Level 3 – Sample scheme of work
(7333)

ENGINEERING
Unit 9: Scientific principles and applications for engineers

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Sample scheme of work

This is an example of a possible scheme of work. You can use it as it is, adjust it or extract content to create a scheme of work to suit your delivery needs. It can also be adjusted by adding theory workshops to support learners who have/need additional learning time.

This unit is assessed through a combination of an external examination and a centre set and marked assignment, which will be externally moderated. A sample assignment brief, a question paper and mark scheme are available at www.diplomainfo.org.uk

Total GLH	90
Aim	To develop learners' understanding of the fundamental scientific principles that engineers use in order to carry out investigations into engineering problems. Learners will be able to: • apply scientific knowledge to real engineering systems • demonstrate analytical and problem solving skills in engineering • use mathematical methods to solve engineering problems • use IT to solve engineering science problems • construct engineering science experiments and record data.
Notes	This scheme includes two types of activities. 1. Learning scientific principles: a series of classroom-based activities, where learners are taught scientific principles and their application in the context of engineering and then develop their abilities through solving engineering problems. These activities mainly support the external element of the assessment. 2. Applying scientific principles: an extended activity demonstrating how to investigate an engineering system. These activities mainly support the internal element of the assessment.

	Working in pairs is used to support the development of teamwork and effective participation, and as a means of facilitating peer review and discussion to address areas of misunderstanding. Under FS (functional skills): * indicates opportunities for assessment in English of speaking and listening and/or written communication + indicates opportunities for use of functional mathematics # indicates opportunities for the use of information and communication technology (ICT).

Session number	Topic and learning outcomes	Activities, assignments, assessments, resources	LO and AC	PLTS	FS	GLH	Other comments
1	**Introduction to the unit**	Provide an overview of the learning objectives and the tasks to be carried out for this unit. Describe the structure of the exam.	LO1		*	1	Throughout this unit the use of mathematics to solve problems could be linked to Unit 8: Mathematical techniques and applications for engineers. Questions from the specimen assessment material and past papers can be used to support and evaluate learning in each topic.
2–11	**Electricity and electronics** Aim/learning outcome: • Be able to apply scientific principles to electricity and electronics in engineering.	Introduce the scientific principles of electricity and electronics, covering the sub-topics listed in the Principal Learning specification for external assessment A, section 1a (see page 89). The sub-topics should be supported by the use of circuit modelling (ie physically making simple circuits and virtual modelling with CAD software) to confirm the results of the mathematical problems. Working in pairs, learners should solve a number of problems covering each area.	LO1 LO3 AC1a AC3a–f	IE CT RL TW SM EP	+ * #	10	These sessions could be linked with the use of CAD software to design electronic circuits in Unit 2: Applications of computer-aided designing.

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12–23	**Statics and dynamics** Aim/learning outcome: • Be able to apply scientific principles to statics and dynamics in engineering.	Introduce the scientific principles of statics and dynamics, covering the sub-topics listed in the Principal Learning specification for external assessment A, section 1b (see page 89). Working in pairs, learners should solve a number of problems covering each area.	LO1 LO3 AC1b AC3a–f	CT RL TW SM EP	+ *	12	The material properties could be linked to Unit 3: Selection and application of engineering materials.
24–31	**Heat and energy** Aim/learning outcome: • Be able to apply scientific principles to heat and energy in engineering.	Introduce the scientific principles of heat and energy, covering the sub-topics listed in the Principal Learning specification for external assessment A, section 1c (see page 89). Working in pairs, learners should solve a number of problems covering each area.	LO1 LO3 AC1c AC3a–f	CT RL TW SM EP	+ *	8	The thermal conductivity and linear expansion of materials could be linked to Unit 3: Selection and application of engineering materials.
32–38	**Engineering chemistry** Aim/learning outcome: • Be able to apply scientific principles to basic chemistry in engineering.	Introduce the scientific principles of	LO1 LO3 AC1d AC3a, f	CT RL TW SM EP	+ *	7	Video case studies are available from a wide range of commercial sources. Many clips are available through internet sites such as www.youtube.com The influence of material structure and heat treatments

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		principles of engineering chemistry, covering the sub-topics listed in the Principal Learning specification for external assessment A, section 1d (see page 90). Support this topic further with short video case studies on the heat treatment of metals and corrosion. Working in pairs, learners should solve a number of problems covering each area.					on properties could be linked to Unit 3: Selection and application of engineering materials.
39–45	**Fluids** Aim/learning outcome: • Be able to apply scientific principles to fluid flow in engineering.	Introduce to the scientific principles of fluid flow in engineering, covering the sub-topics listed in the Principal Learning specification for external assessment A, section 1e (see page 90). Also demonstrate the use of fluid flow measuring devices. Working in pairs, learners should solve a number of problems covering each area.	LO1 LO3 AC1e AC3a–f	CT RL TW SM EP	+ *	7	
46–50	**Waves, sounds and light** Aim/learning outcome: • Be able to apply	Introduce the scientific principles of fluid flow in engineering, covering the sub-topics listed in the Principal Learning specification for external assessment A, section 1f (see	LO1 LO3 AC1f	CT RL TW	+ *	5	

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	scientific principles to waves, sound and light in engineering.	page 90). Working in pairs, learners should solve a number of problems covering each area.	AC3a–f	SM EP			
51–65	**Experimental methodology: mini-project** Aim/learning outcome: • Be able to apply scientific principles to investigate a product or engineering system.	For the following few sessions, learners will work on a min-project investigating the use of solar power in the home. The project should be used as a vehicle to teach the following at the relevant increments through exposition and demonstration. Working in teams of four, learners should be guided through the following activities. Learners should: • research the variety of current solar systems, using IT (this should be supported by an exposition on methods of devising the criteria by which to assess an engineering solution) • apply scientific principles to predict the performance of the system (in this case focusing on power output in differing conditions and the efficiency of galvanic	LO2 LO4 LO5 AC2a AC4a AC5a–f	IE CT RL TW SM EP	* + #	15	The project used for the focus could be modified to link to Unit 7: Innovative design and enterprise.

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		cells) • design an experiment (this should be supported by an exposition on the different methods of investigating criteria, including how to plan and construct experiments and gather data using IT) • safely carry out the experiment • review their results (this should be supported by an exposition on different methods of evaluating test results and making recommendations, including presentation methods using IT).					
66–80	**Assessed assignment**	In these sessions, learners will carry out the example assignment: to investigate wind power generators. This includes: • using IT to carry out research on wind power generators • designing and carrying out a scientific experiment to test the performance of a wind power generator • preparing a poster to summarise the findings.	LO2 LO4 LO5	IE CT RL SM	* + #	15	This example assignment can be found at www.diplomainfo.org.uk
81–87	**Practice examination and review**	Conduct a mock exam using the most recent past paper. Allow learners to mark each other's papers using the published mark scheme. Follow with a question-by-question review, addressing any areas of	LO1 LO3	IE CT RL SM	* +	7.5	A sample question paper and mark scheme are available at www.diplomainfo.org.uk

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		weakness.					
88–90	**External examination**	Learners sit the external examination.	LO1 LO3	IE CT RL SM	* +	2.5	A sample question paper and mark scheme are available at www.diplomainfo.org.uk