PRACTICAL ELECTRONICS

COURSE 565: 5 DAYS: Max 8 Candidates

A basic electronics course for candidates who wish to explore the fundamental building blocks of electronics. The course employs a practical approach based on simple explanations and hands-on exercises. A good precursor to the electronics fault finding (570) course.

PARTICIPANTS

The course is intended for anyone interested in the electronics field and assumes no prior knowledge or for those that have studied the theory of electronic components and circuitry but have little experience of the practical application of that knowledge. Academic students of, for example ONC, HNC or HND electronics often find that this course provides the perfect complement to their studies.

COURSE PRESENTATION

The course provides participants with an understanding of the various commonly-used electronic components and how they would be employed in practical electronic circuits. Participants then build circuits incorporating these components and explore the functionality of them. We then make modifications to the circuit parameters by changing component values and measuring the effects. The course progresses from basic discrete electronic components like transistors and by the end of the course reaches components like analogue to digital converters (ADCs).

COURSE OBJECTIVES

On completion of the course, participants will be able to

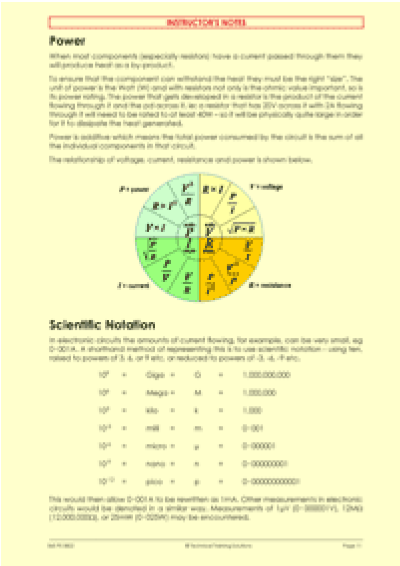
- read electronic circuit diagrams and build small circuits
- understand the operation of electronic components within circuits
- determine the optimum / required values of circuit components
- use electronic test equipment to analyse circuits (oscilloscopes, logic probes, function generators etc)
- design and build an electronic circuit that incorporates ADCs, digital logic, analogue operational amplifiers and associated discrete components.

Successful completion of the course leads to the award of the Technical Training Solutions Certificate of Competence 565: Practical Electronics.

What do candidates on the Practical Electronics course actually do?

We begin with a recap of electrical principles. We remind the candidates about ohm's law, the power law, series and parallel networks, etc. Some of the candidates will have studied these before but we need to make sure everyone has the basic understanding before we proceed.

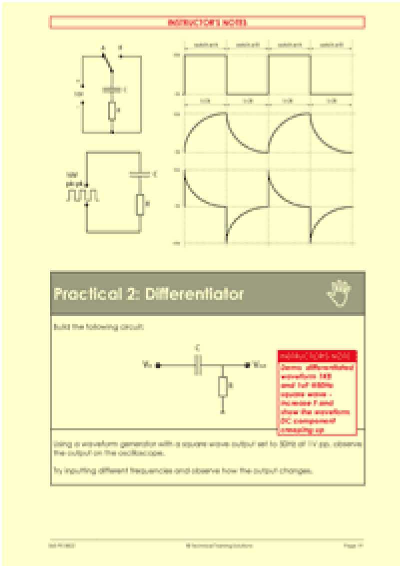
Then we look at capacitors and inductors, how they work and how they can be used, then look at low and high pass filter networks. We build some of these networks then test them with the function generators to see what sort of frequency response they have. We finish the first day by looking at semiconductors and LEDs.


INSTRUCTOR'S NOTES

Power

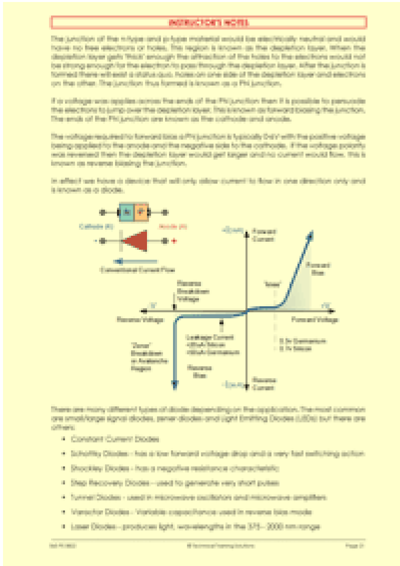
Scientific Notation

Page 11 of the Practical Electronics course notes, discussing the complex forms of Ohm's law


INSTRUCTOR'S NOTES

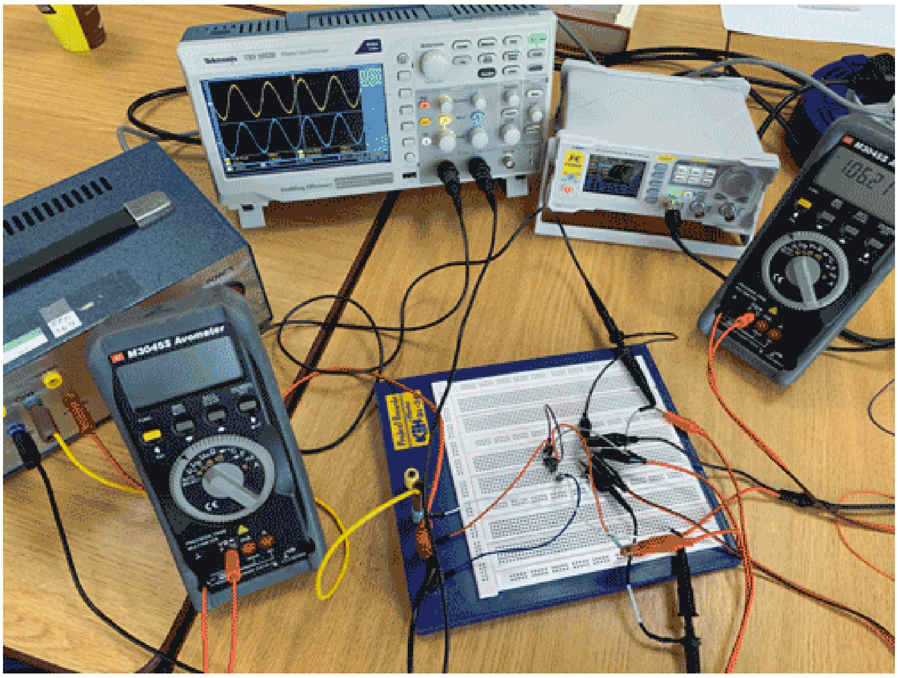
Practical 2: Differentiator

Page 19 of the Practical Electronics course notes, exploring how integrators and differentiators work


INSTRUCTOR'S NOTES

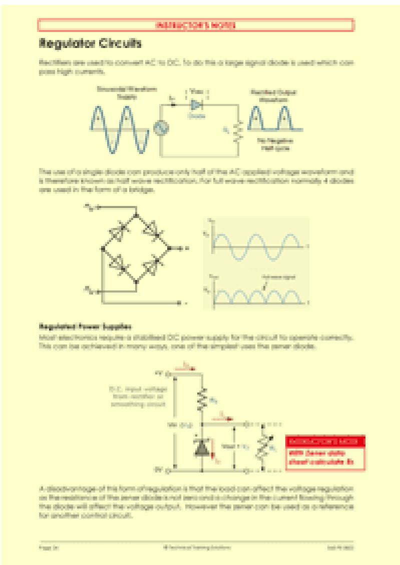
Page 21 of the Practical Electronics course notes, where we look at the various types of LEDs in common use

At strategic points on the course we do practical exercises that reinforce or explore the technical issues. These circuits are built on our breadboards and each candidate has their own test equipment including oscilloscope, multimeter, function generator and power supply, etc.



The test gear that each candidate uses

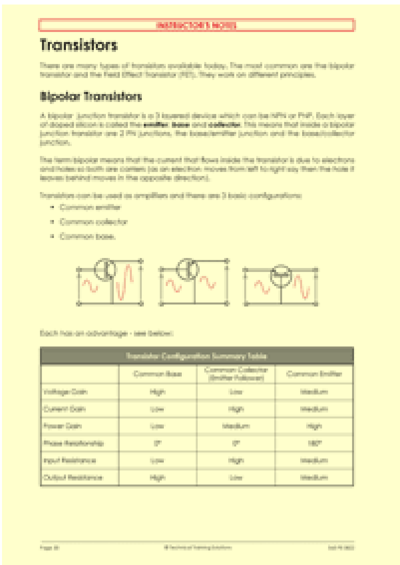
Next we look at rectification, voltage regulators and transistors. We look at how these circuits might be integrated to form a full power supply unit. We build various circuits to explore and prove the operation of these circuits.


INSTRUCTOR'S NOTES

Regulator Circuits

Regulated Power Supplies

Page 24 of the Practical Electronics course notes, exploring rectification and shunt regulation


INSTRUCTOR'S NOTES

Transistors

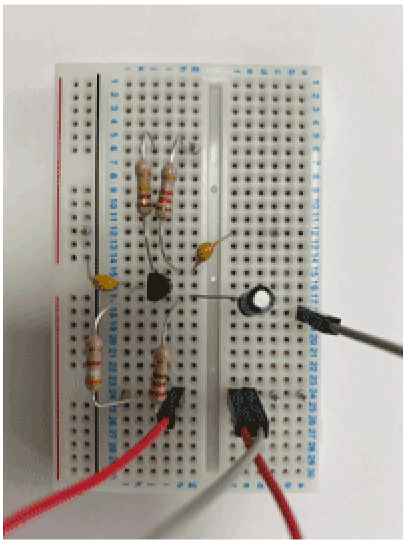
Bipolar Transistors

- Common emitter
- Common collector
- Common base.

Each has an advantage - see below:

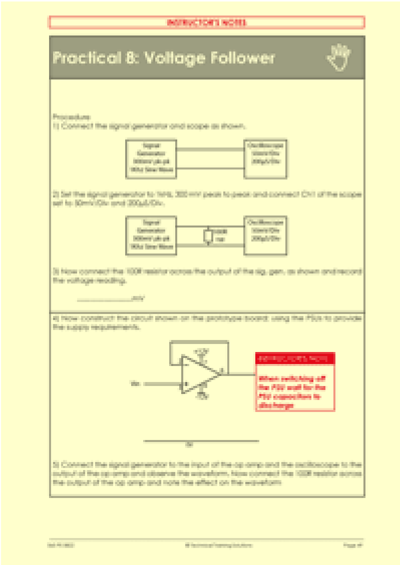
Transistor Configuration Summary Table			
	Common Base	Common Collector (Emitter Follower)	Common Emitter
Voltage Gain	High	Low	Medium
Current Gain	Low	High	Medium
Power Gain	Low	Medium	High
Phase Relationship	0°	0°	180°
Input Resistance	Low	High	Medium
Output Resistance	High	Low	Medium

Page 30 of the Practical Electronics course notes, discussing how transistors are biased and what modes they are used in

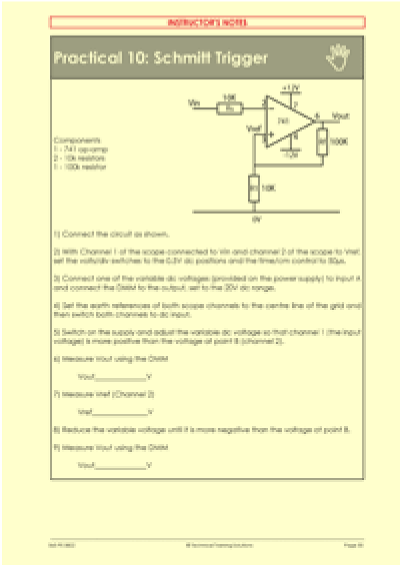


One of the practical exercises where our candidates build a single stage Class A transistor amplifier

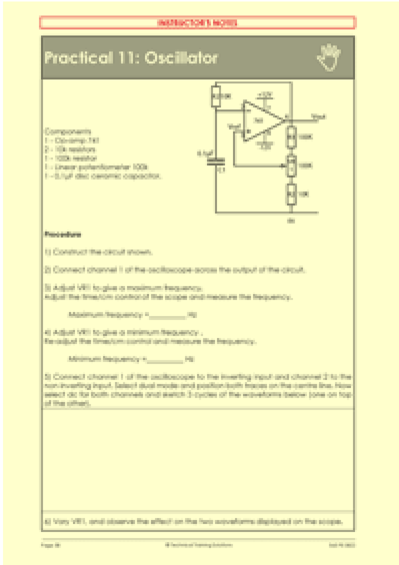
Op-amps are used in many electronics circuits, hence it's important that our candidates gain a proper insight into their uses, configurations, limitations and applications. We look at op-amp circuits like comparators, inverting amplifiers, summing amplifiers, buffers, ac amplifiers, schmitt triggers, oscillators and integrators.



Page 49 of the Practical Electronics course notes, where we do a practical exercise building a voltage follower circuit

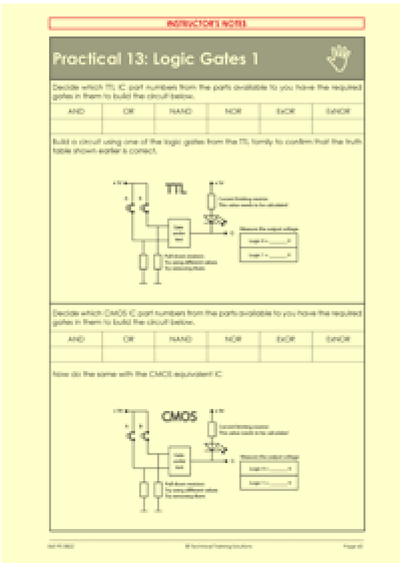


Page 55 of the Practical Electronics course notes, where we do a practical exercise building a schmitt trigger

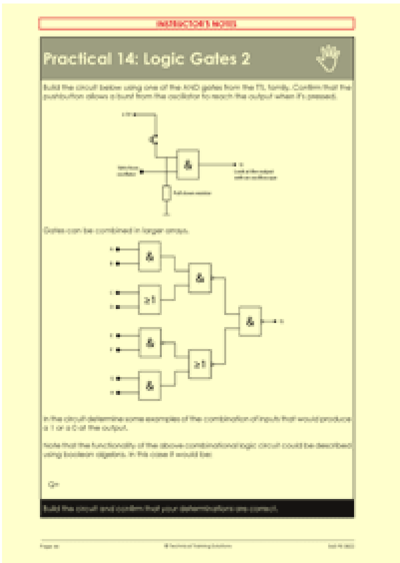


Page 58 of the Practical Electronics course notes, where we do a practical exercise building an oscillator

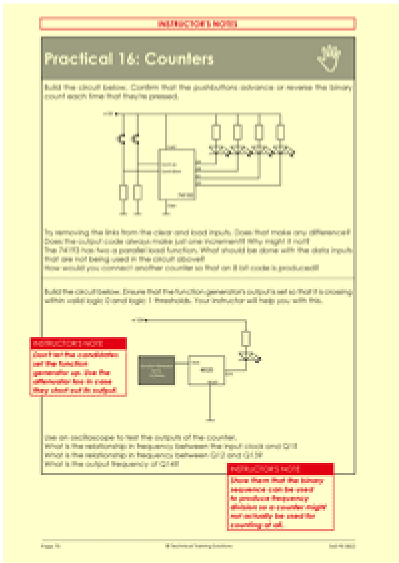
Then we look at digital logic circuits. We look at the main logic families (TTL and CMOS), studying their input and output stages, the common gates that are available, and the more complex functions that are used.



Page 65 of the Practical Electronics course notes, where we do a practical exercise exploring the worst-case logic levels of TTL and CMOS

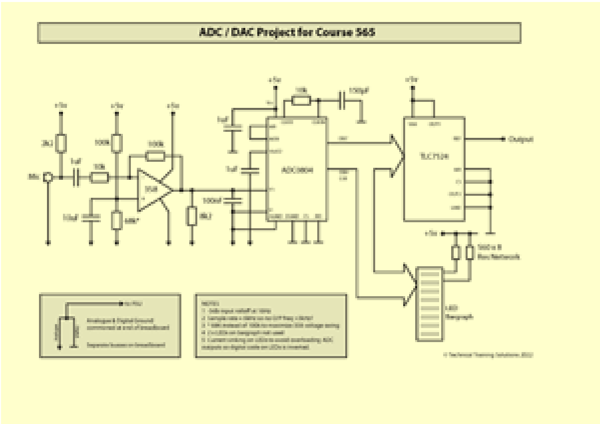


Page 66 of the Practical Electronics course notes, where we do a practical exercise looking at how logic gates can be combined to produce complex functions

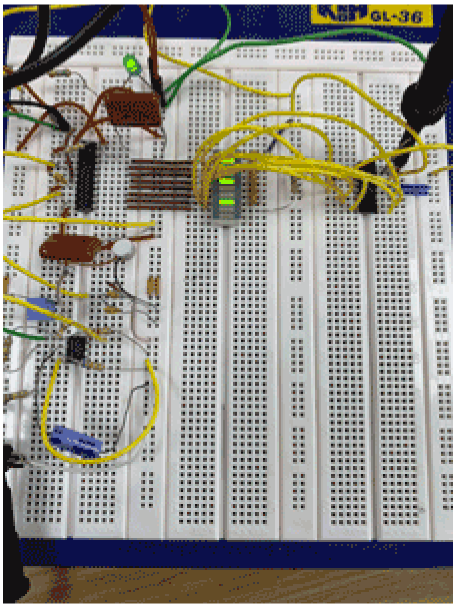


Page 70 of the Practical Electronics course notes, where we do a practical exercise getting a digital counter to increment and decrement its values

The last part of our course sets the candidates the task of bringing all of the above experience together when they design and build a circuit that incorporates an analogue front end to amplify a microphone, an analogue to digital converter (ADC) to convert this into a digital data stream and a digital to analogue converter (DAC) that converts this data back into a signal that we can amplify to drive a speaker. In order to do this the candidates need to study the data sheets for the devices that we want them to use. Each candidate will progress differently in this exercise but we expect all of them to get a basic circuit working - with the help of our instructor of course. The following is an example of what they might produce:



An example of the circuit that candidates might design



An example of the circuit on its breadboard

If you would like to see some of the equipment used on the Practical Electronics training course for yourself, then please call us to arrange a visit to our offices in Kent. Alternatively, we can visit you anywhere in the British Isles.

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