Engineering Curriculum Overview Table Y10 & 11

End Point	Key knowledge	Key skills	Key Vocabulary	Reading and Oracy	Numeracy	Common misconceptions
Term 1 **Introduction to Engineering** **Types and manipulation of different materials** **Engineering Materials** ● **Material properties** ● **Material costs and supply** ● **Factors of materials that influence design**	**Meaning of different material properties.** **Different metals, their properties and how they can be changed.** **Differences between thermosetting and thermoplastic polymers.** **Composite materials and their makeup.** **Understanding of structural timber and ceramics.**	**Select the appropriate material for an application and justify its use.** **Describe the factors that contribute to material selection.** **Calculate the cost of materials for an application.** **Evaluate the effectiveness of a material for an application**	**Yield strength** **Tensile strength** **Ductility** **Hardness** **Malleability** **Toughness** **Brittleness** **Stiffness** **Ferrous** **Non-Ferrous** **Thermosetting** **Thermoplastic**	**Describe the material properties in an application.** **Reading of material manufacturing specifications.**	**Calculations for stress and strain.**	**Ductility vs. Malleability** **Understanding cost implications.**
Term 2 **Engineering drawing and manufacturing techniques.** **Interpreting Technical Drawings and Specifications:** **How to read, understand and create engineering drawings and specifications relevant to engineering design.** **Types of manufacturing process:** **Engineering Manufacturing** ● **Additive Manufacture** ● **Material Removal** ● **Shaping, forming and manipulation** ● **Casting and Moulding** ● **Joining and assembly** ● **Heat and chemical treatment** ● **Surface finishing**	**Additive Manufacturing:** Fused deposition, Sintering (for metals), Rapid prototyping (for polymers). **Material Removal:** Cutting: sawing, shearing, laser, Turning: cylindrical, tapered, boring, Milling: face, slot Drilling: using a pillar drill, center drilling in the lathe. **Shaping**: Forming and manipulation: bending, folding, press forming, composite layup, punching, stamping.	**Know how to demonstrate through explanation and diagrams different engineering drawing , 3D modeling and manufacturing processes.**	**CAD (Computer-Aided Design): Software used to create precise drawings or technical illustrations.** **CAM (Computer-Aided Manufacturing): The use of software and computer-controlled machinery to automate a manufacturing process.** **CNC (Computer Numerical Control): A system that uses computers to control machining tools (like lathes, mills, routers).** **Tolerance: The permissible limit of variation in a physical dimension**	**Describe different engineering manufacturing terms and be able to explain the processes.** **Group Interaction: Collaborating and communicating effectively in group settings.** **Listening and Responding: Actively listening and responding appropriately.**	**Calculate waste where appropriate to the process in question.** **Machining and Material Removal Calculations: Understanding the rates of material removal in processes like drilling, milling, and turning.**	

	Casting and Moulding: Pressure die casting, Sand casting, Injection moulding. **Joining and Assembly:** Permanent and temporary methods: rivets, threaded fastenings, soldering (soft and hard), brazing, welding. **Heat and Chemical Treatment:** Normalising, Annealing, Hardening, Quenching. **Surface Finishing:** Painting, Dip coating, Electroplating, Galvanising, Polishing.		**or measurement.** **Prototype: An early sample or model built to test a concept or process.** **Lean Manufacturing: A production method aimed at reducing waste without sacrificing productivity.** **JIT (Just-In-Time) Production: A strategy that aligns raw-material orders from suppliers directly with production schedules.** **Quality Control: A process by which entities review the quality of all factors involved in production.** **Ergonomics: The study of people's efficiency in their working environment.** **Automation: The technology by which a process or procedure is performed with minimal human assistance.** **Batch Production: Manufacturing process where the components or goods are produced**			

			in groups and not in a continuous stream. **Mass Production: The manufacture of large quantities of standardised products, often using assembly lines or automation technology.** **Customisation: Tailoring a product or service to the specific requirements of individual customers.** **Sustainability: Creating and maintaining conditions under which humans and nature can exist in productive harmony.** **Life Cycle Analysis: The assessment of the environmental impact of a product throughout its lifecycle.** **Rapid Prototyping: Techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer-aided design data.** **Material Properties: Characteristics such as strength,**			

			flexibility, conductivity, etc., that define how materials respond to environmental and mechanical forces. Health and Safety Regulations: Standards and procedures intended to prevent accident or injury in workplaces or public environments. Supply Chain Management: Handling the entire production flow of a good or service — starting from the raw components all the way to delivering the final product to the consumer.			
Term 3 Electronic Systems • Describing systems • Electronic systems • Components and circuit diagrams Using Electronic CAD software to simulate circuits Electrical/Electronic Systems: Basic skills in working with electrical and electronic components, including circuit design and assembly. How to build and test circuits	How block diagrams are used to represent systems. How schematics are used to communicate circuit designs. The main symbols used to construct flowcharts. Electrics- AC vs DC, battery vs mains. The function of resistors, capacitors and diodes. How PIC microcontrollers are used. Analogue and digital signals.	Designing and building electrical systems. How and when to use various control devices and electronic input and output devices. Using sensors. Circuit Design - The design of electrical circuits for specific functions and applications. Soldering - The process of joining two or more metal items by melting and flowing a filler metal into the joint. Health and Safety - Regulations and procedures intended to	Systems Schematic Current Voltage Resistance Relay Solenoid Diode Transistor Microcontroller Capacitor	Reading Skills Comprehension: Understanding the gist and details of texts. Analysis: Interpreting themes, ideas, and arguments in texts. Language Use: Using subject-specific language accurately in speech. Expressing Opinions:	Calculating resistance, voltage and current. Calculating gear ratios. Logic gates Forces	

Microcontrollers, **Components, sensors, inputs and outputs.** **Programing microcontrollers with flow diagrams** **Programming microcontrollers using code.**		**prevent accident or injury in workplaces or public environments.**		**Articulating personal viewpoints with supporting arguments.** **Critical Listening: Evaluating the arguments and speeches of others.**		
Term 4 **Materials testing and Investigation** • **Modelling and calculations** • **Testing**	**Material Testing Methods: Knowledge of various methods for testing materials, such as tensile testing, hardness testing (like the Brinell and Vickers hardness tests), impact testing, fatigue testing, and corrosion testing.** **Data Collection and Analysis: Skills in collecting, analysing, and interpreting data from tests. This includes understanding how to use various measuring tools and equipment, and how to present data in forms such as tables, graphs, and charts.** **Quality Control: Understanding the importance of quality control in engineering, including methods for ensuring products meet required specifications and standards. This might include statistical process control and inspection techniques.** **Failure Analysis: Knowledge of how and why materials**	**Understanding Testing Procedures: Knowledge of standard engineering tests and their applications.** **Data Collection and Analysis: Skills in collecting accurate data during testing and effectively analysing it to draw conclusions.** **Use of Measuring Instruments: Proficiency in using various measuring tools such as callipers, micrometers, and gauges for precise measurements.** **Material Testing: Understanding of different methods for testing materials for properties like strength, durability, and flexibility.** **Product Testing and Evaluation: Ability to test products for functionality, safety, and quality, and to evaluate their performance against specified criteria.** **Problem-Solving and Critical Thinking: Skills in**	**Tensile Strength: The maximum stress that a material can withstand while being stretched or pulled before necking.** **Compressive Strength: The capacity of a material or structure to withstand loads that tend to reduce size.** **Fatigue Testing: Testing that evaluates the durability of a material under repeated or fluctuating stress.** **Hardness Testing: Measures the resistance of a material to deformation, particularly permanent deformation, indentation, or scratching.**	**interpretation of Data:** **Understanding and interpreting data and graphs.**	**Graph Interpretation: Ability to read and interpret graphs, which is essential for understanding relationships between variables in engineering contexts.** **Statistics and Data Analysis: Collecting and analysing data to make informed decisions, understanding statistical concepts like mean, median, mode, and range** **.**	

	fail, including fatigue, fracture, and wear. Understanding the signs of material failure and the methods used to analyse failure, such as fracture surface analysis. **Product Testing: Understanding the processes and importance of testing finished products to ensure they meet design specifications and are safe for use. This includes functional testing, life-cycle testing, and environmental testing.** **Investigative Techniques: Skills in conducting investigations to solve engineering problems, including hypothesis formulation, experiment design, and problem-solving methodologies.**	**identifying problems during testing and coming up with effective solutions.** **Safety and Risk Assessment: Knowledge of safety procedures and risk assessment methods in the context of engineering testing.** **Documentation and Reporting: Ability to document testing processes and results, and to prepare detailed reports.**	**Impact Testing: Determines the amount of energy absorbed by a material during fracture.** **Elasticity: The ability of a material to return to its original shape after being stretched or compressed.** **Plasticity: The quality of being easily shaped or moulded, and the degree to which a material can undergo plastic deformation.** **Ductility: A measure of a material's ability to undergo significant plastic deformation before rupture.** **Malleability: The ability of a material to be deformed or compressed without cracking.** **Brittleness: A material's tendency to fracture without significant deformation.** **Stress-Strain Curve: A graph showing the relationship between the stress applied to a material and the strain produced.**			

			Non-Destructive Testing (NDT): Testing methods used to inspect and evaluate materials, components, or assemblies without causing damage. **Wear Testing: Evaluating the wear resistance or durability of a material under controlled conditions.** **Material Properties: Inherent attributes and features of a material that determine its behavior under specific conditions and uses**			
Term 5 **Practical Engineering skills** **Manufacturing a wood burner to specifications using a range of technical drawings and sheet metal techniques:** ● **Problem solving** ● **Engineering drawing and schematics** ● **CAD, CAM, CNC** ● **Testing materials** ● **Production plans** ● **Predicting performance, calculations and modelling**	**Engineering Drawings: Produce and / or work with engineering drawings or schematics in formats like orthographic (3rd angle), 3D representation (Isometric), assembly, and section view.** **Selection and Use of Tools and Equipment: Choose and safely use various materials, parts, components, tools, and equipment.** **Manufacturing Processes: Select and use appropriate manufacturing processes like measuring, marking,**	**Material Selection and Preparation: Understanding different types of materials used in engineering and how to select and prepare them for specific tasks.** **Marking Out: Learning how to accurately mark out materials for cutting, shaping, and joining, which is a fundamental skill in engineering.** **Cutting and Shaping: Techniques for cutting and shaping materials using various tools and machinery, ensuring**	**CAD (Computer-Aided Design) - Software used for creating precise drawings and technical illustrations.** **CAM (Computer-Aided Manufacturing) - The use of software and computer-controlled machinery in manufacturing processes.** **Tolerances - The allowable limit of variation in a physical dimension or measurement.**	**Vocabulary Development: Expanding knowledge of subject-specific terminology.** **Summarization: Condensing the main points of a text into a concise summary.** **ISpeaking Skills Articulation: Speaking clearly and confidently.** **Presentation Skills: Effectively presenting**	**Measurement and Precision: Understanding and using different units of measurement, accurately measuring lengths, areas, volumes, and angles.** **Geometry and Shapes: Knowledge of geometric principles to understand shapes and their properties, necessary for**	

• Selecting materials, parts, tools and components • Selecting appropriate processes • Quality control methods • Design tests for evaluation	turning, milling, drilling, forming, bending, casting, joining, fastening, folding, shaping, and finishing. Quality Control: Apply quality control methods and techniques during manufacturing, working to necessary tolerances and using tools like Vernier callipers, micrometers, and depth gauges. These skills are integral to the practical engineering aspects of this course	precision and accuracy. Joining and Assembly: Skills in joining materials using techniques like welding, soldering, and mechanical fastenings, as well as understanding assembly processes. Finishing Techniques: Applying finishing techniques such as sanding, painting, and polishing to enhance the appearance and durability of engineering products. Quality Control: Learning about quality control methods to ensure that engineering products meet required standards and specifications. Health and Safety: Knowledge of health and safety practices in the engineering workshop, including the use of personal protective equipment and safe operation of tools and machinery. Technical Drawing and CAD: Developing skills in technical drawing and using Computer-Aided Design (CAD) software to create engineering designs. Problem Solving: Applying problem-solving skills to overcome challenges encountered during the engineering process.	Manufacturing Processes - Techniques and methods used in the transformation of raw materials into finished products. Quality Control - The process of ensuring products meet required specifications and customer expectations. Prototyping - The process of creating an experimental model of a design to test its functionality. Assembly - The process of putting together various components to create a final product. Welding - A process of joining materials, usually metals or thermoplastics, by causing coalescence. Machining - The process of shaping a piece of material (such as metal) by removing excess material. Finishing Processes - Techniques applied to the surface of a product to improve	information or arguments. Discussion and Debate: Engaging in thoughtful discussions and debates on various topics. Persuasion: Convincing others of a point of view or argument.	designing and constructing engineering components. Scaling and Ratios: Ability to scale drawings up or down, understanding and applying ratios in the context of engineering designs. Basic Algebra: Using algebra to solve problems related to engineering concepts such as force, pressure, or electrical calculations. . Budgeting and Cost Calculation: Estimating costs of materials and labor, understanding the importance of budgeting in engineering projects. Time Management and Scheduling: Calculating time requirements for various stages of a project, understanding timelines, and scheduling. Material Properties and Calculations:	

		Project Management: Basics of project management, including planning, organising, and managing resources to complete engineering projects. **Testing and Evaluation: Techniques for testing and evaluating engineering products to assess their functionality and performance.**	**appearance, adhesion, or durability.** **Technical Drawing - The act and discipline of composing diagrams that visually communicate how something functions or is constructed.** **Material Properties - Characteristics of materials, like strength, ductility, hardness, etc., that affect their behaviour in various conditions.** **Tool Use and**		**Understanding properties of different materials and calculating quantities needed for projects.** **Force and Pressure Calculations: Applying principles of physics to calculate forces, pressures, and stresses in materials.** **Electrical Calculations: Basic understanding of electrical principles, calculating current, voltage, resistance, and power in circuits.** **Thermodynamics and Heat Transfer: Basic calculations involving heat transfer, temperature changes, and thermal properties of materials.**	
Term 6 **Using Soldering and CAD to design and prototype a Torch design to a design brief.** **(OCR NEA Sample material)** **Modern technologies** • **The impact of**	**Advanced Materials: Understanding new materials like smart materials, nanomaterials, and composites, and their impact on engineering solutions.** **Automation and Robotics: The use of automation in manufacturing processes**	**Understanding of Emerging Technologies: Familiarity with the latest advancements in engineering technology, such as 3D printing, robotics, artificial intelligence, and sustainable energy sources.**	**The Use of New and Emerging Technologies: Students should understand the effects of these technologies on various aspects including:**	**Critical Thinking: Evaluating arguments and forming opinions about texts.** **Inference: Drawing conclusions from evidence in the**		

modern technology • CAD / CAM • Rapid prototyping • Prototyping methods	and the role of robotics in modern engineering, including programming and control systems. CAD and CAM: The importance of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) in modern engineering processes, including their advantages and limitations. 3D Printing and Additive Manufacturing: The principles of 3D printing and additive manufacturing techniques, and how they have revolutionised prototyping and manufacturing. Internet of Things (IoT): Understanding the concept of IoT and its applications in engineering, including smart devices and systems integration. Artificial Intelligence (AI) and Machine Learning: The basics of AI and machine learning and their applications in solving complex engineering problems and automation. Sustainable Engineering Practices: The impact of modern technologies on sustainable engineering, including renewable energy technologies and sustainable materials. Digital Communications and Networking: The role of digital communication	Computer-Aided Design (CAD): Skills in using CAD software to create detailed engineering drawings and models, which is crucial for modern engineering practices. Materials Technology: Knowledge of new and advanced materials, their properties, and applications in various engineering contexts. Systems and Control: Understanding of electronic systems, control systems, and how they are integrated into modern engineering solutions. Sustainability and Environmental Considerations: Awareness of environmental impacts and the importance of sustainable practices in engineering design and production. Problem-Solving with Technology: Ability to use technology effectively to solve engineering problems, including the use of simulation software and other digital tools. Manufacturing Processes and Techniques: Knowledge of modern manufacturing processes, including CNC machining, laser cutting, and other automated production techniques.	Production Society The environment. The Impact of Engineering Industries: This involves understanding the positive and negative impacts of engineering industries on the social and economic infrastructure.	text. Comparative Skills: Comparing themes, ideas, and styles across different texts		

	technologies in engineering, including wireless communication and networked systems. **Virtual and Augmented Reality (VR/AR): The use of VR and AR in engineering for design, simulation, and training purposes.** **Sensor Technology and Data Analytics: Understanding the role of sensors in collecting data and the use of data analytics in engineering decision-making.**	**Prototyping and Testing: Skills in developing prototypes using modern technologies and testing them to evaluate performance, safety, and functionality.** **Data Analysis and Interpretation: Ability to analyse and interpret data from various sources, including sensors and digital systems, to make informed engineering decisions.** **Project Management: Understanding of project management principles and their application in engineering projects, including planning, resource management, and teamwork.**				
NEA Y10 – END of Year **July 2024** **Week 1: Introduction to NEA - Discuss the assessment criteria and expectations.** **Week 2-3: Topic Selection - Students select their project topics and submit proposals for approval.** **Y11** **NEA 1 begins** **Week 1: Research and Planning - Begin initial research on chosen topics.** **Week 2: Finalise Research - Complete all necessary**	**Engineering Materials:** **Understanding of materials and their properties like toughness, ductility, malleability, hardness, strength, and stiffness.** **Knowledge of metals and alloys (ferrous and non-ferrous), polymers (thermoplastics and thermosetting), composites, and other materials like timber and ceramics.** **Awareness of material costs, supply, and factors like machining, treating, shaping, and recycling of these materials.** **Factors influencing design solutions, including various energy production methods**	**All of the above may be utilised.**	**All of the above may be utilised.**	**Contextual Understanding: Relating texts to their historical, social, or cultural contexts.** **Vocabulary Development: Expanding knowledge of subject-specific terminology.** **Summarization: Condensing the main points of a text into a concise summary.** **Interpretation of Data: Understanding and interpreting data and graphs.**	**All of the above may be utilised.**	

background research. **Week 3 + 4: Design Phase Begins - Start developing initial designs sketching and drawing** **Week 4 -5: 3D CAD models** **November 2024** **Week 6: CAD drawings, exploded, Orthographic parts and assembly drawings.** **Compile and sort out the Digital evidence folder and submit for marking.** **NEA 1 ENDS** **NEA 2 – Prototyping** **Week 1 + 2: Research and investigation, design brief / specification.** **Week 3 + 4 :** **Disassembly of a product, observation and evidence generation, write up.** **Week 5 + 6:** **Production planning prototype making based on technical drawings given by OCR** **January 2024** **Week 1-6: Build and test prototypes while gathering digital evidence and writing up the process.** **Easter Term: Review and Submission of NEA - Final submission of all NEA**	**and engineered lifespans.** **Engineering Manufacturing Processes:** **Knowledge of appropriate manufacturing processes for specific materials, including additive manufacturing, material removal, shaping, casting and moulding, joining and assembly, heat and chemical treatment, and surface finishing.** **Systems:** **Understanding of mechanical, electrical, electronic, structural, and pneumatic systems, including their components and functions.** **Testing and Investigation:** **Knowledge of modelling, calculating, testing methods, and aerodynamics to predict performance and evaluate materials and structures.** **The Impact of Modern Technologies:** **Understanding the impact of new and emerging technologies on production, society, and the environment, as well as the impact of engineering industries on social and economic infrastructure.** **Practical Engineering Skills:** **Skills in problem-solving, analysing, evaluating, using engineering drawings, and applying CAD and CAM. This also includes testing materials, producing and following production plans, predicting performance**			**Speaking Skills** **Articulation: Speaking clearly and confidently.** **Presentation Skills: Effectively presenting information or arguments.** **Discussion and Debate: Engaging in thoughtful discussions and debates on various topics.** **Persuasion: Convincing others of a point of view or argument.**		

components. **Preparation for Exams.**	**using calculations and modelling, selecting materials, components, tools, and equipment, and applying quality control methods.**					