

# Deyes High School Remote Learning



DEYES  
HIGH  
SCHOOL

LYDIA'FÉ  
LEARNING TRUST

# Year 12 Engineering


Engage, Enable and Empower

Work for individual students not attending school

Half Term 3: January- February

Pupils who are absent should select the activity that they are up to. Click on the link in the activity box below. This will take you to Office 365 where the work is stored. In the lesson it will tell the pupil if they need to submit the work to their teacher.

## Lessons

Date (week commencing)	Lesson	Focus/Topic/Theme	Hyper link to Activity
4/01/21	1	Magnetism	<p>Use your revision guides and assessment practise books to hone your skills.</p> <p>Links to lesson PowerPoints below </p> <p><a href="https://deyes.sharepoint.com/sites/TemporaryCurriculumResources/Documents/Forms/AllItems.aspx?id=%2Fsites%2FTemporaryCurriculumResources%2FDocuments%2FTemporary%20Curriculum%20Resources%2FEngineering%20Construction%2FYear%2012%2FMr%20Norbury&amp;viewid=4fb17346%2D4652465%2D4623%2D466b6070cf8">https://deyes.sharepoint.com/sites/TemporaryCurriculumResources/Documents/Forms/AllItems.aspx?id=%2Fsites%2FTemporaryCurriculumResources%2FDocuments%2FTemporary%20Curriculum%20Resources%2FEngineering%20Construction%2FYear%2012%2FMr%20Norbury&amp;viewid=4fb17346%2D4652465%2D4623%2D466b6070cf8</a></p>
11/01/21	2	Permeability	
18/01/21	3	B/H curves, loops and hysteresis	
25/01/21	4	Reluctance and magnetic screening	
01/02/21	5	Induction	
08/02/21	6	Transformers	
15/02/21	7	D.C. Motors	

Who to contact

You can email **your class teacher** if you have any questions regarding the activities set.

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Year 12 T1 Electrical and Electronic Engineering Knowledge Organiser

**Trigonometric methods**  
**Angular measurement**  
 You are already familiar with angular measurements made in degrees. In practical terms, this is the most common way to define an angle on an engineering drawing that a technician might use when manufacturing a component to the workshop.  
 However, there is another unit of angular measurement, called the **radian**, which is used extensively in engineering calculations.  
**Key terms**  
 Degree symbol '°': one degree is 1/360 of a complete circle. A complete circle contains 360°.  
 Radian symbol 'rad': one radian is the angle subtended at the centre of a circle by two radii of length that describe an arc of the same length as the circumference. A complete circle contains 2π rad.  
**Substated** - to form an angle between two lines at the point where they meet.  
**Circle measurement**  
 One revolution of a full circle contains 360° or 2π radians. It is necessary to convert angles stated in degrees to radians and vice versa.  
 Given that 2π radians = 360°  
 $1 \text{ radian} = \frac{360}{2\pi} = 57.3^\circ$  (to 3 s.f.)  
 and  $1^\circ = \frac{2\pi}{360} = 0.0175 \text{ rad}$  (to 3 s.f.)  
 The use of radians means it straightforward to calculate some basic elements of circles with the general formulae shown in Table 1.6, where the angle θ is measured in radians.  
**Table 1.6 General formulae for circular measurements (see Figure 1.7)**  
 Arc length  $= r\theta$   
 Circumference of a circle  $= 2\pi r = 2\pi r$   
 Area of a sector  $= \frac{1}{2}r^2\theta$   
 Area of a full circle  $= \pi r^2 = \pi r^2$   
**Figure 1.7** Arc length and sector of a circle

**Triangular measurement**  
 In right-angled triangles we name the three sides in relation to the right angle and one of the other two angles. (see Figure 1.8)  
**Figure 1.8** Trigonometric naming conventions for a right-angled triangle.  
 The side opposite the right angle is the **hypotenuse** (h).  
 The side next to the angle θ is the **adjacent** (a).  
 The side opposite the angle θ is the **opposite** (o).  
**Pythagorean Theorem**  
 For any right-angled triangle with sides a, b and c and hypotenuse c, the square of the hypotenuse is equal to the sum of the squares of the other two sides.  
 $a^2 + b^2 = c^2$   
 The ratios of the lengths of these sides are given specific names and are widely used in engineering (see Figures 1.9-1.11).  
**Figure 1.9** sine (s), where  $\sin \theta = \frac{o}{h}$   
**Figure 1.10** cosine (c), where  $\cos \theta = \frac{a}{h}$   
**Figure 1.11** tangent (t), where  $\tan \theta = \frac{o}{a}$   
 From these definitions it can also be deduced that  $\tan \theta = \frac{\sin \theta}{\cos \theta}$

**Tables of the trigonometric functions**  
 When plotted graphically, both the sine and the cosine function generate periodic waves. Both functions are used to measure or analyse a 1 Hz function that has a period of 0.001 s, or a rotation of 1 rev per second. The period of the function is 0.001 s. The angular function also has periodic (cyclic) waveforms, although the period of the sine wave is 2π or 360°.  
**Table 1.1** Sine and cosine values for angles from 0° to 90° in radians.  
**Table 1.2** Sine and cosine values for angles from 0° to 90° in degrees.  
**Figure 1.12** Forming conventions when applying the sine rule and the cosine rule.

**Sine and cosine rules**  
 The basic definitions of the trigonometric functions sine, cosine and tangent only apply to right-angled triangles. However, the sine and cosine rules can be applied to any triangle of the form shown in Figure 1.12.  
**The sine rule:**  
 $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$   
**The cosine rule:**  
 $a^2 = b^2 + c^2 - 2bc \cos A$   
 $b^2 = a^2 + c^2 - 2ac \cos B$   
 $c^2 = a^2 + b^2 - 2ab \cos C$

**Vectors and their applications**  
 Many quantities encountered in engineering, such as force and velocity, are only fully defined when magnitude, direction and sense are known (see Figure 1.13). Such quantities are called **vectors**. When adding or subtracting vectors you must always take into account the direction in which they act.  
**Diagrammatic representation of vectors**  
 The length of the arrow represents the magnitude of the vector.  
 The angle it specifies the direction of the vector.  
 The head of the arrow specifies the positive sense of the vector.  
**Vector addition**  
 To find the sum (or resultant) of two vectors, *a* and *b*, you can represent the situation graphically by drawing vector *b* along *a*. (see Figure 1.14) The two vectors are drawn to scale. Forming a triangle or parallelogram from which the characteristics of the resultant vector(s) can be measured.  
**Phasors**  
 Phasors are rotating vectors that are useful in analysing sinusoidal (sine-shaped) waveforms. Figure 1.15 shows the relationship between a phasor and the sine wave it represents.  
**Vector rotation**  
 When using phasors in the analysis of alternating current, the length of the phasor represents the peak voltage (V) or amplitude of the sinusoidal waveform, and the phasor rotates about a point of origin with an angular velocity of ω.  
 Always best suited to AC, the phasor will have a phase angle φ and a useful component will be equal to the instantaneous voltage (v) on the corresponding sine wave.  
 In the instantaneous voltage (v) at any point on the waveform:  
 $v = V \sin \omega t$   
 In terms of angular velocity, this gives:  
 $v = V \sin \omega t$   
 The relationship is true when the waveform begins its cycle when ωt is 0. However, it is necessary to take account of the fact that ωt may not be the reference waveform. The phase difference (see Figure 1.16) is expressed as an angle φ, so that:  
 $v = V \sin(\omega t + \phi)$   
 The angular velocity of the phasor (ω) is related to the frequency of the waveform (f) by:  
 $\omega = 2\pi f$