# Engineering Principles

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| Unit Reference Number | M/618/6101 |
| Unit Title | Engineering Principles |
| Unit Level | 3 |
| Number of Credits | 10 |
| Total Qualification Time (TQT) | 100 |
| Guided Learning Hours (GLH) | 40 |
| Mandatory / Optional | Mandatory |
| Sector Subject Area (SSA) | 14.1 Foundations for learning and life |
| Unit Grading Structure | Pass / Fail |

## Unit Aims

The aim of this unit is for learners to understand the principles of engineering as a broad discipline and show how engineering has developed historically. Learners will also gain an introduction to fundamental concepts leading to a study of the operation of types of engines.

## Learning Outcomes, Assessment Criteria and Indicative Content

| Learning Outcomes – The learner will: | Assessment Criteria – The learner can: | Indicative contents |
|---|---|---|
| 1. Understand applications of SI units and measurement. | 1.1 Discuss the historic development of the International System of Units (SI).<br>1.2 Create a comprehensive table for 22 derived units with special names and symbols.<br>1.3 Demonstrate ability to use SI units in practical context. | • The International System of Units, universally abbreviated SI (from the French Le Système International d'Unités). Modern metric system of measurement. Established in 1960 by the 11th General Conference on Weights and Measures<br>• The seven SI base units<br>o metre for length<br>o kilogram for mass<br>o second for time<br>o ampere for electric current |

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<ul>
<li>kelvin for temperature</li>
<li>candela for luminous intensity</li>
<li>mole for amount of substance</li>
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<ul>
<li>Table should have at least 5 columns - Derived quantity, Name, Symbol, Expressed in terms of other SI units, Expressed in terms of SI base units. An example is given below:</li>
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<table>
<tr><th rowspan="2">Derived quantity</th><th colspan="4">SI coherent derived unit</th></tr>
<tr><th>Name</th><th>Symbol</th><th>Expressed in terms of other SI units</th><th>Expressed in terms of SI base units</th></tr>
<tr><td>Plane angle</td><td>radian</td><td>rad</td><td>1</td><td>m/m</td></tr>
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<td>2. Know how to perform engineering calculations.</td>
<td>2.1 Express numerical solutions to a degree of accuracy that is appropriate to the value being calculated.<br>2.2 Use algebraic expressions.<br>2.3 Define moments of a force and solve related problems using formula.<br>2.4 Define work, power and energy and solve related problems using formula.<br>2.5 Define friction and solve related problems using formula.<br>2.6 Describe the relationship between</td>
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<li>Degree of accuracy: correct to three significant figures, correct to two decimal places, express a decimal fraction in standard form, express tolerance in terms of limits of size</li>
<li>Algebraic expressions: represent numerical quantities using symbols, apply laws of precedence in the use of precedence (BODMAS)</li>
<li>Moments of a force: define and apply the ‘Principle of Moments’, define the meanings of the terms 'torque' & 'couple'</li>
<li>Solve problems: associated with levers and couples</li>
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| | temperature changes and changes in length.<br>2.7 Define types of heat and solve related problems using formula. | work, power and energy define work done in terms of force and distance moved<br>• Work, power and energy: explain what is meant by energy; state that the unit of energy is the joule (J), the unit of power is the watt (W) and the unit of work is the joule (J); define power in terms of voltage/current and work done per second, perform calculations for work, power and energy<br>• Friction: definition, explain coefficient of friction, explain how friction can be reduced, select materials that will rotate, or slide together with low frictional value, perform calculations for friction<br>• Temperature: coefficient of expansion: when an object is heated or cooled, its length changes by an amount proportional to the original length and the change in temperature, if the object is heated or cooled and it is not free to expand or contract (it's tied down at both ends, in other words), the thermal stresses can be large enough to damage the object, or to damage whatever the object is constrained by, for example bridges have expansion joints in them to stop this.<br>• Heat: define: specific heat capacity, specific latent heat (fusion, evaporation) solve numerical problems associated with specific heat capacity, specific latent heat of fusion, specific latent heat of evaporation |
| 3. Know how to interpret engineering information. | 3.1 Explain the relevance of engineering information.<br>3.2 Interpret the information that can be extracted from reference charts, tables, graphs and BS EN standards.<br>3.3 Interpret drawings, dimensioning and labelling. | • Engineering information: BS EN standards, instruction manuals, technical handbooks, tables, charts (including: flow, Gantt, tally), graphs (including histograms, scatter diagrams), Ishikawa diagrams (fishbone diagrams or cause-and-effect diagrams), data sheets, text books and reference materials, computer applications<br>• Reference charts, tables, graphs and BS EN |

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| | | standards: tapping sizes and threads, feeds and speeds, cable sizing, PIN configurations, component ratings, welding symbols, machining symbols and tolerances, piping components<br>• Drawings, dimensioning and labelling: projections (orthographic [first angle, third angle], isometric [including exploded], oblique); reference points, lines, edges and surfaces, continuous dimensions, baseline dimensions |

## Assessment

To achieve a 'pass' for this unit, learners must provide evidence to demonstrate that they have fulfilled all the learning outcomes and meet the standards specified by all assessment criteria.

| Learning Outcomes to be met | Assessment criteria to be covered | Type of assessment |
|---|---|---|
| All 1 to 3 | All AC under LO 1 to 3 | Coursework –<br>The assessment focuses on breadth, challenge and application.<br>Learners will draw on and extend the skills they have learned during the teaching of the unit. |

## Indicative Reading list


- Bird, J.O. (2020). *Science and mathematics for engineering*. Abingdon, Oxon ; New York, Ny: Routledge
- Taylor, B.N. (2002). *The international system of units (SI)*. Gaithersburg, Md: U.S. Dept. Of Commerce, Technology Administration, National Institute of Standards and Technology.