CORE KNOWLEDGE

What I will know and understand by the end of Year 13.

This year in KS5 Unit 1 Engineering we will be learning: **UNIT 1: Engineering Principles**		This links to:	Key vocabulary:
1	Students apply mathematical and physical science principles to solve electrical, electronic and mechanical-based engineering problems. The essential content is set out under content areas. Students must cover all specified content before the assessment.	AO1 Recall basic engineering principles and mathematical methods and formulae AO2 Perform mathematical procedures to solve engineering problems AO3 Demonstrate an understanding of electrical, electronic and mechanical principles to solve engineering problems AO4 Analyse information and systems to solve engineering problems AO5 Integrate and apply electrical, electronic and mechanical principles to develop an engineering solution	Transpose Indices and logarithms Factorisation and quadratics Trigonometric methods Static engineering systems Non-concurrent coplanar forces Young's Modulus Tensile and Shear strength Modulus of rigidity
2	A Algebraic and trigonometric mathematical methods A1 Algebraic methods A2 Trigonometric methods		
3	B Static engineering systems B1 Static engineering systems B2 Loaded components C Dynamic engineering systems C1 Dynamic engineering systems D Fluid engineering systems. D1 Fluid systems		
4	E Static and direct current electricity and circuits: E1 Static and direct current electricity E2 Direct current circuit theory		
5	E3 Direct current networks F Magnetism and electromagnetic induction. F1 Magnetism		
6	G Single-phase alternating current. G1 Single-phase alternating current theory		

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 12.

This year in KS5 Unit 2 Engineering we will be learning: **UNIT 2: DELIVERY OF ENGINEERING PROCESSES SAFELY AS A TEAM**		This links to:	Key vocabulary:
1 2	**Learning aim A:** Examine common engineering processes to create products or deliver services safely and effectively as a team, Evaluate, using high quality written language, the effectiveness of using different engineering processes to manufacture a product or to deliver a service and how human factors, as an individual and as a team, affect the performance of engineering processes.	Linked to assessment criteria: AP1, AP2, AM1, AD1 Links to Unit 5 Health and Safety	Dismantling, Assembly Cooperative, Dissemination, Distribution
3 4	**Learning aim B:** Develop two-dimensional computer aided drawings that can be used in engineering processes, Refine, using layers, an accurate orthographic projection of a component containing at least three different common feature types and a circuit diagram containing at least six different component types to an international standard.	Linked to assessment criteria: BP3, BP4, BM2, BD2 Links to Unit 10 CAD element	CAD/CAM - Computer Aided Design/Manufacture
5 6	**Learning aim C:** Carry out engineering processes safely to manufacture a product or to deliver a service effectively as a team, Consistently manage own contributions effectively using feedback from peers, as a team member and as a team leader, to set up, organise and manufacture a product or deliver a service safely, demonstrating forward thinking, adaptability or initiative.	Linked to assessment criteria: CP5, CP6, CP7, CP8, CM3, CD3 Links to Unit 3 and Unit 5	Disassembly, Processes, Sequential, Adaptability, Innovative, Manufacture

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 12 and 13.

This year in KS5 Unit 3 Engineering we will be learning: **UNIT 3 : Engineering Product Design and Manufacture**		This links to:	Key vocabulary:
1	Learning aim A: Demonstrate knowledge and understanding of engineering products and design. Apply knowledge and understanding of engineering methodologies, processes, features and procedures to iterative design.	PPE 1 will be an exam based around Unit 3 Preparation for Exam series 1 November in Year 12. PPE 2 in March of Year 12 will follow the results from series 1 exam	Specification , Iteration, Design Brief, Profitability, Technology Pull, Market Push, demand, Innovation, Market research, Mechanical power transmission,
2	Analyse data and information and make connections between engineering concepts, processes,features, procedures, materials , standards and regulatory requirements Design triggers, Design Challenges, Equipment level and system level constraints and opportunities.Material properties, Mechanical power transmission, Manufacturing processes		
3	Learning aim B: Evaluate engineering product design ideas, manufacturing processes and other design choices. Design for a customer, Regulatory constraints and opportunities,	Revision and practice for series 2 Summer in Year 13	Profit Margin, Continuous improvement, Design Triggers , Design Challenges, Energy recovery features, Sustainability issues
4	Market analysis, Performance analysis, Manufacturing analysis		
5	Learning aim C: Be able to develop and communicate reasoned design solutions with appropriate justifications. Design proposals, Communicating designs, iterative development process.	External Exam - 3 hours preparation time and research. 8 hour formal Design based exam “Exams one in Year 12 , second opportunity in Year 13	Credibility of Research Sources, Analysis of the Problem, Market Forces, Designing out risk Mechanical properties Additive manufacturing
6	Learning aim D: Statistical methods, Validating designs		

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 12.

This year in KS5 Unit 4 Engineering we will be learning: **UNIT 4: APPLIED COMMERCIAL AND QUALITY PRINCIPLES IN ENGINEERING**		This links to:	Key vocabulary:
1 2	**Learning aim A:** Examine business functions and trade considerations that help engineering organisations thrive. Evaluate, using language that is technically correct and of a high standard, how key business activities and trade considerations combine to influence an engineering organisation, which can create a competitive advantage.	Linked to assessment criteria: AP1, AP2, AM1, AD1 Links to Unit 3 and Unit 5	Competitive advantage, Tendering and contracting, warranties, indemnities,
3 4	**Learning aim B:** Explore activity-based costing as a method to control costs and to determine if an engineering product or service is profitable. Produce an accurate and refined activity-based costing model, during the process, for a product or service to determine the major cost areas that could impact on profitability, explaining the reasons for cost controls.	Linked to assessment criteria: BP3, BP4, BM2, BD2 Links to Unit 3 and Unit 5	direct costs, indirect costs, administration, procurement, profitability.
5 6	**Learning aim C:** Explore how engineering organisations use quality systems and value management to create value. Evaluate the outcome of a value management exercise for a given engineering activity and make recommendations which include the use of quality systems to implement efficiencies in the engineering activity.	Linked to assessment criteria: CP5, CP6, CM3, CM4, CD3 Links to Unit 3 and Unit 5	Quality standards, Quality assurance, accreditation, life-cycle assessments,

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 12.

This year in KS5 Unit 5 Engineering we will be learning: **UNIT 5: A SPECIALIST ENGINEERING PROJECT**		This links to:	Key vocabulary:
1 2	**Learning aim A:** Investigate an engineering project in a relevant specialist area. Evaluate, using language that is technically correct and of a high standard, at least three realistic solutions to an engineering problem on a given theme and justify a preferred solution.	Linked to assessment criteria: AP1, AP2, AM1, AD1 Links to Unit 3 & Unit 4	Dismantling, Assembly Cooperative, Dissemination, Distribution
3 4	**Learning aim B:** Develop project-management processes and a design solution for the specialist engineering project as undertaken in industry. Optimise the project-management processes and design solution while allowing for reasonable contingency and considering constraints.	Linked to assessment criteria: BP3, BP4,BP5, BM2, BM3, BD2 Links to Unit 10 CAD element	CAD/CAM - Computer Aided Design/Manufacture
5 6	**Learning aim C:** Undertake the solution for a specialist engineering project and present the solution as undertaken in industry. Optimise the project-management processes to develop a solution that is fit for audience and purpose while anticipating and resolving risks and issues, demonstrating behaviours to a professional standard.	Linked to assessment criteria: CP6, CP7, CP8, CM4, CD3 Links to Unit 3 and Unit 4	Disassembly, Processes, Sequential, Adaptability, Innovative, Manufacture

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 13.

This year in KS5 Unit 7 Engineering we will be learning: **UNIT 7: CALCULUS TO SOLVE ENGINEERING PROBLEMS**		This links to:	Key vocabulary:
1 2	**Learning aim A:** Examine how differential calculus can be used to solve engineering problems. Evaluate, using technically correct language and a logical structure, the correct graphical and analytical differential calculus solutions for each type of given routine and non-routine function, explaining how the variables could be optimised in at least two functions.	Linked to assessment criteria: AP1, AP2, AP3, AM1, AD1 Links to Unit 1 & Unit 27	Differentiate Stationary point Product rule Quotient rule
3 4	**Learning aim B:** Examine how integral calculus can be used to solve engineering problems. Evaluate, using technically correct language and a logical structure, the correct integral calculus and numerical integration solutions for each type of given routine and non-routine functions, including at least two set in an engineering context.	Linked to assessment criteria: BP4, BP5, BP6 BM2, BD2 Links to Unit 1 & Unit 27	Integration Velocity Acceleration
5 6	**Learning aim C:** Investigate the application of calculus to solve a defined specialist engineering problem. Critically analyse, using technically correct language and a logical structure, a complex engineering problem, synthesising and applying calculus and a mathematical model to generate an accurate solution.	Linked to assessment criteria: CP7, CP8, CM3, CM4, CD3 Links to Unit 1 & Unit 27	Exponential Asymptote

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 12.

This year in KS5 Unit 9 Engineering we will be learning: **UNIT 9: Work Placement in an Engineering Context**		This links to:	Key Vocabulary
1 2	**Learning aim A:** Examine the benefits of work experience in engineering for own learning and development Create a Personal skills profile / audit focus on Personal and Professional skills **Learning aim B:** Develop a work experience plan to support own learning and development Use a flow diagram to plan your work placement experience	Linked to assessment criteria: 9/AB.D1 9/A.M1 9/B. M2 9/A.P1 9/A.P2 9/B.P3 9/B.P4 19/ B.P4 19/ B.P5	Curriculum Vitae, Skills Audit, Flow Diagram, Analysis of need, Implementation, Impact , Expectations, Limitations,
3 4	**Learning aim C:** Carry out work experience tasks to meet set objectives Develop a 3 part logbook - Before /During / After , to Identify, Implement and measure Impact **Learning aim D:** Reflect on how work experience influences own personal and professional development Analyse, reflect and evaluate the process and your development against your set objectives	Linked to assessment criteria: (9/C P5, 9/C P6, 9/C M3, 9/C D2) (9/D P7, 9/D P8, 9/D M4, 9/D D3)	Engineering sector, skills audit, Professional development , Personal Development , Time management, Personal Organisation

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 13.

This year in KS5 Unit 10 Engineering we will be learning: **UNIT 10: COMPUTER AIDED DESIGN IN ENGINEERING**		This links to:	Key vocabulary:
1 2	Learning aim A: Develop a three-dimensional computer aided model of an engineered product that can be used as part of other engineering processes, Refine models and drawings to an international standard of an accurate and correctly orientated 3D assembled product that is fit for purpose, applying appropriate materials to all components and create a drawing template.	Linked to assessment criteria: AP1, AP2, AM1, AD1 Links to Unit 5, Unit 2 & Unit 3 CAD Element Assignment 2	Dismantling, Assembly Cooperative, Dissemination, Distribution
3 4	Learning aim B: Develop two-dimensional detailed computer-aided drawings of an engineered product that can be used as part of other engineering processes, Refine, using accurate layers from a master layer, drawings to an international standard of an accurate and correctly orientated 2D assembled product that is fit for purpose.	Linked to assessment criteria: BP3, BP4, BM2, BD2 Links to Unit 2, Unit 3 CAD element Assignment 2	CAD/CAM - Computer Aided Design/Manufacture
5 6	Learning aim C: Develop a three-dimensional computer aided model for a thin walled product and a fabricated product that can be used as part of other engineering processes, Refine drawings to an international standard of two accurate and correctly orientated 3D models with realistic rendering that are both fit for purpose.	Linked to assessment criteria: CP5, CP6, CM3, CM4, CD3 Links to Unit 5, Unit 2 & Unit 3 CAD Element Assignment 2	Disassembly, Processes, Sequential, Adaptability, Innovative, Manufacture

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 13.

This year in KS5 Unit 10 Engineering we will be learning: **UNIT 19: Electronic Devices and Circuits**		This links to:	Key vocabulary:
1	**Learning aim A:** Explore the safe operation and applications of analogue devices and circuits that form the building blocks of commercial circuits. Simulate using captured schematics, the correct operation of at least one: Diode, Transistor, Operational Amplifier circuit Build at least one circuit safely and test the characteristics of each circuit for Diode, Transistor, Operational Amplifier	Linked to assessment criteria: AP1, AP2, AP3 AM1, AM2, AM3. AD1	Schematic diagram, Operational amplifier, Diiode, Transistor, semiconductors, rectification analogue devices CAD / CAM - Computer Aided Design/Manufacture, logic devices, integrated circuits Health and safety, simulations and testing
2 / 3	**Learning aim B:** Explore the safe operation and applications of digital logic devices and circuits that form the building blocks of commercial circuits As learning Aim A focusing on the use of Logic devices and circuits that form the building blocks of commercial circuits **Learning aim C:** Review the development of analogue and digital electronic circuits and reflect upon your own performance	Linked to assessment criteria: BP4, BP5, BP6. BM4, BM5. BM6, BD2 Linked to assessment criteria:CP7, CP8. CM7 CD3.	

Target Grade		AP1		AP2		AP3	

CORE KNOWLEDGE

What I will know and understand by the end of Year 12.

This year in KS5 Unit 27 Engineering we will be learning: **UNIT 27: STATIC MECHANICAL PRINCIPLES IN PRACTICE**		This links to:	Key vocabulary:
1 2	**Learning aim A:** Examine how the forces acting in pin jointed framed structures influence their structural integrity. Demonstrate accurately the most appropriate method for finding the forces in the central members of a pin-jointed framed structure, justifying the rationale.	Linked to assessment criteria: AP1, AP2, AM1, AD1 Links to Unit 1 & Unit 7	Bows Notation, Method of Joint, Method of Section, Free Body Diagram, Forces, Members, Sum of Moments
3 4	**Learning aim B:** Explore safely the shear forces and bending moments in simply supported and cantilever beams. Evaluate the simple and complex loads acting on simply supported and cantilever beams, comparing the results from safely conducted experiments and theoretical calculations, and suggest improvements to the experimental method used.	Linked to assessment criteria: BP3, BP4, BM2 BM3, BD2 Links to Unit 1 & Unit 7	Bending moments, Equilibrium, Shear force diagram, Cantilever, Beams, Uniform Distributed Loads, Static Loads
5 6	**Learning aim C:** Examine how axial, bending and shear loading affect the design of structural components. Optimise the physical parameters of a structure ensuring that it is fit for purpose when subjected to axial, bending and shear loading.	Linked to assessment criteria: CP5, CP6,CP6, CP7, CM4, CM5, CD3 Links to Unit 1 & Unit 7	Stresses, Compressive, Tensile, Shear, Thermal expansion, Young's modulus,

Target Grade		AP1		AP2		AP3	