GCSE Electronics - Volume Two - Analogue, Digital And Radio Circuits
Course Summary Sheet

General Overview

Comprehensive delivery of the course material is achieved through dividing the content into nine sections. The student is encouraged to work through each section, rather than rapidly move from one to another, thus maintaining cognitive flow. The text is fully narrated and supported by high quality graphics and 3D animations.

Virtually immediate feedback is given by means of regular tests. Worked solutions are available when required. Mock examinations consist of 4 papers each of 12 questions. Following computer assessment, model solutions may be viewed. Unlimited attempts at each paper are possible.

There are 4 virtual laboratories which test the users knowledge and skill. They involve finding faults in logic circuits, building an inverting operational amplifier to give a specified gain, building a power supply and designing a transistor amplifier.

As an addition to the course content, the CD contains a Demo version of "Crocodile Clips", a powerful simulator of electronic and electro-mechanical circuits and systems. As well as being able to experiment with the simulator, using the prepared examples, there are links to the simulator at appropriate points in the course through which the student can observe simulations of the circuit being discussed.

Course Material Overview

Section 1: ***Test Instruments And Measurements***

Material Covered
- The Ammeter
- Units for measuring current
- An ideal ammeter
- The Voltmeter
- Units for measuring voltage
- The loading effect of a voltmeter
- A practical voltmeter
- Multimeters
- The ohmmeter
- The Cathode Ray Oscilloscope
- Waveforms
- Root Mean Square
- Amplitude
- Frequency

Interactive Exercises
- Multimeter switching
- Using an ohmmeter
- Cathode Ray Oscilloscope controls
- Comparing the power from an A.C. and D.C. power supply
- Numerical questions with worked solutions provided when required

Section 2: ***Mains Operated Power Supplies***

Material Covered
- The Transformer
- The Rectifier
- The Half-Wave Rectifier
- The Full-Wave Rectifier
- Smoothing the output
- Reducing the ripple
- Effect of the load resistor on output voltages
- Stabilising power supplies
- A stabilising circuit

Course material Overview (cont'd)

Section 3: ***Digital Electronics and Logic Gates***

Material Covered
- Digital electronics
- Logic gates
- Truth tables
- Combining logic gates
- Logic gates in Control Systems
- Binary arithmetic
- Converting binary to decimal/decimal to binary
- Binary counting
- Adding binary
- The Half Adder Circuit
- Logic technologies
- The Schmitt Trigger
- Interfacing with discrete components

Interactive Exercises
- Interactive circuit examples
- Truth table interactions
- Numerical calculations
- Half Adder circuit drag and drop

Section 4: ***Microprocessor Systems***

Material Covered
- Dedicated and general purpose systems
- Block diagram of a microprocessor system
- Programs (including a simple machine code program)
- Analogue and digital data

Interactive Exercises
- Analogue to digital converter
- Demonstration of a microprocessor system with analogue and digital inputs

Section 5: ***Amplifiers***

Material Covered
- The Transistor Amplifier
- Transistor Characteristics
- Common Emitter amplifier
- Analogue and digital electronics
- Using the linear region to make an amplifier
- Biasing
- Coupling capacitors
- Voltage gain
- Signal distortion
- Emitter Follower
- Increasing the current capability of a stabilised supply

Interactive Exercises
- Investigation into how input and output voltages of the common emitter circuit are related
- Signal distortion demonstration

Course material Overview (cont'd)

Section 6 : *Multivibrators*

Material Covered
- An astable
- Output of an astable
- Clock signals
- The monostable
- Pulse stretching
- Timing with a monostable
- Bistables
- The R-S bistable (including detailed operation of an example)
- The D-Type bistable and using as a Latch
- Toggling a bistable
- A binary counter
- Using a counter to divide frequency
- Using frequency dividers

Interactive Exercises
- Interactive circuit examples
- Building a binary counter

Section 7: *Operational Amplifiers*

Material Covered
- Amplifying the difference voltage
- The inverting amplifier
- The 741 Op. Amp. Integrated circuit
- Using the Op. Amp. as a switch
- Using an Op. Amp. in a stabilised power supply
- The non-inverting amplifier
- Bandwidth, gain and negative feedback

Interactive Exercises
- Investigating an inverting amplifier
- Investigating and demonstrating the comparator
- Investigating a non-inverting amplifier
- Testing the frequency response of an amplifier
- Multiple choice questions

Section 8: *Filters And Radio Circuits*

Material Covered
- The Cross Over circuit
- A tuned circuit
- A.C. circuits
- Resonance
- Using tuned circuits in a radio receiver
- Modulation
- Demodulation
- Filtering out the radio frequency
- A simple radio receiver
- The Superheterodyne Receiver
- Frequency modulation
- Frequency bands
- A radio transmitter

Interactive Exercises
- Investigating filters

Course material Overview (cont'd)

Section 9: ***Electrical Safety***

Material Covered

- Fuses
- Calculating fuse values
- The Earth wire
- Safety when servicing equipment
- Electric shock
- First aid
- Battery operated equipment

Interactive Exercises

- Wiring a mains plug
- Multiple choice question
- What to do if someone suffers an electric shock

Fault Finding Logic Gates Laboratory

A 4-input, 4-output logic circuit is presented. One of the gates in the circuit is faulty. The student can alter the input states and observe the output. By using a logic probe and examining states of the four outputs, it is possible to deduce which gate is faulty.

Building An Operational Amplifier Laboratory

By "Dragging and Dropping" components and wire links onto a prototype "breadboard" the student is able to construct an inverting amplifier to a specified gain.

Building A Power Supply Laboratory

In the first instance, a transformer, rectifier, smoothing capacitor and stabilising circuit must be arranged in the correct order. Then a suitable turns ratio must be selected for the transformer. Following that, the circuit for the bridge rectifier must be designed and a suitable smoothing capacitor selected.

Designing A Transistor Amplifier Laboratory

A common emitter amplifier is to be designed given its current gain and quiescent collector current. The student is required to calculate appropriate base and collector bias resistors. A simulated oscilloscope trace is displayed to allow the student to observe the effect, in terms of signal distortion, of any errors in choice of resistor.