Unit 2: Engineering Maths

Unit code	**M/615/1476**
Unit type	**Core**
Unit level	**4**
Credit value	**15**

Introduction

The mathematics that is delivered in this unit is that which is directly applicable to the engineering industry, and it will help to increase students' knowledge of the broad underlying principles within this discipline.

The aim of this unit is to develop students' skills in the mathematical principles and theories that underpin the engineering curriculum. Students will be introduced to mathematical methods and statistical techniques in order to analyse and solve problems within an engineering context.

On successful completion of this unit students will be able to employ mathematical methods within a variety of contextualised examples, interpret data using statistical techniques, and use analytical and computational methods to evaluate and solve engineering problems.

Learning Outcomes

By the end of this unit students will be able to:

1. Identify the relevance of mathematical methods to a variety of conceptualised engineering examples.
2. Investigate applications of statistical techniques to interpret, organise and present data by using appropriate computer software packages.
3. Use analytical and computational methods for solving problems by relating sinusoidal wave and vector functions to their respective engineering applications.
4. Illustrate the wide-ranging uses of calculus within different engineering disciplines by solving problems of differential and integral calculus.

Essential Content

LO1 **Identify the relevance of mathematical methods to a variety of conceptualised engineering examples**

Mathematical concepts:

Dimensional analysis.

Arithmetic and geometric progressions.

Functions:

Exponential, logarithmic, circular and hyperbolic functions

LO2 **Investigate applications of statistical techniques to interpret, organise and present data, by using appropriate computer software packages**

Summary of data:

Mean and standard deviation of grouped data.

Pearson's correlation coefficient.

Linear regression.

Probability theory:

Binomial and normal distribution.

LO3 **Use analytical and computational methods for solving problems by relating sinusoidal wave and vector functions to their respective engineering applications.**

Sinusoidal waves:

Sine waves and their applications.

Trigonometric and hyperbolic identities.

Vector functions:

Vector notation and properties.

Representing quantities in vector form.

Vectors in three dimensions.

LO4 **Illustrate the wide-ranging uses of calculus within different engineering disciplines by solving problems of differential and integral calculus**

Differential calculus:

Differentiation of functions.

Stationary points:

Rates of change.

Integral calculus:

Definite and indefinite integration.

Integrating to determine area and common functions.

Integration by substitution.

Exponential growth and decay.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Identify the relevance of mathematical methods to a variety of conceptualised engineering examples</td><td rowspan="4">LO1 & 2

D1
Present statistical data in a method that can be understood by a non-technical audience.</td></tr>
<tr><td>P1 Apply dimensional analysis techniques to solve complex problems.

P2 Generate answers from contextualised arithmetic and geometric progressions.

P3 Determine solutions of equations using exponential, trigonometric and hyperbolic functions.</td><td>M1 Use dimensional analysis to derive equations.</td></tr>
<tr><td colspan="2">LO2 Investigate applications of statistical techniques to interpret, organise and present data by using appropriate computer software packages</td></tr>
<tr><td>P4 Summarise data by calculating mean and standard deviation, and simplify data into graphical form.

P5 Calculate probabilities within both binomially distributed and normally distributed random variables.</td><td>M2 Interpret the results of a statistical hypothesis test conducted from a given scenario.</td></tr>
<tr><td colspan="2">LO3 Use analytical and computational methods for solving problems by relating sinusoidal wave and vector functions to their respective engineering applications</td><td rowspan="2">D2 Model the combination of sine waves graphically and analyse the variation between graphical and analytical methods.</td></tr>
<tr><td>P6 Solve engineering problems relating to sinusoidal functions.

P7 Represent engineering quantities in vector form, and use appropriate methodology to determine engineering parameters.</td><td>M3 Use compound angle identities to separate waves into distinct component waves.</td></tr>
</table>

Pass	Merit	Distinction
LO4 Illustrate the wide-ranging uses of calculus within different engineering disciplines by solving problems of differential and integral calculus		**D3** Analyse maxima and minima of increasing and decreasing functions using higher order derivatives.
P8 Determine rates of change for algebraic, logarithmic and circular functions. **P9** Use integral calculus to solve practical problems relating to engineering.	**M4** Formulate predictions of exponential growth and decay models using integration methods.	

Recommended Resources

Textbooks

SINGH, K. (2011) *Engineering Mathematics Through Applications*. 2nd Ed. Basingstoke: Palgrave Macmillan.

STROUD, K.A. and BOOTH, D.J. (2013) *Engineering Mathematics*. 7th Ed. Basingstoke: Palgrave Macmillan.

Electronic

http://www.mathcentre.ac.uk

http://www.mathtutor.ac.uk

Links

This unit links to the following related units:

Unit 39: Further Mathematics