ASHLAWN SCHOOL

Key Stage 5 Curriculum Journey: Year 13 Engineering

The curriculum in Engineering equips learners with the knowledge to understand the processes of engineering including design, analysis, prototype development and evaluation, and the role that engineering plays in the world. The subject is designed to inspire students to be innovate, creative and apply their knowledge in a way which is transferable to, and draws on different real-life contexts such as design, mechanical and quality control engineering. Students are encouraged to move from theory to practice and to bring their ideas into reality by developing solutions to technical issues

THE YEAR 13 CURRICULUM JOURNEY

	HALF TERM 1	HALF TERM 2	HALF TERM 3	HALF TERM 4	HALF TERM 5	HALF TERM 6
Topic and learning focus	Mechanical Engineering ● LO2 – the fundamental geometrical properties ● LO3 – levers, pulleys and gears ● LO4 – properties of beams Electrical Engineering ● LO3 – Power supplies and power transmission ● LO4 – DC Motors and Generators ● LO5 – Analogue circuits – the operational amplifier CAD ● Create assemblies of shapes where different bodies interact with each other. ● Learn how to incorporate animations and moving parts in CAD work.		External examinations in Mechanical and Electrical Engineering. CAD ● Using Fusion 360 to design and run physical simulations.			
Foundational Knowledge Prior learning needed	● Kirchoff's Laws and how they are applied to a variety of circuits. ● Concepts of emf and pd, current and resistance ● An understanding of Alternating current ● Fuses, resistors and diodes ● A good understanding of algebra, standard form and SI units and trigonometry (including graphs of trigonometry functions).		● Scales and methods of production – mass/batch/one-off/just in time, die casting, sand casting etc. ● Stages of design cycle. ● Sustainability and recycling ● Statistics and statistical analysis (from Unit 1) ● Manipulating shapes in Fusion 360.			

	• Calculations of areas and volumes of simple 2d and 3d shapes • Principle of moments • Construction and manipulation of 3d shapes in Fusion 360.		
Core Knowledge and skills	• The components and sequence of a stabilised power supply. • Recall the 3 main methods for AC-DC rectification. • Justify the need for 3 phase power and the relationships between the different phases. • The general circuit layout of separately excited and self excited DC motors and generators. • Analyse motors and generators using the defining equations. • Understand the structure of a DC power supply. • Describe the operation and properties of inverting and non-inverting op-amps. • Calculate the gain of the inverting and non-inverting op-amp. • Calculate the volumes of prisms • Use the density equation to calculate density, mass and volume of bodies. • Calculate the centre of mass of 2d objects and understand the concept of centroid. • Mechanical advantage and velocity ratio • The three classes of lever and how these can be used to solve engineering problems. • Applications of moments to beams. • Types of beam and support conditions • Apply animations to Fusion 360 designs to show how moving parts might behave in a working physical product. •	• Produce simple physical simulations using Fusion 360.	
Developmental Knowledge and Skills	• Describe how the 3 methods for rectification work and compare how they might be used in different situations.	• Produce accurate and detailed physical simulations from CAD models showing points of high stress and highlighting the function of the product.	

	● Calculate phase and line voltage, describing the difference between them and explaining how the star and delta wiring configurations might be used. ● Describe the advantages and disadvantages of shunt wound and series wound motors and use these to justify the choice of motor type for different practical scenarios. ● Explain the operation of the summing amplifier, calculating the gain and suggesting uses. ● Perform calculations analysing the effects of different sizes of gear and gear ratios. ● Calculate the reactions of beams with simple supports or cantilevers. ● Compare the strengths and weaknesses of designs using animations to provide a more realistic view of the product. ●		
Complex Knowledge	● Represent 3 phase power graphically and using trigonometric equations. ● Evaluate the implications of back emf for both motors and generators. ● Evaluate and calculate the effect of flux and other factors on motor speed. ● Calculate the mechanical advantage and velocity ratio for belt-driven systems ● Analyse beam systems by drawing bending moment diagrams. ● Use calculated quantities such as conductivity or Young Modulus to justify material choice.		
Links with the National Curriculum			
Literacy (including reading)	● Reading and notetaking homework regularly set. For example reading from "Structures – or why things don't fall down" ● Reading Fusion 360 tutorial work. ● Use of engineering case studies and latest news articles for homework and class based tasks. Use of research studies on new, emerging materials and their properties.		
Cultural Capital	● Understanding of the use and application of maths to solve real-world problems. ● Mathematical based problem solving skills.		

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	● An appreciation of the complexity of everyday systems. ● An understanding of the widespread use of electricity, how it is generated and subsequently transmitted to our homes. ● How structures work and what is required for buildings to be safely constructed. ● Use of computer software to develop and present ideas.		
Social, Moral, Spiritual and Cultural Development **Fundamental British Values**	● Discussion and teamwork with opportunity for lots of collaborative working. ● Environmental impact of our manufacturing and design choices. The importance of careful use and selection of materials for minimal cost and environmental impact. The need to balance environmental impact against cost and economic factors. ● An appreciation of the legal framework in which designers and companies are required to operate in including safe working and the development and testing of safe products. ● Analysis of products, identifying strengths and weaknesses to ensure that the correct products are chosen for the appropriate tasks. ● Mutual respect is fostered through collaborative working and sharing of ideas.		
Assessment	● For units 3 and 4: 1. 2 x 40 mark assessments per unit 2. 2 x 60 mark past papers per unit ● For Mechanical Design: 1. Assessment of LO1 and LO2	● 60 mark exam paper in Units 3 and 4 ● Externally assessed 60 mark exam paper for units 3 and 4 ● Assessments of LO3 and LO4 for Mechanical Design.	● Resits (if required) for Units 1,2,3 and 4 ● Improvements to Units 9 and 10.