Electrical Systems
Checklist

Use this alongside our Walkthrough Guides to tick off the concepts you're confident with to plan your study and find areas of improvement!

Resistors in DC Circuits

- ◯ I can define the term **electromotive force**, in terms of potential difference
- ◯ I can calculate the electromotive force using $\varepsilon = V + Ir$
- ◯ I can discuss the importance of the internal resistance of a cell, and explain how the voltage of a battery or cell decreases
- ◯ I can describe both **Kirchhoff's Current Law** and **Kirchhoff's Voltage Law**
- ◯ I can apply both of Kirchhoff's Circuit Laws to calculate the current or voltage across components
- ◯ I can state the equations which represent both Kirchhoff's Current Law and Kirchhoff's Voltage Law

Capacitors in DC Circuits

- ◯ I can describe the basic structure of a capacitor
- ◯ I can state the function of a capacitor in an electrical circuit
- ◯ I can explain how the structure of a capacitor gives it its function
- ◯ I can explain the effect a dielectric material has on the capacitance of a capacitor
- ◯ I can state the symbols and units for **capacitance**, **permittivity**, **relative permittivity**, **vacuum permittivity**, **area** and **distance**
- ◯ I can calculate the capacitance, permittivity, area or distance using the formula: $C = \varepsilon\frac{A}{d}$
- ◯ I can calculate the capacitance, relative permittivity, vacuum permittivity, area or distance using the formula: $C = \varepsilon_0 \varepsilon_r \frac{A}{d}$
- ◯ I can calculate the electric field strength, voltage or distance using the formula: $E = \frac{V}{d}$
- ◯ I can state some of the practical roles a capacitor has in an electrical circuit
- ◯ I can calculate the total capacitance of multiple capacitors in parallel
- ◯ I can calculate the total capacitance of multiple capacitors in series
- ◯ I can describe how capacitors charge up and discharge, and how this makes them useful in a circuit
- ◯ I can calculate the time constant of a capacitor, using the resistance and capacitance
- ◯ I can describe what the value of the time constant tells us about the charge/discharge of a capacitor
- ◯ I can calculate the energy stored in a capacitor

Inductors in DC Circuits

- ◯ I can describe **magnetic flux**, and state the direction it travels in, relative to the north and south pole of a magnet
- ◯ I can describe the flux density in terms of magnetic flux
- ◯ I can state the symbols and units of magnetic flux, flux density and area.
- ◯ I can calculate the magnetic flux or flux density using the formula: $\Phi = BA$
- ◯ I can describe **electromagnetic induction**
- ◯ I can explain, in detail, how electricity can be generated using electromagnetic induction
- ◯ I can use the **Right Hand Thumb** rule to find the direction of a magnetic field from the positive charge current flow
- ◯ I can use the Right-Hand Slap rule to state the direction of induced current from the direction of movement and the direction of the magnetic field
- ◯ I can calculate the electromotive force from the change in magnetic flux using the formula: $\varepsilon = \frac{-\Delta\Phi}{\Delta t}$
- ◯ I can explain how **self-inductance** occurs, and how the structure of an inductor gives it its function
- ◯ I can discuss the concept of **back EMF**
- ◯ I can state **Lenz's Law**
- ◯ I can describe the structure of an inductor
- ◯ I can describe inductor function
- ◯ I can state the symbol and unit for inductance
- ◯ I can calculate the time constant inductor, using the resistance and inductance
- ◯ I can describe what the value of the time constant tells us about the change in current caused by an inductor
- ◯ I can calculate the energy stored in an inductor
- ◯ I can describe the structure of a transformer
- ◯ I can describe transformer function
- ◯ I can explain the difference between a **step-down transformer** and a **step-up transformer**
- ◯ I can discuss why transformers are not 100% efficient, and how energy loss occurs
- ◯ I can calculate the number of primary coils, number of secondary coils, primary voltage and secondary voltage using the formula: $\frac{N_p}{N_s} = \frac{V_p}{V_s}$

AC Circuits

- ◯ I can describe the flow of charge in a direct-current **(DC) circuit**
- ◯ I can describe the flow of charge in an alternating-current **(AC) circuit**
- ◯ I can compare the behaviour of resistors in AC and DC circuits
- ◯ I can compare the behaviour of capacitors and inductors in AC and DC circuits
- ◯ I can define the **reactance** of AC circuits
- ◯ I can calculate the reactance of a capacitor and the reactance of an inductor
- ◯ I can calculate the peak voltage from the root mean square voltage
- ◯ I can calculate the peak current from the root mean square current
- ◯ I can define the **frequency** and **period** of an AC circuit
- ◯ I can define the i**mpedance** of an AC circuit
- ◯ I can calculate the impedance of a circuit
- ◯ I can describe a **phasor**
- ◯ I can draw a phasor diagram for current and voltage in AC capacitive and AC inductive circuits
- ◯ I can discuss **resonance** and its importance, and explain when the resonant frequency occurs

