Energy and the Environment	Mechatronics	Food Process Engineering	Food Production, Processes and Technologies
Statics and Dynamics	Food Safety, Quality Assurance, HACCP and Hygiene	Control Systems	Robotics and Automation for the Food Industry
Electrical and Electronic Technology	Food Factory Systems	Applied Thermofluids	Individual Industry Project
CAD & Technical Drawing	Analogue Electronics *OR* Dynamics	Advanced Application of Automation to Food Industry *OR* Food Production and Operations Management *OR* Advanced Mechanical Food Systems	
Mathematics for Engineers	Digital Systems *OR* Solid Body Mechanics		

Key Dates

Campus Week	September 2018 Start	January 2019 Start
Week 1	8th October 2018	18th March 2019
Week 2	18th March 2019	17th June 2019
Week 3	17th June 2019	2nd December 2019

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Entry Requirements

New entrants require 104 UCAS points or equivalent at A Level, including a B grade in Mathematics. This equates to a BCC A Level Profile; or BTEC Extended Diploma with a Distinction, Merit, Merit Profile; or an International Baccalaureate of 28 points overall with a higher-level grade 5 in maths; or an Advanced Apprenticeship in a related subject will be considered.

Adults are required to demonstrate industrial experience and professional competence and should ideally hold vocational and professional qualifications.

Holding GCSE Maths and English at grade C or above or equivalent is a requirement for all entrants.

'Top Up' Degrees

Opportunities to 'Top up' previous foundation degree or HND qualifications to the BEng (Hons) are currently being prepared for September 2019. Bridging modules may be required to ensure successful completion of the level 6 apprenticeship, hence transcript of previous learning and future study plans will be considered on a case-by-case basis from 2019.

University of Lincoln School of Engineering and National Centre for Food Manufacture

The University of Lincoln was ranked 22nd out of 121 Universities in the 2019 Guardian University Guide.

This programme builds on the successes of the University overall and particularly of the School of Engineering with its award- winning engagement with industry, including the Lord Stafford Award for Open Collaboration with Siemens, IET Team Award and the IMechE Charles Sharp Beecher Prize and the established expertise of the National Centre for Food Manufacture with its range of part-time courses for the food industry.

The programme combines Teaching Excellence Framework Gold standard practitioners and state-of-the-art facilities reflecting industry standards for the food engineering environment. This includes a range of specialist labs on both Lincoln and Holbeach campuses to bring together a team with a wealth of experience that covers a broad range of material.

The team are also able to advise on and support the process of apprenticeship recruitment.

Contact Details

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Foundation Degree in Food Engineering (Levels 4 - 5)
Bachelor of Engineering (BEng) in Food Engineering (Levels 4-6)

Level 4

Food Components and Materials for Food Engineers

Outlining syllabus – typical module content covers
Engineering properties of foods

1. Volume, density, porosity, surface area, pore size distribution.
2. Rheological Properties of Fluid Foods: Newtonian Fluids, Non-Newtonian Fluids, Shear Thickening Fluids, Shear Thinning Fluids.
3. Rheological Properties of Solid Foods.

Food chemistry for engineers

1. Major components of foods: carbohydrates, lipids, proteins, minerals, vitamins, water.
2. Chemical changes of food components during processing and storage: oxidation, Maillard reactions; protein denaturation; enzymatic and non-enzymatic browning, aggregation, alteration of viscosity, colour, phase separation.
3. Revision of measures of concentration of solutions: (Mass per unit volume (grams/litre), Per cent by mass, %(w/w), Per cent by volume, %(v/v), Parts per million (ppm)).

Food microbiology for engineers

1. Microbiology of food spoilage and preservation.
2. Microbiological hazards in foods.
3. Microbial growth and death kinetics. D and z-values.

Equipment materials

1. Materials in Engineering: metals, ceramics, polymers and composites
2. Diffusion fundamentals and mechanisms. Processes using diffusion.
3. Phase Diagrams and Phase transformations
4. Mechanical properties and methods of measurement including mechanical failure mechanisms

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Health and Safety, Energy and the Environment

Outlining syllabus – typical module content covers

1 Legislation and enforcement: Energy and environment.
2 Environmental awareness.
3 Maximising the use of resources.
4 Finding the optimal business case.
5. Widening stakeholder awareness.
6. Legislation and enforcement: Health and safety.
7. Health and safety leadership and responsibility.
8. Assessing risks, controlling risks and identifying hazards.
9. Investigating accidents and incidents.
10. Contractor control.
11. Application to food production.

Food Safety, Quality Assurance, HACCP and Hygiene

Outlining syllabus – typical module content covers

1. Relevant Legislation and codes of practice, external bodies e.g. Food Standards Agency
2. Assurance schemes (including Farm and crop assured, Red Tractor, BRC, Soil Association (organic schemes).
3. Producer/ processor constraints; sources of biological/ chemical, physical and allergenic contamination in relation to food safety; Hazard Analysis Critical Control Point (HACCP) principles of implementation; Total Quality Management (TQM), Auditing and subjective and objective testing; Food safety risk assessment.
4. Quality management systems (definitions and content).
5. Records and traceability.
6. Defining the required factory hygiene standards (internal and external and personal hygiene).
7. Cleaning chemicals; their purpose and efficacy.
8. Cleaning equipment, systems and procedures.
9. Assessment of cleaning results (including rapid hygiene testing and environmental swabbing).
10. Microbiological control within the factory environment.

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Statics and Dynamics

Outlining syllabus – typical module content covers

1. Introduction to statics.
2. Force systems: moment and couple, resultants.
3. Equilibrium: mechanical system isolation, equilibrium conditions. Structures: plane trusses, frames and machines.
4. Distributed forces: centroids, beams.
5. Friction: principles, application in machines.
6. Concepts of stress: direct and shear stresses.
7. Statically determinant systems.
8. Analysis of stress and strain: plain stress, principal stresses, maximum shear stress, Mohr's circle, plane strain, measurement of strain, relations involving E, G and V.
9. Axially loaded members; method of superposition; thermal deformations and stress, stress concentrations, Saint-Venant's principle Dynamics.
10. Motion of Particles: rectilinear motion; position, velocity and acceleration, graphical methods; curvilinear motion; rectangular components, tangential and normal components, radial and transverse components.
11. Kinetics of Particles: Newton's Laws, units, equations of motion, rectilinear motion, curvilinear motion.
12. Work and Energy: potential energy, conservation of energy, power and efficiency.
13. Impulse and Momentum: impulsive motions, conservation of momentum, impact, energy and momentum steady streams of particles, systems gaining and losing mass.
14. Kinematics of Rigid Bodies: rotation, angular velocity, general planar motion, velocity diagrams, instantaneous centre of rotation, angular acceleration, acceleration, acceleration diagrams.
15. Mass Moment of Inertia: mass moment of inertia, parallel axis theorem, radius of gyration, composite bodies.
16. Kinetics of Rigid Bodies: constrained planar motion, work and energy for a rigid body, rotary kinetic energy, conservation of energy, power.
17. Impulse and Momentum: conservation of angular momentum, impulsive motion, eccentric impact.

CAD and Technical Drawing

Outlining syllabus – typical module content covers

1. Technical Drawing.
2. Drawing layout, legal implications and traceability.
3. Types of drawings, their uses and scheduling for assembly.
4. Orthographic, pictorial and multi-view standards and conventions.
5. The application of geometrical construction techniques.
6. Basic principles of dimensioning, including dimensioning for function.
7. Design for manufacture and the need to specify tolerances.

8. Thread forms and fasteners.
9. Manual drawing.
10. Production of drawings using CAD.
11. Recording the dimensions of real engineering objects in note form using the orthographic view.

Mathematics for Engineers

Outlining syllabus – typical module content covers

1. Elementary functions.
2. Ordinary and partial differentiation: techniques and applications including stationary values and errors.
3. Integration: analytical techniques and Simpson's rule, applications (e.g. area, mean value, centroids, RMS, volumes of revolution).
4. Ordinary differential equations: first order separable and linear equations, second order linear equations with constant coefficients, applications (e.g. Newton's law of cooling, free and forced vibration).
5. Algebra of complex numbers, complex variables, vectors and matrices.
6. Solution of systems of linear equations: determinants, matrices and Gauss elimination.
7. Iterative solution of non-linear equations (Newton Raphson).
8. Laplace transforms: application to solving ordinary differential equations.
9. Sequences and series: infinite series, convergence, Binomial, Mac Laurin and Taylor series.

Introduction to Robotics

Outlining syllabus – typical module content covers

1. Robotic applications.
2. The economics of robotics.
3. Architecture and components of an industrial robot.
4. Geometrical configurations.
5. Sensors and actuators.
6. Introduction to kinematics: spatial description and transformations.
7. Trajectory planning.
8. Introduction to robots programming.
9. Introduction to mobile robotics.
10. Building your own robotic system.

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Electrical and Electronic Technology

Outlining syllabus – typical module content covers

1. The Nature of Electricity: Triboelectrification, electrostatic forces and Coulomb’s law, electric field, Voltage, current, power, Faraday’s law, Ampere’s magnetic force law.
2. Circuit Theory: Electrical units: The principles of electrical conduction, electromagnetism and electrostatics; Circuit theory: DC circuits - Ohm's Law, Kirchhoff's Laws, Thevenin's Theorem. Superposition.
3. Digital Electronics: Numbers and numbering systems, addition and subtraction of binary numbers. Logic fundamentals: Boolean algebra, Karnaugh mapping, De Morgan's Law, basic logic functions (AND, OR, NAND, NOR, XOR), encoding and decoding, multiplexers. Arithmetic networks: Multiplexing.
4. Programmable logic, ROMs, PLAs. An introduction to sequential logic, including Bi Stables, Counters and Registers
5. AC Circuits: Sinusoidal excitation, impedance, voltage and current relationships, phase diagrams and resonance. The transformer. Complex impedances and phasor representation.
6. Transducer and Microprocessor Interfacing. Sensors for the measurement of position, velocity; acceleration and force using analogue and digital circuits. Concepts of ADC and DAC. Input and output impedance loading. Driving inductive loads. Isolated operational amplifiers. Bridge circuits. Common sensor interface, position encoder, acceleration, force
7. Diode and Transistor Circuit Techniques: The PN Junction diode and circuits. Introduction to BJT, FET and MOSFET characteristics. Amplifier circuits. Introduction to Operational Amplifiers: inverting, non-inverting, summing, differential circuits.
8. Simulink: Simulation and analysis of basic circuits

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Level 5

Food Packaging Systems and Machinery

Outlining syllabus – typical module content covers

1. Introduction to Food Packaging Systems.
2. The Role and Functions of Packaging.
3. Packaging Legislation and the Environment.
4. Packaging Materials and Conversion: Plastics, Carton & Corrugated Board, Metal & Glass.
5. Food safety and quality.
6. Closure Systems.
7. Packaging Design and Marketing.
8. Aseptic and Modified Atmosphere Packaging.
9. Packaging Machinery Systems in the Food Industry.
10. Food Preservation Principles Applied to Packaging Systems.

Food Processing Engineering

Outlining syllabus – typical module content covers

1. Principles of food preservation. Thermal processing of foods. Blanching, pasteurisation, sterilisation, UHT. General method for process calculation. Heat transfer by conduction, convection, radiation. Heat exchangers, baking ovens.
2. Refrigeration. Refrigeration cycle. Components of a refrigeration system. Refrigeration fluids. Freezing and freezing time calculation.
3. Food factory service (boilers, steam generation, cooling towers, emergency power, compressed air, sewage treatment).
4. Psychrometrics. Drying processes. Drying equipment.
5. Evaporation. Types of evaporators. Single and multiple effect evaporators. Extrusion processes. Extrusion systems.
6. Pneumatic and hydraulic systems. Material handling: conveyors, screws. Pumps, pipes and valves.
7. Advanced food engineering systems (Irradiation, microwave, HPP, PEF, RF, ultrasound, osmotic dehydration, dielectric, ohmic and infrared heating).
8. Mechanical separations: cyclones, centrifugal separations, sieving; air classification.
9. Application and case-studies.

Control Systems

Outlining syllabus – typical module content covers

1. Open and closed loop systems, feedback control.
2. Mathematical modelling - Laplace transforms, transfer functions, block diagram algebra.
3. Steady state and transient behaviour.
4. S-plane representation of poles and zeros.
5. Response of first and second order system.

6. Lead and Lag Compensators.
7. Routh-Hurwitz stability criteria.
8. Steady state errors.
9. Root locus techniques.
10. System design using root locus.
11. Frequency Response.
12. Nyquist Diagrams.
13. Design using Bode diagrams; proportional compensator design.
14. Introduction to Simulink.
15. Introduction to State Variables & State Space.

Food Factory Systems

Outlining syllabus – typical module content covers
Factory and plant

1. The design features of a modern food manufacturing premises, such as designing the factory to meet the needs of the process, customers, employees and regulatory authorities and design of drainage systems, wall and floor constructions, air flow and ventilation requirements, process size and capacity.
2. The total costs associated with the running of a process to include direct and indirect cost area.
3. Identify the cost drivers for the premises and quantify the costs using locally validated cost data.
4. The appropriate steps in the scale up of a process to ensure that the higher output does not result in product quality becoming unacceptable, such as conducting tests to validate the scale up process.
5. Cost benefit and risk analysis on the automation of a production process; investigate the automation of the proposed process and carry out a cost benefit analysis to decide if the automation is justified.
6. Process control specifications with identified critical control points along with tolerances and permitted corrective actions.
7. Process design principles will be used to decide the factory requirements; Impact on operator safety, environmental factors and overall equipment effectiveness: the process and factory will be assessed for the potential impacts.

Equipment
Fundamentals of hygienic design

1. Design principles: permanent, semi-permanent joints, fasteners, drainage, internal angles and corners, dead spaces, bearings and shaft seals, controls.
2. Materials of construction.
3. Surface finishes.
4. Equipment location and installation.

Application of hygienic design

1. Open or closed tanks.
2. Pumps.

3. Pipelines and fittings (steel pipe, plastic pipe, connections, dead-legs, air-pockets, tees pieces, reducing pieces, jackets and insulation).
4. Valves.
5. Hygienic design of solid product transfer systems.
6. Motors and drives.
7. CIP systems.

Applied Thermofluids

Outlining syllabus – typical module content covers

Thermodynamics

1. Basic definitions, including: energy, working fluid, continuum, property, open and closed systems, phase, state, equilibrium, process, cycle.
2. Work and heat definitions, path functions, types of work, sign conventions.
3. Properties of pure substances; sub cooled, saturation and superheated properties, use of tables and ideal gas equation of state.
4. Perfect gases; ideal gas equation of state, specific heats, internal energy, enthalpy and datum levels.
5. Conceptual development of the First and Second Laws of Thermodynamics.

Fluid Mechanics

1. Basic definitions, including: laminar, turbulent and transitional flows, boundary layer.
2. Dimensional analysis: fundamental and derived units, dimensional and dimensionless concepts.
3. Static, stagnation and dynamic pressure, centre of pressure, pressure measurement.
4. Streamlines, particle paths and the physical interpretation of the Bernoulli equation.
5. Introduction to the study of flowing fluids and control volume analysis.
6. The conservation principles for open system.

Mechatronics

Outlining syllabus – typical module content covers

1. Digital Logic.
2. Sensors and Signal Conditioning: Displacement, position and proximity, velocity and motion, temperature, switches. Power amplifier, the operational amplifier, filtering, pulse modulation. Digital signal processing (Quantisation) .
3. Data acquisition systems. Computer with plug-in boards (DAQ boards). Data loggers
4. Data Presentation Systems. The effect of 'loading'. Displays (LEDs and LCDs). Examples of measurement systems (analogue and digital voltmeters).
5. Mechanical and Electrical Actuation Systems. Gears, belt and chain drives. D.C. motors, A.C. motors, stepper motors, motor selection. Combined mechanical and electrical systems
6. Microcontroller Programming and Interfacing. Introduction to Simulink® and MALAB® support packages for the Arduino® board. Introduction to the Arduino® board and its development

environment. Input/output addressing, interface requirements, serial communications interface.
7. Frequency response measurements and system identification.
8. Feedback Control. Stepper motor control. D.C. motor velocity and position control.
9. Case studies.

Dynamics (Option Mechanical)

Outlining syllabus – typical module content covers
1. Arithmetic Circuits: Combinational logic circuits for the parallel adder; carry propagation; carry look-ahead; subtraction; logic functions; the ALU; multiplication and shifting; serial multipliers: parallel and carry save methods.
2. Sequential Logic: Synchronous systems; Finite state machines; state assignment; synthesis of synchronous FSMs; implementation methods; memory and combinational logic; examples of implementation of controllers and algorithms.
3. Asynchronous systems: Fundamental mode; implementation of a primitive flow table; races; metastability and synchronisation failure.
4. Software tools: Introduction to Verilog; Modelling of hardware behaviour in software, Combinational and sequential implementations;
5. Microprocessor systems: Hardware components of a microprocessor system (using AVR as a case study) Central processing unit: ALU, memory, input/output, Register-based architectures Instruction sets Assemblers Peripheral circuits and their modelling.

Analogue Electronics (Option Electrical)

Outlining syllabus – typical module content covers
1. Basic Analog Concepts; Power amplifier circuits: Class A, B and AB amplifiers; issues of efficiency, power dissipation and heat sinking requirements. High frequency performance of transistors; Common-emitter amplifier.
2. Operational Amplifiers and basic circuits; Sources of noise in electronic circuits. Concepts of noise figure, noise temperature and the design of low-noise amplifiers. The design of active RC filters.
3. Oscillators – Amplifier with feedback, Condition of harmonic oscillation, RC oscillator circuits. Waveform Generators – OPAMP as a comparator, Regenerative comparator, Timer, Relaxation oscillator, Non-sinusoidal waveform generator using comparator. D-C Power Supply – Half-wave and Full-wave rectifiers, Shunt capacitor filter, Ripple and voltage regulators. Communication Circuits and Data Conversion.

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Solid Body Mechanics (Option Mechanical)

Outlining syllabus – typical module content covers

1. Bending: Statically determinate and statically indeterminate structures. Bending stresses. Properties of areas. Slope and deflection of beams.
2. Stability: Elastic instability. Buckling of struts. Euler theory. Empirical methods.
3. Stress and failure analysis: Review of 2-D stress transformations and principal stresses. 3-D stress transformations. Hydrostatic stresses. Stress-strain relationships. Tresca, Von-Mises and Rankin yield criteria.
4. Complex stress: Review of principle of superposition and axial loading. Stresses in beams. Bending. Torsion. Internal pressure.
5. Energy methods in stress analysis: Work and strain energy. Castigliano's theorems. Virtual load and unit load methods.

Digital Systems (Option Electrical)

Outlining syllabus – typical module content covers

1. Arithmetic Circuits: Combinational logic circuits for the parallel adder; carry propagation; carry look-ahead; subtraction; logic functions; the ALU; multiplication and shifting; serial multipliers: parallel and carry save methods.
2. Sequential Logic: Synchronous systems; Finite state machines; state assignment; synthesis of synchronous FSMs; implementation methods; memory and combinational logic; examples of implementation of controllers and algorithms.
3. Asynchronous systems: Fundamental mode; implementation of a primitive flow table; races; metastability and synchronisation failure.
4. Software tools: Introduction to Verilog; Modelling of hardware behaviour in software, Combinational and sequential implementations;
5. Microprocessor systems: Hardware components of a microprocessor system (using AVR as a case study) Central processing unit: ALU, memory, input/output, Register-based architectures Instruction sets Assemblers Peripheral circuits and their modelling.

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Level 6

Engineering Management and Lean Manufacturing

Outlining syllabus – typical module content covers
1. Planned Preventative Maintenance.
2. Project management.
3. Procurement and costings.
4. Contracts.
5. Financial Management. Budget and cost control.
6. Asset management and care.
7. Management of food factory systems.
8. Leadership and people management.
9. Lean Manufacturing and Continuous Improvement.
10. The 7 wastes within a manufacturing operation: motion, waiting time, overproduction, processing time, defects, inventory, excessive transportation.
11. Kanban system to minimise work in progress: push and pull in factory design, WIP (Work in Progress), JIT (Just in Time), Kanban Card Systems, 2 bin systems.
12. Rapid changeover techniques: internal and external work, standard operating procedures
13. Total productive maintenance techniques: OEE (Overall Equipment Effectiveness), autonomous maintenance, planned maintenance, equipment management.

Automation and Robotics for the Food Industry

Outlining syllabus – typical module content covers
1. Definition of robotic systems and historical facts.
2. Classification of robotics types.
3. Kinematics.
4. Networked operation of robotics.
5. Introduction to robotics control aspects.
6. Teleoperation and human-in-the-loop.
7. Sensors and interpretation of sensory information.
8. Vision systems.
9. Introduction to robot programming (C++/Python via ROS).

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Food Production Processes and Technologies

Outlining syllabus – typical module content covers

1. Scoping the project: Characterisation of food product, packaging, volume of production.
2. Line design:
3. Design of production flow diagram/PID/production capacity.
4. Selection and dimensioning of equipment (including thermal process and refrigeration/freezing)
5. Process control and automation;
6. Hygienic design of processes and equipment;
7. General manufacturing services.
8. Legal compliance: Food safety, HACCP plan, health, safety and environmental considerations.
9. Business case: Project costing and evaluation.

Food Production and Operations Management (Option Production)

Outlining syllabus – typical module content covers

1. Scoping a project.
2. Project design.
3. Legal compliance.
4. Working with stakeholders.
5. Business case.
6. Project framework.
7. Tendering/Contractor selection and control.
8. Procurement/budget control.
9. Installation.
10. Evaluating the project.

Advanced Mechanical Food Systems (Option Mechanical)

Outlining syllabus – typical module content covers

1. Case studies of mechanical food systems
2. Analysis of mechanical components, mechanisms or systems in food production
3. Introduction to Finite Element Analysis (FEA), covering:
    a. Pre-processing: solid and finite element model development for a system consisting of various structural elements.
    b. Static, as well as free, harmonic and forced vibration analyses, stress analysis and heat transfer.
    c. Post processing: validation and interpretation of results for design purposes, elementary structural optimisation.
4. Consideration of failure/risk in food production.
5. Design of mechanical solutions to improve reliability or reduce risk.

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Individual Industry Project

Students will complete an industry project that is related to the specialist stream that they will follow at level 6, with industry mentorship and departmental supervision. As such, the specific content of each project will vary, but in general an honours levels project will include analytical elements and either a computational or an experimental aspect. Students are expected to conduct their work in a professional environment. Academic staff will liaise with industry and student to identify possible areas of study that align with learning outcomes and apprenticeship standards.

The final choices are subject to approval by the department who will make an assessment of the suitability of the project with respect to its content and deliverables. Regular meetings with the project supervisor throughout the project will ensure that students are able to develop their understanding of the relevant ideas in their chosen subject area.

Projects will typically include: a clear statement of objectives and deliverables; evidence of project planning and time/resource management; a survey of relevant published literature; design/manufacture/execution of equipment; appropriate experiments, use of software or simulation; research methodology, analysis and discussion of results; conclusions relative to the agreed objectives, and identification of further work. The analysis will also include an evaluation of the environmental impacts and sustainability of the chosen engineering solution.

This module also includes some taught elements in relation to project management techniques in order to ensure that students are able to understand the process involved in this module. This is also done to ensure that students have a realistic experience of standard industry practice.

Advanced application of automation to food industry (Option Automation)

Outlining syllabus – typical module content covers

1. Case studies of food automation systems
2. Analysis of automation systems in food production
3. Advanced industrial automation including:
    a. Sensors and Actuators
    b. Industrial networks
    c. PLC-based systems
4. Consideration of failure/risk in food production.
5. Design of mechanical solutions to improve reliability or reduce risk.

Modules are currently under review pending validation at the end of June and subject to change as part of this process. Final module information will be available post-validation.

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Guided Learning Hours Breakdown

Total hours worked per year (8 hours per day) = 2080 hours.

The Standard expects a minimum of 20% off the job training = 416 hours

The Programme developed meets this requirement through a combination of activities, broken down below.

Activity	Hours Per Week	Weeks Per Year	Total Hours
Guided learning - online materials	6*	30	180
Campus Weeks	30	3	90
Coursework	3**	30	90
e-Seminars	2	30	60
Welcome week	10	1	10
Exams	3	3	9
Total			439

* *Equivalent full-time provision through traditional modes of study has 16 hours contact per week. Additional to these guided hours, further resources will be provided to enhance and expand students learning and e-Seminars.*

** *Hours are average and will vary according to modes of assessment and weightings in each module.*