1: Working within the Engineering and Manufacturing Sectors

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Lessons																								
		Careers - Manufacturing Technology	Careers - Mechatronics	Careers - Rapid Manufacturing	Manufacturing Processes	Computer Integrated Manufacture	Computers and Manufacturing	Extending System Life	Maintenance and Accident Prevention	Maintenance Principles	Maintenance Inspection	Mechanical Breakdown	Tools and Safety	Introduction to Engineering Design	Introduction to Engineering Design - Task (VJC6)	Engineering Problems	Engineering Problems - Task (VJC6)	Alternative Solutions	Alternative Solutions - Task (VJC6)	Models and Prototypes	Models and Prototypes - Task (VJC6)	Communicating Engineering Design	Communicating Engineering Design - Task (VJC6)	Design Project - A Railroad Crossing System	Design Project - A Railroad Crossing System - Task (VJC6)
1.1: Key principles and methodologies in engineering and manufacturing design.	C1. Types of manufacturing process (wasting, forming, shaping, joining, finishing, casting, additive). Fitness for purpose (influences on design and manufacture, functional requirements, environmental requirements).				■																				
	C2. User requirements (design brief, specification, needs to be met).																							■	■
	C3. Approaches to design (linear design, iterative design, inclusive design, user centred design, anthropometric data (ergonomic design), design for manufacture, design for assembly, sustainable design, 6Rs (reduce, refuse, rethink, repair, reuse, recycle)).													■	■	■	■		■		■		■	■	■
	C4. Research and testing methodologies.																	■							
	C5. Methods of communicating design requirements to technical and non-technical audiences.																					■	■		
	How different types of manufacturing processes influence the design of engineered products.																								
	How different requirements affect the user and designs related to the manufacture of products.															■									
	The steps of the linear and iterative design processes and the contribution that testing makes to achieve a suitable and effective design.															■				■					
	How to interpret anthropometric data.																								
1.2: The role of maintenance, repair and installation in engineering.	C1. Types of maintenance activity (planned, reactive, preventative, condition-based monitoring).									■	■														
	C2. Roles and functions (machine operator, maintenance engineer, maintenance manager).	■																							
	C3. Operations (monitoring, repair, shutdown, servicing).									■	■	■													
	C4. Tools and equipment (mechanical (hand tools, portable power tools), electrical/electronic (hand tools, soldering irons).												■												
	C5. Measurement devices, instrumentation and gauges).																								
	C6. Installation requirements (provision of services, commissioning).																								
	C7. Developments in maintenance (influence of new technologies, environmental influences).									■															
	The role and purpose of maintenance, repair and installation.									■		■													
	The advantages and disadvantages of different approaches to maintenance.									■	■														
	The responsibilities of the different roles involved in maintenance.																								
	Approaches to monitoring and the reasons for carrying out monitoring.									■	■														
	The reasons for, and implications of shutdown and servicing.											■													
	An overview of the types of tools and equipment used.												■												
	The reasons for commissioning activities.																								
	How effective maintenance reduces impact on the environment and the safe and environmentally friendly disposal of waste.																								
1.3: Approaches to manufacturing, processing and control.	C1. Manufacturing – Scale of manufacture (one off, batch, mass, continuous), infrastructure (functional, product and matrix arrangements, cellular manufacture, production lines), level of automation (manual, computer aided manufacture (CAM), fully automated, robotic).				■	■																			
	C2. Control – Infrastructure (monitoring of performance, quality assurance, quality control).						■																		
	How the scale of manufacture affects the level of automation.																								
	Examples of products made at different scales of manufacture.																								
	Different types of manufacturing infrastructure, their purpose and relative advantages and limitations.																								
	The purpose and application of CAM systems and software.					■																			
	The advantages and limitations of different levels of automation.																								

2: Engineering and Manufacturing Past, Present, and Future

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Lessons									
		Agricultural Technology and Careers	Construction Technology and Careers	Engineering Design and Careers	Health and Biomedical Technology and Careers	Manufacturing Technology and Careers	Transportation Technology and Careers	Generating Electricity	Introduction to Mobile Robots	Rapid Prototyping	Nuclear Energy
(1) 2.1: Sectors of the engineering industry.	C1. Sectors – Aerospace, rail, agriculture, automotive, chemical, structural, materials, logistics, defence, electrical and electronic, control, medical, manufacturing, marine, petrochemical, power generation (renewables, non-renewables, nuclear), telecommunications, water and waste management.										
	An overview of the main activities, the products and/or services provided by the stated sectors.										
(2) 2.2: Significant technological advances in engineering from a historical perspective.	C1. Technological advances – Development of materials, electrical power and electrical sources of artificial lighting, the internal combustion engine, electric motors, replaceable parts and mass production, television (valves, cathode ray, LED, OLED, curved screens, 4K/5K), radio, automated machines, computers and the internet.										
	How technology advances and their operations have evolved and contributed to engineering, and social and economic development, to include transportation, healthcare, housing, employment and sustainability.										
(3) 2.3: Areas of innovation and emerging trends in engineering.	C1. Areas of innovation and emerging trends – Artificial intelligence (AI), virtual reality (VR), augmented reality (AR), digitalisation, robotics, drones, autonomous systems, distributed energy, hybrid technologies, cyber-physical systems, the internet of things (IOT), cloud computing, sustainability (product life cycle, circular economy, exploring alternatives, renewables, waste and disposal).										
	How innovation and emerging trends are evolving and could influence manufacturing, environmental considerations, social and economic development.										

3: Engineering Representations

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:		Lessons					
		Drawing Standards	Basic Geometric Construction	Types of View	Co-ordinate Systems	Dimensions	Tolerances and Fits
3.1: Drawings and information conveyed by drawings.	C1. Drawings – Computer aided design models, freehand sketching, isometric, orthographic projection (first angle, third angle, section, assembly, general arrangement), exploded views, block diagrams, flowcharts, circuit diagrams, schematics (wiring diagrams, pneumatics, hydraulics).						
	C2. Information – Scale, title block, view (elevation, plan, end, section, auxiliary), types of line (outlines, hidden detail, centre line, projection, dimension, leader, construction), surface finish, manufacturing detail, standard features (screw threads, nuts, bolts, pins, repeated items, counterbore, countersink, centre mark), abbreviations (across flats AF, centre line CL, diameter DIA, drawing DWG, material MTL, square SQ, chamfer CHAM, countersunk CSK, hexagon head HEX, radius R, thread THD, undercut UCUT, pitch circle diameter PCD), graphical symbols used on drawings (projection symbols, diameter, surface finish).						
	The characteristics of, purposes of, and audience for different drawing types.						
	The purpose and application of CAD systems and software.						
	How to interpret and present information, symbols, conventions and annotations on engineering drawings in accordance with the conventions of BSEN8888 and BS3939.						
3.2: Dimensions and tolerancing on engineering drawings.	C1. Dimensions and tolerancing – Dimensions (linear, diameter, radius, angular), tolerances, limits and fits, geometric dimensioning and tolerancing (GDT) symbols (datum, parallelism, perpendicularity, concentricity, straightness).						
	How to interpret dimensions and related drawing symbols.						
	How to calculate tolerances, limits and fits.						

4: Essential Mathematics for Engineering and Manufacturing

LJ CREATE™ Learning for life

KEY:
- Theory Lessons (■)
- Practical Lessons (●)

Unit Learning Objectives:

Lessons

	Unit Learning Objectives	Adding and Subtracting	Multiplication and Division of Decimal Numbers	Multiply Sums	Fractions - Addition and Subtraction	Fractions - Multiplication and Division	Use Fractions	Simplify Fractions	Percentages	Calculate Percentages of Values	Calculate Percentage Increases	Calculate Percentage Reductions	Indices	Scientific Notation 1	Algebra - Simple Formula	Transpose Equations	Calculate the Unknown Variable in an Equation	Equating Method for Solving Simultaneous Equations	Addition Method for Solving Simultaneous Equations	First, Second, and Third Order Brackets	Simple Factorisation	Calculate Volume	Calculate the Area of a Rectangle	Calculate the Area of a Complex Shape	Graphs - Pie Chart	Graphs - Straight Line Graphs	Graphs - Square Law	Measuring Angles	Calculating with Angles	Lengths and Pythagoras' Theorem	Pythagoras' Theorem	Basic Trigonometry	Vectors	Moments and Levers	Moments and Levers	Number Systems	Binary and Decimal Conversions	Calculations in Binary	Conversion Between Number Systems
4.1: Applied mathematical theory in engineering applications.	C1. Standard arithmetic – Ordering, integers, decimals, standard forms, fractions, percentages, ratios.	■	■	■	■	■	■	■	■	■	■	■																											
	C2. Algebra – Factorising and manipulating equations, solving quadratics, using indices and logarithms, determining numbers in a sequence, standard matrices and determinants.														■	■	■	■	■	■	■																		
	C3. Geometry – Calculation of areas and volumes.																					■	■	■															
	C4. Calculus – Graphs and charts relevant to engineering and manufacturing contexts, differentiation and integration.																																						
	C5. Trigonometry – Pythagoras' theorem, triangle calculations, circular measure, trigonometric functions and graphs of trigonometric functions, sine and cosine rules, common trigonometric identities and values, applications of vectors and coordinates, scalars.																											■	■	■	■	■	■	■	●				
	C6. Statistical analysis – Analysis of data and calculation of probabilities in engineering contexts, estimation.																																						
	Perform arithmetic operations on integers, decimal numbers and numbers in standard form using rules of arithmetical preference: brackets indices division multiplication adding and subtraction (BIDMAS).	■	■	■																																			
	Work to a specified number of decimal places or significant figures.		■																																				
	Carry out calculations using fractions, percentages, ratios and scale.				■	■	■	■	■	■	■	■																											
	Simplify, factorise and manipulate equations to change the subject.														■	■	■				■																		
	Solve simultaneous and quadratic equations.																	■	■	■																			
	Apply rules of indices.												■	■																									
	Apply laws of logarithms (base 10 and natural) - problem solving including problems involving growth and decay.																																						
	Determine numbers in a sequence using arithmetic and geometric progression, power series.																																						
	Calculate the area of 2D shapes (square, rectangle, triangle, circle) and the volume of 3D shapes (cube, cuboid, cylinder, cone).																					■	■	■															
	Interpret and express changes in an engineering system from a graph (straight line, trigonometrical and exponential relationships).																									■	■												
	Determine the equation of a straight line from a graph (y = mx + c).																									■													
	Determine standard differentials and integrals (basic arithmetic operations, powers/indices, trigonometric functions).																																	■					
	Calculate maximum and minimum values in engineering contexts using differentiation.																																						
	Use of Pythagoras' theorem and triangle measurement.																													■	■								
	Circular measure including conversion between radians and degrees.																																■						
	Application of trigonometric functions (sin, cos, tan), their common values, rules and graphical representation.																																						
	Determining dimensions of a triangle using sine and cosine rules.																																						
	Common trigonometric identities (sec, csc, cot).																																						
	Use of vectors including addition, dot and cross product.																																■	■					
	Addition, subtraction and multiplication of matrices in engineering contexts. Calculation of range, cumulative frequency, averages (mean, median and mode) and standard deviation for statistical data in an engineering context.																																						
	Determination of probabilities in practical engineering situations.																																						
4.2: Number systems used in engineering and manufacturing.	C1. Numbering systems – Decimal, binary, hexadecimal.																																			■			
	How to identify and convert between numbering systems.																																				■	■	■
	The applications of numbering used in engineering and manufacturing.																																						

5: Essential Science for Engineering and Manufacturing

LJ CREATE™
Learning for life

KEY:
- Theory Lessons
- Practical Lessons

Lessons

Unit Learning Objectives:		SI Units	Scientific Notation 1	Scientific Notation 2	Definition of Science	Scientific Theories	Planning Investigations	Implementing Investigative Procedures	Accuracy and Precision	Making Measurements with Accuracy and Precision	Measuring with a Caliper, Micrometer, or Dial Gauge	Measuring Angles	Triple Beam Balance	Absolute and Relative Measurement Errors	Vectors	Periodic Table and Properties of Elements	Chemical Families	Solubility	Solubility in Water (Soluble or Insoluble in Water)	Solubility in Water (Effect of Temperature on the Solubility of a Solid)	Dalton's Atomic Theory	Thomson and the Properties of the Electron	Electron Configuration	Acids and Bases	pH Scale	pH Scale	pH Scale (Universal Indicator Solution)	pH Scale (Universal Indicator Paper)	Acid Rain	Acid Rain (Reaction of Metals Exposed to Acid Rain)	Forces of Attraction Between Particles	Molecules and Chemical Properties	Chemical Reactions	Chemical Reactions	Purification	Purification	Distillation	Distillation	Chemical Decomposition	Decomposition (Catalytic Decomposition of Hydrogen Peroxide)	Decomposition (Thermal Decomposition of Different Copper Salts)	Conductivity	Conductivity	Electrolysis of Liquids	Electrochemistry	Electrolysis of Liquids (Copper(II) Sulfate Solution)	Electrolysis of Liquids (Potassium Salt Solutions)	Batteries and Cells	Electrochemistry (Electrolysis of Water)	Effects of Force	Effects of Force	Forces Acting at a Distance	Friction	Friction	Magnetic and Electrical Forces	Electric and Magnetic Forces in Everyday Life	Kinetic and Potential Energy 1	Kinetic and Potential Energy 2	Force and Work	Work-Energy Theorem	Power and Mechanical Energy	Efficiency of an Electro-mechanical System	Force, Mass, and Acceleration	Acceleration	Force and Momentum	Investigating the Relationship between Force and Acceleration	Circular Motion	Free-Body Force Diagrams	Free-Body Force Diagrams (Force and Slope Angle)	Free-Body Force Diagrams (Forces Acting at a Single Point)	Kinetic Molecular Theory	Boyle's Law	Pressure in Fluids	Viscosity in Fluids	Heat Transfer	Convection of Thermal Energy	Radiation of Thermal Energy	Conduction of Thermal Energy	Charles' Law
5.1: Units of measurement used in engineering	C1. SI units: Metre (m), kilogram (kg), second (s), newton (N), metre cubed (m3), metre per second (m s-1), metre per second squared (m s-2), newton metre (N m), Pascal (Pa or N m-2), mass per unit volume (kg m-3), unit multiples and submultiples (tera, giga, mega, kilo, milli, micro, nano, pico).																																																																												
	C2. Imperial units: Foot (ft), inches (in), yard (yd), ounce (oz), gallon (gal).																																																																														
	The difference between base and derived units.																																																																															
	The units applicable to different properties.																																																																															
	How to convert between SI units and comparable imperial units.																																																																															
	How to convert between different multiples and submultiples.																																																																															
5.2: Vector and coordinate measuring systems.	C1. Vector and coordinate – Vectors and scalar quantities (distance, displacement, speed, velocity, acceleration), polar coordinates, Cartesian coordinates.																																																																															
	The definitions of, and differences between, scalar and vector coordinates.																																																																																
	How to convert between Cartesian and polar coordinates where angles are in degrees.																																																																																
5.3: Scientific methods and approaches to scientific inquiry and research.	Atomic and chemical structures of matter including:																																																																															
	The concept of the scientific method (observation, questioning, making a hypothesis, prediction/simulation, testing, conclusion, iteration).																																																																																
	How to analyse, evaluate, synthesise and apply information, data, research findings, deliberation, and the processes, results and outcomes of testing, modelling and experimenting (accuracy, reliability, precision and replication).																																																																															
	The principal behaviours and effects of chemical interactions in straightforward engineering and manufacturing contexts, including:																																																																															
5.4: Measurement equipment, techniques and principles.	C1. Equipment – Rule, callipers (digital, Vernier), micrometers (inside, outside, depth), gauges (angle, slip, go/no-go), dial test indicator (DTI), coordinate measuring machines (CMM).																																																																															
	C2. Principles – Precision, accuracy, uncertainty, resolution, calibration, tolerance.																																																																															
	What can be measured by each item of equipment.																																																																															
	The techniques used to carry out measurements using the stated equipment.																																																																															
	The accuracy and relative limitations and benefits of the listed devices.																																																																															
	How the principles and techniques are used in measuring and problem solving.																																																																															
5.5: Chemical composition and behaviours.	C1. Chemical composition – Atomic structure (atom, nucleus, electron, proton, neutron, valence, valence shell, ion, element, molecule), chemical structure (solutions, suspensions, solubility, compound and mixture), periodic table.																																																																															
	C2. Behaviours – Chemicals in electricity (cells (simple, primary and secondary), cell capacity, power capacity, internal resistance), electrolysis (anode, cathode, electrolyte, anion, cation, dissociation, plating, galvanic protection), reactions of metals and alloys with weak and strong acids and alkalis.																																																																															
	The definitions of the term atom, element, molecule, compound and mixture.																																																																																
	The applications, characteristics, management and control of chemical interactions and reactions used in engineering (chemical etching, surface finishing, bonding, applications for oils and lubricants, high-risk operations).																																																																															
5.6: Forces and motion in engineering.	C1. Forces and motion – Types of motion (rotary, linear, reciprocating, oscillating), pressure, vector representation of forces, balanced and unbalanced forces, moments about a force, torque, conditions for equilibrium, coplanar forces.																																																																															
	The application of theory and calculations to solve practical engineering problems involving forces and motion.																																																																															
5.7: Fluid dynamics in engineering.	C1. Fluid dynamics – Hydrostatic pressure (p = r g h), hydrostatic thrust on an immersed plane surface (F = ρ g A x), centre of pressure, viscosity, Bernoulli's principle, immersion of a body, flow characteristics around a two-dimensional shape (laminar, turbulent, vortices, separation points), principles of aerodynamics (drag, thrust, lift).																																																																															
	The application of theory and calculations to solve practical engineering problems involving fluids.																																																																																
	The key differences between liquid flow and aerodynamics.																																																																																
5.8: Thermodynamics in engineering.	C1. Thermodynamics – Heat transfer mechanisms (conduction, convection, radiation), systems (open, closed, temperature, pressure, volume), sensible heat, latent heat of fusion, latent heat of vaporisation, expansivity, coefficient of heat transfer, equations (absolute temperature, absolute pressure, volume, mass, density, Boyle's law (pV = constant), Charles' law (V/T = constant), general gas equation (pV/T = constant), characteristic gas equation (pV = mRT)).																																																																															
	The application of theory and calculations to solve practical engineering problems involving thermodynamics.																																																																															

6: Materials and their Properties

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:		Lessons																									
		Characteristics of Materials	Corrosion	Lubrication	Density	Iron and Steel	Non-Ferrous Metals	Ceramic and Sintered Materials	Synthetic Materials	Composite Materials	Polymers	Smart Materials	Forming Procedures	Forming - Material Use and Scrap	Material Conversion	Joining Procedures	Screw Connections	Joining with Glues	Joining with Soldering	Joining with Welding	Erosive Manufacturing Processes	Finishing Processes	Materials Testing - Tensile and Impact Testing	Materials Testing - Hardness and Non-Destructive Testing	Interpretation of Test Results
6.1: Physical and mechanical properties of materials.	C1. Physical properties – Density, melting point, thermal and electrical conductivity (resistivity), thermal expansivity, corrosion resistance, specific heat capacity, hardenability, weldability, permeability, permittivity, ability to be recycled.																										
	C2. Mechanical properties – Strength (tensile, compressive, shear, torsion), hardness, toughness, brittleness, ductility, elasticity, plasticity, malleability.																										
	The difference between physical and mechanical properties.																										
	The definitions of the stated properties.																										
	Calculation of density																										
6.2: Types of material and their structures.	C1. Types: Ferrous metals (cast iron, low carbon steel, medium carbon steel, high carbon steel, stainless steel); Non-ferrous metals (aluminium and alloys, copper, brass and bronze, nickel, zinc); Thermoplastic polymers (ABS, HIPS, PLA, sheet and polystyrene foam, polycarbonate, polypropylene, PMMA/acrylic); Thermosetting polymers (urea formaldehyde, melamine formaldehyde, phenol formaldehyde, epoxy resin, polyester resin); Elastomers (rubber, neoprene); Composites (GRP, CRP, MDF); Engineering ceramics (silicon carbide, glass); Timber (soft wood, hard wood, engineered wood); Smart materials: shape memory alloys, quantum tunnelling composite, thermochromic materials, photochromic materials, piezoelectric crystals.																										
	C2. Structures – Atomic structure (atoms, compound), bonding mechanisms (metallic, covalent, ionic, van der Waal's forces), microstructure (grains), lattice structure in metals (dislocation movement and pinning), crosslinking of polymers, ceramic structures (crystalline and non-crystalline (amorphous) materials), composite (particulate, fibrous, laminated).																										
	The common forms of supply, relative properties, applications and methods of disposal of the listed materials.																										
	The differences between: pure metals and alloys, ferrous and non-ferrous metals, thermoplastic and thermosetting polymers, composites and alloys.																										
	The definition of a smart material, the characteristics and typical applications of smart materials.																										
	The relationship between the structure of a material and its properties.																										
	The difference between crystalline and non-crystalline materials.																										
6.3: The effects of processing techniques on materials.	C1. Metals – forming (rolling, forging, moulding/press forming), welding, brazing, casting, sintering, coating, hot working, cold working.																										
	C2. Thermoplastic polymers – temperature, mould/injection pressure.																										
	C3. Thermosetting polymers – curing.																										
	C4. Ceramics – sintering pressing force and firing temperature.																										
	C5. Composites – influence of alignment of reinforcement on anisotropy of properties, influence of matrix/reinforcement ratio on tensile strength.																										
	How the stated processes affect the structure, physical and mechanical properties of materials.																										
6.4: Heat treatments and surface treatments.	C1. Heat treatments – Case hardening, quench hardening, tempering, normalising, annealing and precipitation hardening.																										
	C2. Surface treatments – Painting, plastic coating, galvanising and electrolytic (galvanic) protection.																										
	How heat treatment and surface treatment processes affect the structure and properties of materials.																										
	Common applications of each method.																										
6.5: Causes of material failure and their prevention.	C1. Causes – Corrosion (oxidation of metals including rusting of ferrous metals, chemical composition and attack, stress corrosion), aging, physical (deformation, fracture, fatigue, creep, erosion).																										
	C2. Prevention – Coatings, sacrificial anodes and cathodes, galvanising.																										
	Materials fail due to corrosion as a result of material consumption, chemical composition and attack, reduction in thickness and perforation.																										
	The factors that contribute to fatigue failure and the three stages of creep.																										
	The different methods of preventing corrosion and their relative benefits and limitations.																										
6.6: Materials testing methods and interpretation of results.	C1. Methods – Visual inspection, tensile testing, toughness testing, hardness,																										
	C2. Interpretation of results – Hooke's law, load-extension graphs (tensile strength, elastic limit, ultimate tensile strength, maximum plastic deformation, calculation of stress, strain and Young's modulus), characteristic graphs of different materials, necking and transition zone in steel.																										
	The advantages and limitations of different testing methods.																										
	The steps involved in the materials testing methods and how these determine the material properties.																										
	How to interpret load extension graphs.																										

7: Mechanical Principles

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Lessons																																			
		Mechanical Systems	Mechanical Systems	Forces and the Laws of Motion	Theory of Gravity	Forces Acting at a Distance	Friction	Friction	Forces	Forces	Beams	Beams	Kinetic and Potential Energy 1	Kinetic and Potential Energy 2	Law of Conservation of Energy	Conservation of Energy	Springs	Springs	Speed and Velocity	Projectiles	Acceleration	Describe and Calculate Motion	Measuring the Acceleration due to Gravity	Design a Force-Mass-Acceleration Investigation	Generating Electricity	Generating Electricity	Energy and Power	Fossil Fuels	Power from the Wind	Power from the Wind	Solar Power	Solar Power	Creating Power from Biomass	Biomass Power	Geothermal Energy	Nuclear Energy
7.1: Principles of motion and mechanics in engineering and manufacturing systems.	C1. Motion and mechanics – Newton's three laws of motion, types of forces (concurrent, non-concurrent, co-planar, non-contact), simply supported beams (loading, load distribution (point, uniformly distributed, combination of point and uniformly distributed), reaction forces, loaded components, shear force, bending moments).																																				
	The practical application of Newton's three laws of motion, including appropriate calculations.																																				
	Calculation of stated variables for simply supported beams.																																				
7.2: Principles of forces and energy.	C1. Forces and energy – Principle of conservation of momentum, principle of conservation of energy, D'Alembert's principle, potential and kinetic energy, gravitational force, frictional resistance, mechanical work, power, types of power sources (mechanical, electrical, renewable).																																				
	Calculations using equations of motion to determine displacement, velocity and uniform linear acceleration relating to falling objects and collisions between two objects in line.																																				
	Explanation and examples of tractive effort, braking force, frictional resistance, rotational kinetic energy, moment of inertia, mechanical work, power in practical applications (fly wheels, springs, height, pressurised fluids).																																				
	The function and relative advantages of the alternative power sources and examples of their use, including solar, hydro, wind, biofuel, geothermal, electric motors, internal combustion, fossil fuels, nuclear.																																				

8. Electrical and Electronic Principles

LJ CREATE™ Learning for life

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Lessons
		Atomic Structure and Ions
		Electric Forces
		Electrostatics
		Electrical Principles
		Basic Electrical Quantities in Circuits
		Units, Multiples and Sub-multiples
		Magnetic Principles
		Electromagnetism
		Electromagnetism
		Potential Difference and Voltage
		Introduction to Electric Current
		Resistance and Conductance
		Measurement in Circuits
		Measuring Voltage
		Measuring Voltage
		Measuring Current in a Circuit
		Circuit Diagrams
		Resistors
		Measuring Resistance
		Electrical Power
		Calculation of Electrical Power
		Calculating Electrical Power for a Load
		Gradient of Linear Voltage–Current Graphs
		Relationship between Voltage, Current and Resistance
		Applications of Ohm's Law
		Calculation of Resistors in Series
		Resistors in Series
		Calculation of Resistors in Parallel
		Resistors in Parallel
		Kirchhoff's First Law
		Current Behavior at a Node
		Kirchhoff's Second Law
		Voltages in a DC Network
		Introduction to Alternating Current
		Measuring with an Oscilloscope
		Amplitude and Timebase Settings of an Oscilloscope
		Capacitors in AC Circuits
		Capacitors in AC Circuits
		Inductors in AC Circuits
		Inductors in AC Circuits
		Graphical Representations and Equations of RL Circuits
		Graphical Representation and Equations of RC Circuits
		Graphical Representation and Equations of RLC Circuits
		Phasor Diagrams
		Electronic Communication Systems
		Types of Analog Circuits
		Analogue Signal Processing
		Signal Processing
		Electronic Systems
		Types of Control Signals
		Diode Operation
		Diode Characteristics
		Transistors
		Bipolar Transistor Characteristics
		Classes of Transistor Amplifiers
		Class A Transistor Amplifier
		Class B and AB Transistor Amplifiers
		Class C Transistor Amplifier
8.1: Principles of electrical and electronic systems.	C1. Basic principles of electricity and electronics – flow of electrons, charges, energy, power, networks, force, current, capacitance, waves, conduction, magnetism (flux density, field strength), electromagnetism, inductance, measurements of electrical quantities in electrical systems (standard units of measure, multimeters).	
	C2. Electric circuit theories – voltage, current (alternating current (AC), direct current (DC)), power, resistance, potential difference and dividers, basic electrical elements, Ohm's law (series, parallel and combination circuits), Kirchhoff's current and voltage laws, phasor diagrams, protection systems (lightning arrestors, time graded over current protection, distance protection), residual current devices (RCD)).	
	C3. DC circuit networks – resistors, capacitors and inductors in series, parallel, and combined circuits, semiconductors (forward and reverse bias, N-type and P-type), hierarchical design.	
	C4. Signals – types (analogue, digital), waveforms (sinusoidal, square, rectangular, triangular, sawtooth), signal processing, signal conditioning, fan in and fan out.	
	The physical principles underpinning electrical and electronic systems and devices.	
	The basic properties and principles of magnetism and electromagnetism and their common applications.	
	The relationship between flux density and field strength.	
	The definitions of terms used in electric circuit theory and their applications.	
	The use of Ohm's law and electric circuit theories to calculate values in circuits, such as voltage, current and resistance.	
	How differential protection schemes work to protect transmission lines.	
	How transformer protection schemes work for common faults.	
	The characteristics of the different concepts related to signals.	
	The characteristics of analogue and digital systems, including their waveforms and applications.	
	The characteristics of DC circuit networks comprising resistors, capacitors and inductors in various arrangements, including time constants.	
	The relationship between voltage, current and power in AC circuits and how to represent them in graphs and phasor diagrams.	
	The properties and applications of semiconductor diodes and transistors.	
	Factors affecting the operation and applications of high-power electrical equipment and electronic devices.	

9: Mechatronics

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Lessons																																																					
		Control Examples	Manufacturing Facilities	Assembly Technology	Controlling Machines	Sensors	Actuators	Mechanical Systems	Mechanical Systems	Gears and Simple Gear Trains	Gears and Simple Gear Trains	Pulleys	Fixed and Movable Pulleys	Pulley Belt Drive	Pulley Belt Drive	Cams and Cranks	Cams	Cams	Compressing Air	Fundamental Principles of Pneumatics	Making use of Pneumatics	Basic Control Valves	Pneumatics Diagrams, Series and Parallel Circuits and Time Delays	Combining Pneumatics and Electronics	Electro-pneumatics (rig)	Problem Solving - Sorting Parts	Problem Solving - Sorting Parts	Hydraulics	Hydraulic Applications	Compressing Fluids!	Building a Hydraulic Circuit	Building a Hydraulic Circuit	Hydraulic Laws	Lifting Force	Lifting Force	Hydraulics in Operation	Danger - High Pressure	Construction and Function of a PLC	Components of a Sequence Control System	Sequence Control System	PLC Programming	Connecting a PLC	Basic Structure of a PLC	Create a STEP 7 Project (Siemens panel)	Enter a STEP 7 Ladder Program (Siemens panel)	Run a STEP 7 Ladder Program (Siemens panel)	Timers (Siemens panel)	Memory Stores (Siemens panel)	Analog Inputs (Siemens panel)	Analog Outputs (Siemens panel)	Sorting Parts 1 (Siemens panel)	Sorting Parts 2 (Siemens panel)	Flip-Flop Latches (Siemens panel)	Counting Parts (Siemens panel)	Introduction to SCADA
9.1: The key components of a mechatronics system.	C1. Components – Mechanical (gears, cams, linkages, levers, pulleys), electrical/electronic (sensors and transducers, microprocessors, microcontrollers, actuators), common drive devices (standard electrical motors, servo motors, stepper motors).																																																						
	Mechatronics is the integration of mechanical and electronic systems to produce a functioning system.																																																						
	The purpose and function of the mechanical and electrical components.																																																						
9.2: The operation, function and applications of programmable logic controllers (PLC) in mechatronic systems.	C1. Programmable logic controllers – Types (unitary, unitary with modular features, modular), architecture.																																																						
	C2. Operation – Sensor signal conditioning, programming.																																																						
	C3. Function – Process blocks, motor driver integrated circuits, interface devices.																																																						
	C4. Applications – Robotic arms, conveyor belts, packaging, supervisory control and data acquisition (SCADA), remote technical units, animatronics.																																																							
	The differences between the types of PLCs.																																																						
	An overview of how a PLC operates.																																																						
	An overview of the functions.																																																						
	The advantages and limitations of using PLCs for the applications given, compared to the alternatives (dedicated integrated circuits, computer-based systems).																																																						
9.3: The basic principles of hydraulics and pneumatics.	C1. Principles – Transmission of power, fluid compressibility, components (valves, pumps, actuators, cylinders, compressors).																																																						
	The differences between hydraulic and pneumatic systems, and their advantages and limitations.																																																						
	The purpose and function of the stated components and how they are they are represented on schematic diagrams.																																																						

10: Engineering and Manufacturing Control Systems

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Basic Logic Functions and Their Algebra	Logic Gates	Systems and Sub-Systems	Inputs, Outputs and Processes	Inputs, Outputs and Processes	On/Off Control Systems	An Example On/Off Control System	Information Flow	Sensors	Actuators	The Voltage Divider Principle	Variation of Output Voltage with Setting of Rotary Potentiometer	Variation of Output Voltage with Setting of Slide Potentiometer	Effect of Loading on the Potentiometer Output Voltage	Characteristics of an IC Temperature Sensor	Characteristics of an NTC Thermistor	Two Thermistor Bridge Circuits	IC Sensors	Light Controlled System	Characteristics of Non-Linear Components	Characteristics of an Air Flow Transducer	Characteristics of an Air Pressure Transducer	The DC Motor	Characteristics of a DC Solenoid	Characteristics of an Air Valve	Characteristics of a DC Permanent Magnet Motor	Proportional Control - Step Input Response	The Control Loop	Controller Responses	Proportional Speed Control	Integral Control Step Response	Derivative Control Ramp Response	PID Control Step Response	VCL System Equipment	Proportional Position Control	Three Term PID Control	Analog Interfacing	Digital Control	Industrial Networks
		Lessons																																						
10.1: Principles and applications of control system theory.	C1. Principles – Input, process (logic gates (AND, OR, NOT), timer, comparator, pulse unit, counter, latch), output, signal, feedback, open and closed loop systems, transfer function, summing points, analogue, digital, pulse width and amplitude modulation, how control systems are represented in diagrams.																																					
	C2. Applications – Electrical, pneumatic, hydraulic, measured parameters (pressure flow, temperature, speed, position).																																					
	How to produce a system diagram with multiple inputs, outputs, a combination of process blocks and feedback, and explain its operation.																																					
	Applications of open and closed loop control systems (under or over-damped, and time dependency).																																					
	The advantages and disadvantages of open and closed loop control systems.																																					
	The relationship between input and output (steady rate error).																																					
	The relative advantages and disadvantages of analogue and digital signals in control systems.																																					
	Applications of control systems in industry, including effective and efficient networked communication and data transmission.																																					
10.2: How sensors and actuators are used in automation control systems.	C1. Sensors and actuators – Types (analogue, digital, active, passive), applications (switches, proximity sensors, laser, vision systems), power sources, hard-wired, wireless.																																					
	C2. Uses in automation – Position and volume of objects being processed, mechanised lifting and moving of objects, measurement applications (electrical, mechanical, thermal, chemical, biological, optical, acoustic, radiation).																																					
	The purpose and function of the different types of sensors and actuators.																																					
	Applications and uses of sensors and actuators.																																					

11: Quality Management

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:		Lessons									
		Industry Standards	Electrical installation in Residential Buildings	Re-Testing to Electrical Standards	Quality and Environmental Management	Quality Management	Quality Control	Statistical Analysis	Rules and Procedures 1	Maintenance Documentation	Customer Care
11.1: Quality standards, assurance, control and improvement.	C1. Standards – British standards, ISO standards, CE, engineering bodies (Engineering Council, Institution of Engineering and Technology (IET), Institution of Mechanical Engineers (IMechE), Society of Operations Engineers (SOE), Chartered Institution of Building services Engineers (CIBSE), Institute of Agricultural Engineers (IAgrE), Institute of the Motor Industry (IMI), The Welding Institute (TWI)).										
	C2. Assurance and control – Culture of quality, right first time, quality standards (ISO9001), inspection and testing, traceability, document management and version control, process capability, statistical process control (SPC), six sigma, total quality management (TQM).										
	C3. Improvement – Failure mode effect analysis (FMEA), Pareto analysis, cause and effect diagrams, quality circles.										
	The function, purpose and value of standards (safety, quality, compliance) and how to access this information.										
	The roles and responsibilities of the engineering bodies.										
	The main principles, purposes and outcomes of quality assurance, quality control, inspection and testing. The difference between quality control and quality assurance.										
	The main requirements of quality standards.										
	The reasons for document management and version control.										
	The advantages and disadvantages of 100% sampling compared to statistical process control (SPC).										
	The use of six sigma for high volume manufacture.										
	The main principles, purposes, advantages and disadvantages of different approaches to quality improvement.										
11.2: Types and applications of Standard Operating Procedures (SOPs) and their purposes.	C1. Types and applications – Manufacturing, quality, maintenance.										
	C2. Purposes – Standardisation of activity, customer satisfaction, safety, training.										
	The typical format and content of SOPs.										
	How SOPs are used in the different applications.										
	The reasons for using SOPs (consistency, conformance to standards).										
	How SOPs are produced, implemented and evaluated.										

12: Health and Safety Principles and Coverage

LJ CREATE™ Learning for life

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Lessons																																		
		Safety and Protective Measures	Safe Working Practices	Rules and Procedures 1	Personal Protective Equipment 1	Legal Regulations	Legal Regulations for Shipping	Packaging of Goods	Manufacturing Processes and Waste	Workplace Hazards	Accident Prevention in the Warehouse	Hazards During Transport	Loading Goods Overview	Picking Vehicles and Lifting Equipment	Securing Loads	Storage and Warehouse Technology	Stowage Planning for Dangerous Goods	Handling of Hazardous Materials	Material Safety Data Sheets (MSDS)	Management of Hazardous Substances	Designing for Safety	Risk Assessment of Electrical Dangers	Dangers of Electric Current for Humans	Electric Current and Safety	Dealing with a Victim of an Electric Shock	Motor Installations and Safety	Safeguards Against Electric Shock	Circuit Breakers	Interlock Systems	Earthing Systems	TN Earthing Systems	First Aid 1	First Aid 2
12.1: The main requirements of key health and safety legislation applicable to engineering activities.	C1. Legislation – The Health and Safety at Work Act (HASAWA), Management of Health and Safety at Work Regulations, Provision and Use of Work Equipment Regulations (PUWER), Personal Protective Equipment (PPE) Regulations, The Control of Noise at Work Regulations Manual handling operations regulations, Lifting operations and lifting equipment regulations (LOLER), Work at Height Regulations, Electricity at Work Regulations, The Control of Electromagnetic Fields at Work Regulations (CEMFAW), Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR), Control of Substances Hazardous to Health (COSHH)																																			
	The main requirements of the current key legislation, how to access it and how it affects their own activities in the workplace.																																			
	That the legislation should be satisfied by their company's safe systems of work and other procedures, and they therefore do not need to know every detail of the law.																																			
	The purpose of legislation within the engineering industry: · why there is a need for the legislation, · that there is legislation to cover every aspect of the workplace, · how the legislation keeps them safe in the workplace, · who is responsible for compliance with current regulations and legislation, · health and safety culture, training and information																																			
12.2: The importance of health and safety practices within the workplace.	How health and safety legislation affects the frequency of accidents and related incidents.																																			
	The importance of mental health and wellbeing in the workplace.																																			
	The persons responsible for ensuring compliance – employer, employee, Health and Safety Executive (HSE).																																			
	Implications of non-compliance.																																			
12.3: Responsibilities for health and safety.	C1. Responsibilities – Individual, employee and employer obligations, local, national, and global requirements.																																			
	Health and safety responsibilities of employees, including: work safely so as not to cause injury to self and others in the vicinity; not to attempt any work task unless trained and authorised to do so; co-operate with the employer to enable the duties placed on the employer to be performed; have regard of any duty or requirement imposed upon the employer or any other person; under any of the statutory provisions; not interfere with or misuse anything provided in the interests of health, safety or welfare																																			
	Health and safety responsibilities of employers, including: minimising risks in the handling, storage and transport of articles and substances; instruction, training and supervision to maintain high standards of health and safety at work; maintaining the workplace and its environment to be safe and minimising risk to health; to provide a statement of general health and safety policy; provide arrangements for safety representatives and safety committees; ensure the safety of visitors, contractors and members of the public																																			
	Differences between local, national and global requirements.																																			
12.4: Risk assessment.	C1. Stages of risk assessment – Identification of hazards (hazard and operability study (HAZOP), hazard identification (HAZID)), evaluation of risks (likelihood, severity, number of people affected), implementation of control measures (hierarchy of control: elimination, reduction/substitution, isolation, controls, administration/training/safe system of work, PPE).																																			
	The hazards associated with engineering and manufacturing contexts (equipment, stored energy, tools, electricity, harmful substances including gases, environments).																																			
	Common industrial injuries that can occur without appropriate precautions.																																			
	Methods of identifying hazards.																																			
	How to evaluate risks.																																			
	The hierarchy of control for control measures.																																			
	Types of control measures typically used in engineering (guarding, machine isolation, PPE (eye protection, safety shoes, ear protection, gauntlets, helmets).																																			
12.5: Health and safety considerations in specific engineering contexts.	C1. Considerations – Safe systems of work, oxygen use in the workplace, asphyxiation hazards, heat, moving parts, fire and explosion hazards, fire safety, guarding, manual handling, permit to work, lock out tag out (LOTO), maintenance.																																			
	C2. Contexts – Chemicals, equipment with moving parts, confined spaces, electrical testing, high voltage electrical (generation, distribution, isolation and storage).																																			
	The different considerations appropriate to a range of engineering contexts.																																			
12.6: Principles and practices relating to environmental legislation and considerations.	C1. Legislation – Environmental Protection Act, Pollution Prevention and Control Act, Clean Air Act, Radioactive Substances Act, Controlled Waste Regulations, Dangerous Substances, Hazardous Waste Regulations																																			
	C2. Considerations – ISO 14001, waste disposal.																																			
	The main requirements of the current key environmental legislation, how to access it and how it affects their own activities in the workplace.																																			
	That the legislation should be satisfied by their company's environmental policies and other procedures, and they therefore do not need to know every detail of the law.																																			
	The purpose of legislation within the engineering industry: why there is a need for the legislation; who is responsible for compliance with the regulations																																			
	ISO 14001: Aims, benefits and consequences.																																			
	Methods of waste disposal (landfill, reuse, recycling, controlled waste) and their implications.																																			

13: Business, Commercial and Financial Awareness

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Lessons																				
		Corporate Mission and Goals	Marginal Cost Calculations	Process Chains and Networks	Pricing and Types of Markets	Needs, Wants and Demand	Product Range	Product Range Development	Types of Contracts	The Basics of Contract Law	Contracts and UN Law	Breach of Contract	Business Organisational Structure	Business Process Optimisation	Purchase Cost Calculations	Balance Sheet Changes	Balance Sheet Accounting	Profit and Loss Accounts	Profit and Loss Analysis	Accounting - Valuation Principles	Valuation of Balance Sheet Items
13.1: Principles of commercial operations and markets.	C1. Principles – Commercial priorities (profit, addressing stakeholder needs), efficiency, value added, non-value added, competition, supply and demand.	■	■																		
	C2. Markets – Customers, local, national, international.				■	■															
	The goals of commercial operations and how these are addressed.	■																			
	How organisations address the needs of different customers and markets.					■															
	How organisations evaluate activities in terms of quality, cost and time.		■																		
	The role of research and development and innovation to address changing customer needs.						■	■													
13.2: Business and commercial practices	C1. Practices – Legal (tendering, contracts, warranties, force majeure, indemnity clauses, liabilities), management (resource allocation and planning, staffing, training and development), business models (traditional, agile), company management systems, policies and procedures.			■			■		■					■							
	How business practices influence the operation of engineering organisations.			■									■								
	The legislation affecting tendering and contracts.								■	■	■	■									
13.3: Financial and economic concepts.	C1. Concepts – Financial responsibility, recording financial transactions, sources of finance (loans, shares, capital), budgets, transactions, costs (direct, indirect, overheads), payment terms, revenue, creditors and debtors, cash flow, profit and loss, break even, assets (depreciation), liabilities, solvency, taxes, rates.		■												■	■	■	■	■	■	■
	The meaning of the stated financial concepts and their implications for the operation of a business.		■																		

14: Professional Responsibilities, Attitudes, and Behaviours

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:

		Lessons							
		Personal Space	Common Courtesy	Dress Code	Handle Collective Property	Punctuality	Legal Regulation of Employment Contracts	Types of Employment Contract	Employee Representation
14.1: Professional conduct and responsibilities in the workplace.	C1. Conduct and responsibilities – Job descriptions, behaviours required in the workplace, personal conduct (reputation, ethical responsibilities), levels of accountability in organisational structures (apprentice, operator, management, director), equality, diversity, accessibility, inclusion.								
	Purpose, function and typical content of job descriptions.								
	How behaviour and personal conduct in the workplace influence interactions with people.								
	How to seek advice and guidance, where necessary.								
	Expectations for reputation and ethical behaviour in the workplace.								
	The main responsibilities of the different roles in an organisation and how they affect the business in terms of accountabilities and inter-dependencies.								
	The main duties of an organisation regarding equality, diversity, accessibility and inclusion.								
14.2: Continuous professional development (CPD) and professional recognition.	C1. CPD – Training courses, industry placement, academic study, events and seminars.								
	What is CPD and how it motivates staff and improves performance.								
	Professional standards for engineering, as set out by the Engineering Council.								
14.3: Human factors within engineering and manufacturing contexts.	C1. Human factors – Human characteristics (physical, mental), workplace design (considerations, assessment criteria), human error.								
	How human characteristics, capabilities and limitations affect the company and production.								
	How the design of the workplace affects safety, comfort and productivity.								
	Causes of human error (insufficient training, fatigue, workload, stress) and methods to reduce these.								

15: Stock and Asset Management

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:		Lessons											
		Material Procurement	Material Requirements Planning (MRP)	Key Figures of Picking	Organisation of Picking	Stock Control and the Production Process	Storage Indicators	Warehousing	Autocare Stock Management	Inventory Accounting: The Perpetual Method	Storage and Warehouse Technology	Storage Costs
15.1: Stock and inventory management principles and practices.	C1. Principles – Demand, stock turnover, cost of inventory, redundant stock / write down, obsolescence, minimum stock levels, supply chain, packaging/storage.											
	C2. Practices – Just in time, made to stock, made to order, material requirements planning.											
	The purpose of effective stock and inventory management and control.											
	Key issues, risks, advantages and disadvantages associated with the different practices.											
15.2: Asset management and control principles.	C1. Principles – Capacity management (manufacturing resource planning, bottleneck), key stages of asset life cycle management (planning, acquisition, operation and maintenance, disposal), budgetary control practices (life cycle, whole life approach, depreciation).											
	The purpose and methodology of effective asset management.											
	Advantages and disadvantages associated with methods of capacity management.											

16: Continuous Improvement

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:		Lessons			
		Production Planning	Production Process Planning	Production Process Control	Improving Production
16.1: Continuous improvement principles and practices.	C1. Principles – Reflection and evaluation of processes, incremental change and improvement, key performance indicators (KPIs), implementation (plan, do, check, act – PDCA), 8 wastes (transportation, inventory, motion, waiting, excess production, over-processing, defects, unused talent), lean, Kaizen.				
	C2. Practices – Value stream mapping, visual management, 6S (sort, set in order, shine, standardise, sustain, safety), single minute exchange of dies (SMED), operation effective efficiency (OEE), total productive maintenance (TPM), kanban.				
	Methods of gathering feedback and evidence about performance, including types of KPIs and how these can be used to evaluate continuous improvement activities.				
	How the 8 wastes affect the performance of engineering activities.				
	Purpose, methodology, benefits and limitations of the different practices.				

17: Project and Programme Management

KEY:
- Theory Lessons
- Practical Lessons

Unit Learning Objectives:		Lessons						
		Planning and Organising Work Processes	Charting Data	Process Chains and Networks	EPC Diagrams	Product Range Development	Research and Design Approach	The Design Loop
17.1: Principles of project management.	C1. Principles – Project brief, project goals, success criteria, project life cycle (initiation, planning, implementation, monitoring, reporting, evaluation), constraints, risk management (budget, cost, quality, time, safety, resource availability, communication, reputation, changing requirements), collaborative working (matrix working, collaborative technologies).							
	How projects are defined and structured.							
	The management practices, processes and documentation needed at each stage of the project.							
	Types of risk and how these are managed throughout the life of the project, including the role of research and development.							
	The benefits and limitations of collaborative working.							
17.2: Roles and responsibilities in projects.	C1. Roles – Stakeholders (clients, regulators), project manager, team members.							
	C2. Responsibilities – Communication, monitoring, planning, finance, reporting.							
	The responsibilities of the different roles and how they contribute to a project							
17.3: Project planning and control.	C1. Planning – Resource requirements (time, budget, human resources, training needs, communication needs, production facilities), Gantt charts, critical path analysis (CPA), project evaluation review technique (PERT), management of interdependencies, contingency planning.							
	C2. Control – Monitoring reports (budget, quality, cost, time), manage by stages, manage by exception.							
	How to identify the resources required to carry out a project.							
	The benefits and limitation of the different planning methods.							
	How to plan projects using the different methods.							
	How to monitor and evaluate the progress of projects.							
	The reasons for reviewing and evaluating of projects to improve subsequent projects.							