Level 3 – Sample scheme of work
(7333)

ENGINEERING
Unit 8: Mathematical techniques 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 an external examination. A sample question paper and mark scheme are available at www.diplomainfo.org.uk

Total GLH	60
Aim	To enable learners to use mathematics and model engineering problems and to understand how mathematics is an essential tool in engineering. Learners will be able to: • apply mathematics and mathematical modelling to solve engineering problems • use trigonometry and co-ordinate geometry to solve engineering problems • use algebra, statistics and calculus to solve engineering problems.
Notes	This scheme involves a series of classroom-based activities, where learners are taught mathematical tools and how to apply them in the context of engineering problems and then develop their abilities through solving similar problems. Where an individual subject area (such as structures or electronics) is used as the context for the learning, it is important that the similar problems also include the application of the tools within other contexts. 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, questions from the specimen assessment material and past papers can be used to support and evaluate learning in each topic.
2–7	**Using mathematics for engineering materials** Aims/learning outcomes: • Be able to apply mathematical skills to solve engineering problems. • Be able to change the subject and manipulate equations.	Introduce using mathematics in engineering by working through the following examples. • Explain volumes of engineering components in the context of calculating the amount of material required for a production batch. This should include an introduction to changing the subject and manipulating equations. • Introduce stress and strain using the example of structural parts. This should include the use of IT to identify data on material properties. Discuss heat transfer through the wall of a furnace. Working in pairs, learners then need to calculate the thickness of material required for a furnace lining, its volume and weight; and (separately) the thickness of a lifting bar required to lift a load and the strain that will be experienced during the lift.	LO1 LO5 AC1a–d AC5a	IE CT RL TW SM EP	+ * #	6	This work could be linked to Unit 3: Selection and application of engineering materials.

8–14	**Structures: using trigonometry and coordinate geometry** Aims/learning outcomes: • Be able to use the sine and cosine rule. • Be able to use and convert angles in both degrees and radians.	Discuss moments applied to levers and beams, and the sine and cosine rule, using the context of calculating angles in structures. Introduce using and converting angles in radians and degrees, using the example of the positions of a cam in a motor engine. After each example, working in pairs, learners should solve a number of similar problems.	LO1 LO2 AC1a–d AC2a	IE CT RL TW SM EP	+ *	7	
15–18	**Machining: coordinates and vectors** Aims/learning outcomes: • Be able to apply mathematical skills to solve engineering problems. • Be able to use and convert Cartesian and polar coordinates to determine the position of objects. • Be able to use vector addition and subtraction.	Demonstrate the use of Cartesian and polar coordinates and vector addition in the context of plotting the movement and determining the position relative to the origin of the tool on a CNC machine. Working in pairs, learners should plot the coordinates of a tool path to machine a simple shape on a CNC machine. Learners should use vector addition to ensure that the shape is always within a specified area.	LO1 LO2 AC1a–d AC2a	IE CT RL TW SM EP	+ # *	4	These sessions could be linked to Unit 2: Applications of computer-aided designing, and Unit 6: Production and manufacturing.

19–25	**Using algebra** Aims/learning outcomes: • Be able to apply mathematical skills to solve engineering problems. • Be able to find solutions to quadratic equations. • Be able to use rules of indices and logarithms.	Introduce indices and logarithms, using the context of radioactive decay. Introduce how to use quadratics to solve problems involving parabolas, using the context of a satellite dish. Working in pairs, learners should solve a number of similar problems.	LO1 LO3 AC1a–d AC3a	IE CT RL TW SM EP	+ *	7	
26–30	**Electronics** Aims/learning outcomes: • Be able to apply mathematical skills to solve engineering problems. • Be able to manipulate equations to solve engineering problems. • Be able to use rules of indices and logarithms.	Provide an overview of how to manipulate equations to solve problems of power (and similar). Introduce how to apply trigonometric waveforms and phase angles for AC electricity. Provide an overview of applying indices and logarithms in the context of capacitor charging. Working in pairs, learners should solve a number of similar problems.	LO1 LO2 LO3 AC1a–d AC2a AC3a	IE CT RL TW SM EP	+ *	5	Parts of this work could be linked to signal processing in Unit 4: Instrumentation and control engineering.

31–44	**Using graphs and statistics** Aims/learning outcomes: • Be able to understand and use graphs. • Be able to use statistical techniques to solve engineering problems. • Be able to identify turning points and maximum, minimum and optimum values.	Introduce the use of data to create tables, plot graphs and identify trends. Cover the use of computer software to process statistical data and create and analyse graphs. Show how to identify turning points using, as an example, the position of a projectile. Introduce how to identify maximum and minimum values by using examples from statistical process control in manufacturing (showing variation in performance over time). Working individually, learners should solve a number of similar problems.	LO1 LO3 LO4 LO5 AC1a–d AC3a AC4a AC5a	IE CT RL TW SM EP	+ * #	14	The use of graphs for quality control could be linked to Unit 6: Production and manufacturing, and Unit 4: Instrumentation and control engineering.
45–50	**Using calculus to analyse data** Aims/learning outcomes: • Be able to use differentiation and integration. • Be able to identify turning points and maximum and minimum values.	Introduce differentiation and integration, using the example of motion applied to a car. Show how to identify turning points, maximum and minimum values using the example of the position of a projectile. Working in pairs, learners should solve a number of similar problems.	LO1 LO3 LO5 AC1a–d AC3a AC5a	IE CT RL TW SM EP	+ *	6	
51–57	**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 weakness.	All	IE CT RL SM	* +	7.5	A sample question paper and mark scheme are available at www.diplomainfo.org.uk

58–60	**External examination**	Learners sit the external examination.	All	IE CT RL SM	* +	2.5	A sample question paper and mark scheme are available at www.diplomainfo.org.uk