



AVCE - Engineering Medium Term Plan: Module 3: - Compulsory Unit 3, Engineering Materials

Module 3: Engineering materials – Unit 3						
Sequence of Lessons	Theme/Aims	Key Activities	Resources	Student Outcomes	Assessment Opportunities	Key Vocabulary
1	Introduction to the unit – to understand the range of materials and the development of modern materials.	Discussion/introduction to the unit. The history of materials, natural materials, processing and refining to produce metals, polymers and ceramics. Explanation of the main classes and identifying examples. Product analysis of workshop and household artefacts to identify the materials used and why.	Past exam papers dealing with product analysis. Range of materials found in the workshop and the environment	Students will have a basic knowledge of the main materials used in engineering and begin to understand why.	Tests and completion of exam type questions.	Names of materials and classes – metals, polymers, composites, ceramics. Ferrous non ferrous alloys common plastics. Thermoplastic and thermosetting.
2	Measuring properties of engineering materials – qualitatively.	Students will test a range of samples for simple properties. Materials in the room can also be non-destructively included. Answering exam type questions about materials suitability based on properties.	Range of samples – mostly metals and polymers.	Completion of table displaying results and general conclusions drawn. Able to identify the most suitable materials for a purpose.	Website www.the-warren.org is used to support the course. Relevant quizzes for self assessment are to be used. Response to questions.	Conductivity, resistivity, density, tensile strength.
3	Testing materials quantitatively.	Demonstrate tensile strength testing machine. Take measurements using metal specimens.	Materials testing machine and laptop. Specimens. Impact testing machine.	Understanding of how materials behave when they have various forces applied. How materials fail.	Test/quiz on materials testing. Write up testing procedures and results. Completion of exam	Stress, strain, Names of tests.

		Impact test demonstration. Hardness testing by simple experiment and by reference to website. Looking at stress strain graphs – notes on web.		Standardisation of tests and the preparation of specimens for testing.	questions on testing machines and stress strain graphs	
4	Other properties.	Discussion and notes on the other general properties of materials. Thermal properties such as insulation, expansivity Electrical/magnetic properties such as conductivity, permittivity, permeability. Durability properties such as stability and resistance to environmental degradation, corrosion, chemical solubility, absorption.	Samples including some that have suffered damage. Web.	Understanding that there are many factors to be considered when choosing suitable materials for applications.	Exam questions and web quizzes.	Range of names of material properties.
5	Structure of materials. Grain structure.	Discussion and notes on the structure of materials. Modifying a material's properties. - Hardening and tempering. Alloying. Work hardening, annealing.	Silver steel, copper sheet, polythene sheet. Brazing hearth. Files. Weights.	Understanding of how materials can have their properties modified, and how the internal molecular structure in polymers and the grain structure in metals can be modified to enhance the properties.	Tests/quizzes and exam questions.	Hardening and tempering. Alloying. Work hardening, annealing.
6	Manufacturing Processes.	List and describe the manufacturing processes which have been experienced already. Demonstrate processes which have not been experienced. E.g. vacuum forming, injection moulding. Pewter casting, Production of a GRP product. Casting in	Horizontal mill. Laser cutter. Pewter. Ready-mix and wooden mould. GRP resin and glass fibre. Pop rivets and snap set. Self tapping screws. Machine screws.	Expanded view of how to manufacture. Understanding of the relative costs of processes.	Tests/quizzes and exam questions.	Range of processes.

		concrete. Laser cutting. Milling – horizontal and vertical. Joining using rivets.				
7	Project.	Students are to design a hovercraft or vehicle to travel over a set course carrying a load. – The design must be drawn in Prodesktop and manufactured using engineering processes using materials from the main classes i.e. no paper, card or wood.	Paper and drawing equipment. Prodesktop and PCs.	Designs for vehicle.	Quality of design work. (Drawings to be carried over into the CAD module)	CAD. Process names. Material names.
8	Manufacture of project.	Students manufacture their design in the engineering workshop.	Workshop facilities. Range of engineering materials, fixings and machines such as the Vacuum former.	The vehicle manufactured – work in teams.	Workshop organisation and quality of workmanship.	Process names. Material names
9	Testing and evaluation of project and processes.	Students complete their design and make work, then test competitively.	Workshop facilities. Range of engineering materials, fixings and machines such as the Vacuum former. Test track/ area. Load.	Understanding about the suitability of the materials and manufacturing processes chosen.	Testing evaluation and overall performance on project.	
10	Exam preparation.	Students to answer complete exam papers under exam conditions.	Past papers.	Ability to complete answers to highest grade.	Exam papers.	General materials vocabulary.