

Unit 52: Further Mathematics in Construction and the Built Environment

Unit code: M/600/0234

QCF Level: 3

Credit value: 10

Guided learning hours: 60

Unit aim

This unit aims to enable learners to develop skills in applying transposition of formulae, arithmetical methods, calculus and statistics to construction engineering problems. The unit gives learners an opportunity to study relevant aspects of 'pure' mathematics and to explore how complex practical problems can be solved. Learners will be able to solve applied mathematical problems involving statistical data, structural properties for beams and columns, complex linear, angular, area and volume measurements, trigonometric identities, rates of change and decay, differentiation of maxima and minima, numerical integration, and complex areas or volumes by definite and indefinite integration.

Learning outcomes and assessment criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

Learning outcomes	Assessment criteria
1 Be able to transpose formulae to simplify and solve mathematical problems	1.1 Apply transposition techniques to mathematical formulae and expressions
2 Be able to apply arithmetical techniques to solve engineering problems	2.1 Use arithmetical techniques to determine values for properties of sections, including irregular areas and volumes
3 Be able to use calculus to solve practical engineering problems	3.1 Use differential calculus techniques to solve algebraic, trigonometric and logarithmic expressions
	3.2 Use integral calculus to solve simple algebraic, trigonometric and exponential expressions

4 Be able to produce solutions to engineering problems using statistical methods	4.1 Use statistical methods to produce accurate and appropriate solutions to construction engineering problems
--	--

DRAFT

THIS IS AN ACCREDITED SPECIFICATION AND CAN BE USED FOR TEACHING AND ASSESSMENT

Unit content

1 Be able to transpose formulae to simplify and solve mathematical problems

Transposition techniques: rearrangement of formulae to determine new subjects; use of given and rearranged formulae to evaluate data

Mathematical formulae to transpose: trigonometric expressions; binomial theorem applied to errors

2 Be able to apply arithmetical techniques to solve engineering problems

Arithmetical techniques: formulae for irregular areas and volumes (Trapezoidal Rule, Mid-Ordinate Rule, Simpson's Rule); arithmetical calculation of various properties of sections

Engineering-related problems: determination of irregular areas and volumes; determination of properties of sections (eg cross-sectional area, location of centroid, neutral axis, moment of inertia, section modulus, radius of gyration); application to simple, regular and irregular shapes

3 Be able to use calculus to solve practical engineering problems

Differential calculus: basic differentiation techniques applied to algebraic, trigonometric and logarithmic functions; products and quotients; function of a function; second-order derivatives; the location of stationary values

Integral calculus: indefinite and definite integration techniques applied to algebraic, trigonometric and exponential functions

Practical engineering problems: solution of problems involving maxima and minima; solution of problems involving centroids, moments of inertia, areas under curves and volumes of revolution

4 Be able to produce solutions to engineering problems using statistical methods

Statistical methods: presentation of data (histograms, frequency graphs, cumulative frequency graphs); sampling distributions (normal distribution tables; confidence limits; significance testing; large samples only)

Construction engineering problems: measures of central tendency (mean, mode, median); measures of dispersion (range, variance, standard deviation, quartiles, deciles and percentiles); grouped and ungrouped data