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| **Term**  | **INTENT** | **IMPLEMENTATION** | **IMPACT**  |
| **Substantive Knowledge**Topics to be covered = subject matter to be learned.Note we use Eduqas as out exam board.This should be read in conjunction with the specification, which can be found here: <https://www.eduqas.co.uk/umbraco/surface/blobstorage/download?nodeId=11666>Format: A1 XX = AS text book chapter XX<https://resources.eduqas.co.uk/Pages/ResourceSingle.aspx?rIid=937>Format: A2 YY = A2 text book chapter YY<https://resources.eduqas.co.uk/Pages/ResourceSingle.aspx?rIid=1179> | **Disciplinary Knowledge (Skills)**Most lessons will consist of peer marking the homework from the previous lesson or a starter consisting of an exam question, theory, then practical, which may consist of computer simulation or building circuits in real life. At the end of each topic there will be a formal end of unit test.SEE BELOW FOR A MUCH MORE DETAILED VERSION | **Assessment opportunities**Students will be assessed on homework marks, end of unit tests and trail exams. |
| **The timetable below is based on the 2023/5 lesson planned sequence and is subject to change.** |
| **Year 12 Autumn 1** | **Intro to Electronics. Some material from the A1 Core Concepts and A1 01s chapters will be covered** <https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-core-concepts.pdf>[gce-electronics-book-chapter-1.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-1.pdf) |  |  |
|  | **A1 05 Semiconductor components**[gce-electronics-book-chapter-5.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-5.pdf) |  |  |
|  | **A1 02 Logic systems**[gce-electronics-book-chapter-2.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-2.pdf) |  |  |
| **Autumn 2** | **A1 02 Timing Circuits**[gce-electronics-book-chapter-3.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-3.pdf) |  |  |
|  | **A1 03 Sequential Logic Systems**[gce-electronics-book-chapter-3.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-3.pdf) |  |  |
|  | **A1 04 Operational Amplifiers**[gce-electronics-book-chapter-4.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-4.pdf) |  |  |
| **Spring 1** | **A1 04 Operational Amplifiers continued**[gce-electronics-book-chapter-4.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-4.pdf) |  |  |
|  | **A1 06 Microcontrollers (Physical computing using flowchart interpreter)**[gce-electronics-book-chapter-6.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-6.pdf) |  |  |
| **Spring 2** | **A1 07 Mains Power Supplies**[gce-electronics-book-chapter-7.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-7.pdf) |  |  |
|  | **A2 01 Further Sequential Logic Systems**[gce-electronics-book-chapter-1.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-1.pdf) |  |  |
| **Summer 1** | **A2 04 AC Circuits**[gce-electronics-book-chapter-4.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-4.pdf) |  |  |
|  | **A2 05 Signal conversion (Analogue to digital conversion)**[gce-electronics-book-chapter-5.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-5.pdf) |  |  |
| **Summer 2** | **A2 09 Communications systems (intro to sending data long distance)**[gce-electronics-book-chapter-9.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-9.pdf) |  |  |
|  | **A2 02 Further Mains Power Supplies**[gce-electronics-book-chapter-2.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-2.pdf) |  |  |
|  | **A2 08 High Power Switching Systems**[gce-electronics-book-chapter-8.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-8.pdf) |  |  |
| **Year 13 Autumn 1** | **Start of year test****Past papers** [AS and A Level Electronics | Eduqas](https://www.eduqas.co.uk/qualifications/electronics-as-a-level/#tab_pastpapers) |  |  |
|  | **A2 10 Wireless Transmission (Intro to radio communications)**[gce-electronics-book-chapter-10.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-10.pdf) |  |  |
|  | **A2 07 Instrumentation Systems (differential op amps, encoders and strain gauges)**[gce-electronics-book-chapter-7.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-7.pdf) |  |  |
|  | **A2 11 Digital Communications (Intro to data links)**[gce-electronics-book-chapter-11.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-11.pdf) |  |  |
|  | **A2 12 Optical Communications (Intro to fibre optic communications)**[gce-electronics-book-chapter-12.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-12.pdf) |  |  |
| **Autumn 2** | **A2 06 Audio Systems**[gce-electronics-book-chapter-6.pdf\_(wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-6.pdf) |  |  |
|  | **A2 03 Further Microcontrollers (assembly language physical computing)**[gce-electronics-book-chapter-3.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-3.pdf) |  |  |
|  | **A2 13 Further Semiconductors (how PN junctions & FETs work)**[gce-electronics-book-chapter-13.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-13.pdf) |  |  |
|  | **Assembly language coursework (NEA 1)** |  |  |
| **Spring 1** | **Main project (NEA 2)**  |  |  |
| **Spring 2** | **Main project (NEA 2) continued** |  | **As above** |
| **Easter 1** | **NEA 1 & 2 hand in** |  |  |
|  | **Revision** |  |  |
| **Easter 2** | **Revision** |  |  |
|  | **Exams** |  |  |

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| **Term**  | **INTENT** | **IMPLEMENTATION** | **IMPACT**  |
| **Substantive Knowledge**Topics to be covered = subject matter to be learned.Note we use Eduqas as out exam board.This should be read in conjunction with the specification, which can be found here: <https://www.eduqas.co.uk/umbraco/surface/blobstorage/download?nodeId=11666>Format: A1 XX = AS text book chapter XX<https://resources.eduqas.co.uk/Pages/ResourceSingle.aspx?rIid=937>Format: A2 YY = A2 text book chapter YY<https://resources.eduqas.co.uk/Pages/ResourceSingle.aspx?rIid=1179> | **Disciplinary Knowledge (Skills)**Most lessons will consist of peer marking the homework from the previous lesson or a starter consisting of an exam question, theory, then practical, which may consist of computer simulation or building circuits in real life. At the end of each topic there will be a formal end of unit test.This document has been produced in two lengths at the request of Beths’ leadership team. The first is the short version with links to the chapters and the specification.The second is the same document with the key passages from the specification cut, pasted and formatted to fit.I would be interested to find out which version is most useful to you – please do email me at mrmorgan AT beths.bexley.sch.uk | **Assessment opportunities**Students will be assessed on homework marks, end of unit tests and trail exams. |
| **The timetable below is based on the 2023/5 lesson planned sequence and is subject to change.** |
| **Year 12 Autumn 1** | **Intro to Electronics. Some material from the A1 Core Concepts and A1 01s chapters will be covered** <https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-core-concepts.pdf>[gce-electronics-book-chapter-1.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-1.pdf)*This first unit in Year 12 builds from the prior knowledge from the work covered in Year 11 in the ‘Electricity’ module and enable students to build a step-by-step approach to more complex systems*At the end of this topic you should be able to: • recognise that electronic systems are assembled from sensing, processing and output sub-systems; • state the need for and use driver sub-systems; • design, analyse or modify a block diagram of a system. | distinguish between electrical charge, current and voltage; • distinguish between energy supplied and power rating; • recall and use the formula: P=I × V; • distinguish between conductors, insulators and semiconductors in terms of their electrical conduction properties; • distinguish between series and parallel connections; • recall that ammeters are connected in series with the component under investigation, that voltmeters are connected in parallel with the component under investigation and that multimeters combine the functions of ammeter and voltmeter | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A1 05 Semiconductor components**[gce-electronics-book-chapter-5.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-5.pdf) | 1. SEMICONDUCTOR COMPONENTSOverviewThis topic covers the construction of semiconductors in terms of n-type and p-typematerials and the processes at a p-n junction and looks at the use of a range ofdiodes and transistors.Electronic skillsThe topic gives learners the opportunity to explore the action of several types ofdiodes and npn bipolar and MOSFET transistors. Learners will also work withvarious semiconductor devices and calculate values using component data andgraphs.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal and standardform; estimating results; using an appropriate number of significant figures; changingthe subject of an equation; and translating information between graphical, numericaland algebraic forms.Learners should be able to:(a) recall the conduction processes in n- and p-type semiconductors in terms ofelectrons and holes(b) recall conduction processes at a p-n junction, the reasons for the difference inthe conducting properties of a p-n diode in the different directions and explainthe operation of an LED(c) recall the principles of operation of a photodiode(d) explain the properties of an n-channel enhancement mode MOSFET in termsof the effects of bias voltage on the conducting channel (pinching)(e) describe the use of light-emitting diodes, silicon diodes and zener diodes inelectronic systems and using data, including interpreting and sketchingcharacteristic graphs to carry out relevant calculations on circuits containingthese devices(f) calculate series resistor values for LED circuits and select appropriate zenerdiodes(g) describe the use of n-channel enhancement mode MOSFETs and npn bipolartransistors in switching circuits, using data to select suitable components forcircuits(h) define gM as the gradient of an ID-VGS graph.(i) select and apply the equationsIC . hFE.IB bipolar transistorD M GS I . g (V .3) MOSFET2D DSon P . I r power dissipated in a MOSFET. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A1 02 Logic systems**[gce-electronics-book-chapter-2.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-2.pdf) | 2. LOGIC SYSTEMSOverviewThis topic involves the study of logic gates in control. Learners will look at the typesof logic gates and their function, develop combinations of logic gates to perform otherlogic functions and to solve set tasks. Methods for simplifying logic systems will alsobe developed.Electronic skillsThis topic involves learners exploring the use of logic to control systems. Learnerswill work with different types of logic gates, understand how to connect and combinethem to create different functions. They will use several methods to examine theworkings of logic systems and be able to simplify these systems.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in Boolean algebra;simplifying logic systems using Boolean algebra, Karnaugh maps and multiplexers;and translating information between graphical, numerical and algebraic forms.Learners should be able to:(a) identify and use NOT; 2 and 3-input AND, NAND, OR, NOR, XNOR and XORlogic gates(b) construct, recognise and use truth tables for these gates and simplecombinations of them(c) use combinations of one or more types of gate to perform other logic functionsincluding NAND-gate simplification(d) simplify logic systems using Boolean algebra, Karnaugh maps andmultiplexers(e) design and construct circuits containing logic gates, with consideration tosourcing, sinking, pull-up and pull-down resistors | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
| **Autumn 2** | **A1 02 Timing Circuits**[gce-electronics-book-chapter-3.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-3.pdf) | TIMING CIRCUITSOverviewThis topic develops the use of RC circuits to create time delays and their use in thecreation of mono and astable timing circuits.Electronic skillsThis topic gives learners the opportunities to explore the charging and discharging ofa RC network and its application in debouncing switches. Learners also investigatethe operation of a 555 timer IC in monostable and astable circuits throughcalculation, modelling and simulation. They will also study astable circuits basedupon Schmitt triggers.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal and standardform; using an appropriate number of significant figures; changing the subject of anequation; substituting numerical values into algebraic equations using appropriateunits for physical quantities; using calculators to find and use power, exponential andlogarithmic functions; solving simple algebraic equations; translating informationbetween graphical, numeric and algebraic form; plotting two variables fromexperimental or other data; interpreting and plotting logarithmic plots; interpret datapresented in graphical form; and changing the subject of an equation.Learners should be able to:d) calculate values of T, R and C for a charging / discharging capacitor by usinga graph (including log graphs)(e) use a RC circuit in debouncing switches(f) recall the properties of monostable circuits(g) explain the use of a monostable circuit in conjunction with a RC network in atime-delay circuit(h) recall the properties of an astable circuit and its use as a pulse generator | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A1 03 Sequential Logic Systems**[gce-electronics-book-chapter-3.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-3.pdf) | OPERATIONAL AMPLIFIERSOverviewThis topic develops the uses of operational amplifiers (op-amps) and how they canbe connected for different purposes. It involves the study of gain and outputscalculated from different inputs and resistor values and looks at bandwidth, distortionand slew-rate.Electronic skillsThis topic gives learners the opportunity to explore the different types of op-ampsthrough modelling or simulation and to compare results to expected estimations andcalculated results.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal and standardform; understanding and using the symbols: =,<,<<,>>,>,˜,.; estimating results;using an appropriate number of significant figures; making order of magnitudecalculations; translating information between graphical and numerical form;interpreting data presented in graphical form; and changing the subject of anequation.Learners should be able to:(a) recall the characteristics of an ideal op-amp and be aware that these may bedifferent for a typical op-amp(b) recognise that the voltage difference between the two inputs of an op-ampwith negative feedback is virtually zero (resulting in a virtual earth if one of theinputs is at 0 V) provided the output is not saturated(c) explain the use of an op-amp in a comparator circuit(d) recall how the output state of a comparator depends upon the relative valuesof the two input states and design comparator switching circuits(e) recall and apply the conditions for the balance of a bridge circuitand apply the equation(g) draw, recognise and recall the characteristics of the following op-amp circuits:. non-inverting amplifier. inverting amplifier. summing amplifier. comparator. voltage follower circuit(h) select and apply the following equations for op-amp circuits:(j) relate the input impedance of an op-amp to its configuration(k) recall that the bandwidth is the frequency range over which the voltage gain isfrequency response curve and use the gain-bandwidth product (unity gainbandwidth) to estimate bandwidth(l) design single stage amplifiers based on inverting and non-inverting voltageamplifiers to achieve a specified voltage gain or bandwidth;(m) explain how clipping and slew-rate can lead to distortion(n) select and apply the equations | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A1 04 Operational Amplifiers**[gce-electronics-book-chapter-4.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-4.pdf) | OPERATIONAL AMPLIFIERSOverviewThis topic develops the uses of operational amplifiers (op-amps) and how they canbe connected for different purposes. It involves the study of gain and outputscalculated from different inputs and resistor values and looks at bandwidth, distortionand slew-rate.Electronic skillsThis topic gives learners the opportunity to explore the different types of op-ampsthrough modelling or simulation and to compare results to expected estimations andcalculated results.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal and standardform; understanding and using the symbols: =,<,<<,>>,>,˜,.; estimating results;using an appropriate number of significant figures; making order of magnitudecalculations; translating information between graphical and numerical form;interpreting data presented in graphical form; and changing the subject of anequation.Learners should be able to:(a) recall the characteristics of an ideal op-amp and be aware that these may bedifferent for a typical op-amp(b) recognise that the voltage difference between the two inputs of an op-ampwith negative feedback is virtually zero (resulting in a virtual earth if one of theinputs is at 0 V) provided the output is not saturated(c) explain the use of an op-amp in a comparator circuit(d) recall how the output state of a comparator depends upon the relative valuesof the two input states and design comparator switching circuits(e) recall and apply the conditions for the balance of a bridge circuit(g) draw, recognise and recall the characteristics of the following op-amp circuits:. non-inverting amplifier. inverting amplifier. summing amplifier. comparator. voltage follower circuit(j) relate the input impedance of an op-amp to its configuration(k) recall that the bandwidth is the frequency range over which the voltage gain isfrequency response curve and use the gain-bandwidth product (unity gainbandwidth) to estimate bandwidth(l) design single stage amplifiers based on inverting and non-inverting voltageamplifiers to achieve a specified voltage gain or bandwidth;(m) explain how clipping and slew-rate can lead to distortion(n) select and apply the equations | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
| **Spring 1** | **A1 04 Operational Amplifiers continued**[gce-electronics-book-chapter-4.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-4.pdf) | **As above** |  |
|  | **A1 06 Microcontrollers (Physical computing using flowchart interpreter)**[gce-electronics-book-chapter-6.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-6.pdf) | MICROCONTROLLERSOverviewThis topic covers the microcontroller as a programable integrated circuit (PIC) and itsinternal structure. It also covers how microcontrollers are interfaced and programedthrough flowcharts and assembler language to perform tasks.Electronic skillsLearners will have the opportunity in this topic to work with microcontrollers,interfacing them to inputs and outputs and programing them to perform set tasks.Learners will also use both flowcharts and assembler language to program themicrocontrollers and look at the application of microcontrollers.Mathematical skillsThere are some opportunities for the development of mathematical skills in this topic.These include: converting between binary and decimal number systems; and drawingand interpreting flowcharts.Learners should be able to:(a) analyse and design flowchart programs to program microcontrollers(b) recall and describe the structure of a PIC microcontroller as programmableassemblies of memory, input ports, output ports, CPU, clock and reset(c) recall and explain the use of interrupts to allow an external device to beserviced on request(d) recall and describe the application of a PIC microcontroller(e) analyse, design and program PIC microcontroller-based circuits usingassembler language. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
| **Spring 2** | **A1 07 Mains Power Supplies**[gce-electronics-book-chapter-7.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2016-17/16-17_1-9/gce-electronics-book-chapter-7.pdf) | MAINS POWER SUPPLY SYSTEMSOverviewThis topic explores power supplies with half and full wave rectification, the use ofcapacitors and load and line regulation. The topic also involves the analysis anddesign of regulators based upon a zener diode, a transistor emitter follower and anon-inverting amplifier.Electronic skillsThis topic gives learners opportunities to model and simulate half and full waverectification, by examining the effect of capacitors and loads on the output of simplepower supplies. Learners have the opportunity to construct and test a range ofvoltage regulators consisting of a zener diode, a transistor emitter follower or noninvertingamplifier.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal and standardform; using an appropriate number of significant figures; making order of magnitudecalculations; changing the subject of an equation; translating information betweengraphical and numerical form; and interpreting data presented in graphical form.Learners should be able to:(a) recall the use of diodes for half-wave and full wave rectification(b) describe the effect of capacitors and loads on the output of a simple powersupply(c) select and apply the ripple voltage equation(d) design zener regulated power supplies and draw graphs to show the effect ofloading(e) distinguish between load regulation and line regulation(f) analyse and design a voltage regulator based upon a zener diode, a transistoremitter follower and a non-inverting amplifier(g) select and apply the gain equation | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A2 01 Further Sequential Logic Systems**[gce-electronics-book-chapter-1.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-1.pdf) | SEQUENTIAL LOGIC SYSTEMSOverviewThis topic covers latches based on NAND gates and propagation delays in sequentialsystems. It involves the study of characteristics and uses for a range of systemsbased on D-type flip-flops, dedicated 4-bit counters, 2 digit decimal counter andsynchronous counter systems.Electronic skillsThis topic expands on the logic systems topic, which gives learners furtheropportunities to design and analyse sequential logic systems. Learners will alsoexplore a range of uses for D-type flip-flops.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in Boolean algebra;simplifying logic systems using Boolean algebra, Karnaugh maps and multiplexers;translating information between graphical, numerical and algebraic forms,constructing and using timing diagrams; and converting between binary, decimal,hexadecimal and binary-coded decimal (BCD) number systems.Learners should be able to:(a) design and describe the action of a Set-Reset (SR ) latch based on NANDgates(b) describe the significance of propagation delays in sequential systems(c) construct and use timing diagrams to explain the operation of sequential logiccircuits(d) recall the characteristics and uses of the inputs and outputs of D-type flipflopsfor:. transition gates. frequency divider circuits. asynchronous counters. parallel-in-series-out (PISO) registers. series-in-parallel-out (SIPO) registers. synchronous counters(e) design systems that use a dedicated 4-bit counter and combinational logic toproduce a sequence of events(f) design and analyse a 2 digit decimal counting system(g) convert between binary, decimal, hexadecimal and binary-coded decimal(BCD) number systems(h) design sequence generators based on D-type flip-flops configured assynchronous counters, use state diagrams and explain the significance ofstuck and unused states, including Boolean manipulation to produce simplersolutions. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
| **Summer 1** | **A2 04 AC Circuits**[gce-electronics-book-chapter-4.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-4.pdf) | AC CIRCUITS AND PASSIVE FILTERSOverviewThis topic involves the study of resistive loads for AC circuits and impedance topassive filters. High-pass and low-pass passive RC filters and passive LC band-passfilters are also included.Electronic skillsThis topic allows learners to explore the use of capacitors and inductors in ACcircuits and their use to form filters. Filters are further investigated to see how theycan be adapted for different uses.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal and standardform; calculating squares and square roots; using an appropriate number ofsignificant figures; making order of magnitude calculations; understanding and usingthe symbols =, p; changing the subject of an equation; substituting numerical valuesinto algebraic equations using appropriate units for physical quantities; findingarithmetic means; translating information between graphical and numeric form;plotting two variables from experimental or other data; interpreting and plottinglogarithmic plots; and interpreting data presented in graphical form.Learners should be able to:(a) use V-t, I-t and P-t graphs for resistive loads(b) describe the relationship between rms and peak values(c) select and apply the equations to calculate the reactance of capacitors andinductors and the impedance for a series circuit(d) draw, recognise and interpret the output of RC passive filters using linear-logand log-log output graphs and describe the advantage of buffering passivefilters(e) recognise, analyse, design and draw circuits for high-pass and low-passpassive RC filters and passive LC band-pass filters | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A2 05 Signal conversion (Analogue to digital conversion)**[gce-electronics-book-chapter-5.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-5.pdf) | SIGNAL CONVERSIONOverviewThis topic will cover the need for signal conversion and investigate the design anduse of both digital to analogue and analogue to digital signal conversion subsystems.Electronic skillsThis topic allows learners to explore the conversion of digital to analogue signals andanalogue to digital signals by using operational amplifiers. ADC converters arefurther investigated to look at flash and digital ramp ADCs.Mathematical skillsThere are some opportunities for the development of mathematical skills in this topic.These include: recognising and using expressions in decimal and standard form;estimating results; using an appropriate number of significant figures; and changingthe subject of an equation.Learners should be able to:(a) explain the need for signal conversion between analogue and digital form incommunications and microprocessors(b) describe how an op-amp summing amplifier can be used as a DAC to converta digital signal into an analogue signal(c) analyse and design a DAC based upon an op-amp summing amplifier to meeta given specification(d) describe how comparators can be used as an ADC to convert an analoguesignal into a digital signal(e) describe the process of digitising audio signals and explain the effects ofsampling rate and resolution(f) analyse and design a flash converter ADC based on comparators and priorityencoders to meet a specification and describe the factors affecting theresolution(g) select and apply the equation for calculating the resolution of a n-bit flashConverter(h) compare the difference of a digital ramp ADC and a flash ADC. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
| **Summer 2** | **A2 09 Communications systems (intro to sending data long distance)**[gce-electronics-book-chapter-9.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-9.pdf) | COMMUNICATIONS SYSTEMSOverviewThis topic involves the study of communication systems and provides a basicunderstanding of communication systems to develop in wireless transmission, digitalcommunication and optical communication topics.Electronic skillsThis topic allows learners to explore communications systems. Learners will look atthe concept of communication and the structure of communication systems. Thisprogresses to exploring data transmission through calculation of bandwidth, data rateand gain. Learners will also be introduced to the concepts of noise and distortion.Mathematical skillsThere are some opportunities for the development of mathematical skills in this topic.These include: translating information between graphical and numeric form; changingthe subject of an equation; substituting numerical values into algebraic equations;using decibel notation and logarithmic functions; using appropriate units for physicalquantities; and interpreting data presented in graphical form.Learners should be able to:(a) recall that communication is the transfer of meaningful information from onelocation to another(b) recall the structure of a simple communication system consisting of:information source, transmitter/encoder, transmission medium,amplifier/regenerator receiver/decoder and information destination(c) recall and explain the relationship between bandwidth, data rate andinformation-carrying capacity and select and apply the equations(d) explain the need to multiplex a number of signals onto one transmissionmedium and describe the principles of frequency and time divisionmultiplexing(e) describe the role of filters in communication systems(f) use the decibel scale to express power gain in amplifiers/attenuation intransmission media and select and apply the equation(g) differentiate between noise and distortion(h) calculate the total gain in a communication system given the power gain orattenuation of its component parts(i) state what is signal to noise ratio and select and apply the equations(j) state what signal attenuation is and describe the significance of signalattenuation (in dB) for the signal-to-noise ratio. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A2 02 Further Mains Power Supplies**[gce-electronics-book-chapter-2.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-2.pdf) | Continuation of Mains Power Supplies | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A2 08 High Power Switching Systems**[gce-electronics-book-chapter-8.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-8.pdf) | HIGH POWER SWITCHING SYSTEMSOverviewThis topic involves the study of high power switching for both DC/AC loads. It coversthe use and application of thyristors, diacs and triacs for high power switching.Electronic skillsThis topic gives opportunities for learners to model and simulate switching circuits forboth DC and AC systems.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal and standardform; using calculators to find and use power, exponential and tan functions;estimating results; using an appropriate number of significant figures; making order ofmagnitude calculations; changing the subject of an equation; translating informationbetween graphical and numerical form; and interpret data presented in graphicalform.Learners should be able to:(a) describe the advantages of using thyristors and triacs to switch high powerDC/AC loads respectively, compared to using a transistor or a relay(b) recall the general thyristor characteristics, the conditions under which athyristor conducts and explain the significance of the following terms:holding current, minimum gate voltage, minimum gate current(c) design DC thyristor switching circuits and explain the process of capacitorcommutation(d) draw the circuit diagram and analyse graphs for an AC phase control circuit,using a RC network, a triac and a diac(e) select and apply the equationto calculate the phase shift between supply voltage and capacitor voltage. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
| **Year 13 Autumn 1** | **Start of year test****Past papers** [AS and A Level Electronics | Eduqas](https://www.eduqas.co.uk/qualifications/electronics-as-a-level/#tab_pastpapers) |  | **Informs UCAS predicted grades** |
|  | **A2 10 Wireless Transmission (Intro to radio communications)**[gce-electronics-book-chapter-10.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-10.pdf) | WIRELESS TRANSMISSIONOverviewThis topic covers the principles of wireless transmission including amplitudemodulation (AM) and frequency modulation (FM).Electronic skillsThis topic gives learners the opportunity to explore wireless transmission, includingthe radio spectrum for data transmission, bandwidth requirements and availablefrequency channels. Learners will also perform calculations on the different types ofmodulation.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal and standardform; understanding and using the symbols =,.; substituting numerical values intoalgebraic equations; using appropriate units for physical quantities; solving simplealgebraic equations; estimating results; using an appropriate number of significantfigures; making order of magnitude calculations; translating information betweengraphical and numerical form; interpreting data presented in graphical form; andchanging the subject of an equation.Learners should be able to:(a) recall and explain the use of the different regions of the radio spectrum for thetransmission of data, including in terms of bandwidth requirements andavailable frequency channels(b) describe and explain the use of amplitude modulation and frequencymodulation and select and apply the equations(c) sketch, recognise and analyse the resulting waveforms for a sinusoidal carrierbeing amplitude and frequency modulated by a single frequency audio signal. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A2 07 Instrumentation Systems (differential op amps, encoders and strain gauges)**[gce-electronics-book-chapter-7.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-7.pdf) | INSTRUMENTATION SYSTEMSOverviewThis topic draws together the use of op-amps for instrumentation systems, the use ofbridge circuits with thermistors and strain gauges in instrumentation and the use ofslotted and encoded discs.Electronic skillsThis topic enables learners to further explore the op-amp difference amplifier forinstrumentation and the use of bridge circuits with thermistors and strain gauges.Learners also investigate methods of sensing rotational speed and angular positionusing slotted and encoded discs.Mathematical skillsThere are a number of opportunities for the development of mathematical skills in thistopic. These include: recognising and using expressions in decimal form; usingappropriate number of significant figures; changing the subject of an equation;substituting numerical values into algebraic equations using appropriate units forphysical quantities; translating information between graphical and numeric form; andinterpreting data presented in graphical form.Learners should be able to:(a) draw and recognise an op-amp difference amplifier circuit and select andapply the equation(b) analyse and design instrumentation amplifiers based upon the op-ampdifference amplifier circuit(c) describe the use of bridge circuits with thermistors and strain gauges(d) describe the use of the slotted discs (for sensing rotational speed) andencoded discs (for sensing angular position)(e) compare the Gray coding of encoded discs with binary coding(f) design logic system to process the output of slotted and encoded discs. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A2 11 Digital Communications (Intro to data links)**[gce-electronics-book-chapter-11.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-11.pdf) | DIGITAL COMMUNICATIONSOverviewThis topic develops the concepts of digital communication by examining differenttypes of modulation and the regeneration of digital signals. Block diagrams of pulsecode modulation (PCM) systems are used to explain their operation. Also Nyquisttheorem and time division multiplexing (TDM) is introduced.Electronic skillsThis topic enables learners to explore the construction of systems required for digitalcommunications. They will also have opportunity to explore parts of digitalcommunication systems.Mathematical skillsThere are some opportunities for the development of mathematical skills in this topic.These include: translating information between graphical and numeric form; plottingtwo variables from data; and interpreting data presented in graphical formLearners should be able to:(a) analyse and design Schmitt trigger circuits to regenerate a digital signal(b) analyse and draw graphs to illustrate pulse modulation techniques (pulsewidth modulation (PWM), pulse amplitude modulation (PAM), pulse positionmodulation (PPM))(c) draw a block diagram for and describe the operation of a pulse codemodulation (PCM) communication system consisting of:transmitterlow pass filter, sampling gate, sampling clock, ADC, PISO shift register,PISO clockand receiverSchmitt trigger, SIPO shift register, SIPO clock, DAC, low pass filter(d) use the relationship between required sampling frequency to the highestfrequency in the signal and Nyquist theorem(e) describe how time division multiplexing (TDM) can be used to improve theuser capacity of a PCM communications link(f) state the limitation on the number of channels that can be incorporated into aPCM communications link, using TDM and use given data to calculate howmany channels can be incorporated into a PCM communications link, usingTDM. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A2 12 Optical Communications (Intro to fibre optic communications)**[gce-electronics-book-chapter-12.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-12.pdf) | OPTICAL COMMUNICATIONOverviewThis topic introduces the principles of optical communication, its limitations and theprinciples for converting between electrical and optical signals.Electronic skillsLearners will have the opportunity to study optical communications, with practicalopportunities to explore basic circuits for converting between electrical and opticalsignals by modelling the systems.Learners should be able to:(a) describe how the refractive properties of glass allow signals to be transmittedover long distances in optical fibres(b) describe the effects of dispersion, attenuation and radiation losses in opticalfibre communication and the relative advantages of single and multi-modeoptical fibres in a communication network(c) describe the principles of operation of circuits for converting betweenelectrical and optical signals(d) describe the use of LED and laser light sources in an optical fibre transmitter. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
| **Autumn 2** | **A2 06 Audio Systems**[gce-electronics-book-chapter-6.pdf\_(wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-6.pdf) | AUDIO SYSTEMS Overview This topic develops the use of amplifier and filter sub-systems to construct audio systems. Electronic skills This topic develops ideas studied in earlier topics and involves the use of amplifiers and filters in practical situations for audio systems. Learners will have opportunity to investigate through calculations, modelling and simulation a range of amplifier circuits based on a multi-stage voltage preamplifier, summing amplifier, emitter and source follower power amplifiers, push-pull power amplifiers including active filters. Mathematical skills There are a number of opportunities for the development of mathematical skills in this topic. These include: recognising and using expressions in decimal and standard form; understanding and using the symbols: =,≈; estimating results; using an appropriate number of significant figures; making order of magnitude calculations; changing the subject of an equation; translating information between graphical and numerical form; and interpreting data presented in graphical form. Learners should be able to: (a) recall the structure of a simple audio system based upon preamplifiers, a mixer, tone controls, a power amplifier and output loudspeaker (b) analyse and design a multi-stage voltage preamplifier to meet bandwidth and gain requirements (c) analyse and design a mixer circuit based upon a summing amplifier (d) describe and explain the operation of first order active filters (bass boost, treble boost, bass cut, treble cut) based upon an op-amp inverting amplifier and select and apply the equation to calculate the break frequency(e) recall and apply the maximum power transfer theorem (f) draw circuits for and recall the properties of emitter and source follower power amplifiers for source follower)(g) draw circuits for and recall the properties of push-pull power amplifiers consisting of either emitter or source followers and select and apply the equation(h) analyse and draw graphs of the waveforms for first order active filters, emitter and source follower power amplifiers and push-pull power amplifiers (i) describe cross over distortion in push-pull amplifiers and its removal using negative feedback. |  |
|  | **A2 03 Further Microcontrollers (assembly language physical computing)**[gce-electronics-book-chapter-3.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-3.pdf) | MICROCONTROLLERSOverviewThis topic covers the microcontroller as a programable integrated circuit (PIC) and itsinternal structure. It also covers how microcontrollers are interfaced and programedthrough flowcharts and assembler language to perform tasks.Electronic skillsLearners will have the opportunity in this topic to work with microcontrollers,interfacing them to inputs and outputs and programing them to perform set tasks.Learners will also use both flowcharts and assembler language to program themicrocontrollers and look at the application of microcontrollers.Mathematical skillsThere are some opportunities for the development of mathematical skills in this topic.These include: converting between binary and decimal number systems; and drawingand interpreting flowcharts.Learners should be able to:(a) analyse and design flowchart programs to program microcontrollers(b) recall and describe the structure of a PIC microcontroller as programmableassemblies of memory, input ports, output ports, CPU, clock and reset(c) recall and explain the use of interrupts to allow an external device to beserviced on request(d) recall and describe the application of a PIC microcontroller(e) analyse, design and program PIC microcontroller-based circuits usingassembler language. | Weekly homeworkPast paper questions as startersClasswork MarkedPeer and self-assessmentEnd of unit tests for chapter |
|  | **A2 13 Further Semiconductors (how PN junctions & FETs work)**[gce-electronics-book-chapter-13.pdf (wjec.co.uk)](https://resource.download.wjec.co.uk/vtc/2017-18/17-18_3-3/eng/gce-electronics-book-chapter-13.pdf) | No further information from the exam board available!The chapter is about how PN junctions and FETs work at the atomic level, with students being able to explain how a PN junction and a FET works with reference to doping, depletion regions, and energy levels. |  |
|  | **Assembly language coursework (NEA 1)** | Task 1 is intended to introduce learners to software control techniques usingassembly language which is widely used to program microcontrollers for consumerproducts. It is not expected that learners will be familiar with every instruction in theinstruction set, or use every programming technique available. Severalmanufacturers produce PIC development systems which can be used to deliver thispart of the component. The work should not be limited to 'onscreen' design andemulation, but must involve the actual programing of a PIC chip, and its testingremotely on a physical circuit. Initial program testing can be carried out using adevelopment board to prove the program works before final testing on a physicalcircuit.The report must include a listing of the program, a description of how the programworks and testing of the program | Past paper questions as starters Weekly homework – NEA pagesPeer and self-assessment of NEA progressEnd of project assessment (NEA) |
| **Spring 1** | **Main project (NEA 2)**  | Once the learner has decided on a context for the task, they should undertakeappropriate research so that a list of performance parameters (specification) can begiven. It is expected that the design specification will contain realistic numericalvalues against which the final performance of the system can be judged.In each task the overall system should be developed as a number of sub-systemswhich should be individually tested and evaluated before being incorporated into the complete system. This will ensure that the complete system develops by a gradualand incremental process, having been assessed at each stage of its development.For microcontroller-based projects, a sub-routine can be considered as a sub-systemprovided its specification can be tested and evaluated in a similar fashion to acomponent-based sub-system. To meet the assessment requirements, amicrocontroller-based project will also need to include, as a minimum, somecomponent-based processing sub-systems for interfacing signals to and from themicrocontroller (in addition to the microcontroller circuitry).In each task the system should be fully tested when the project is complete. Thetesting should be documented with results being displayed in tables and graphs,where appropriate. These tests will enable the learner to assess the system andidentify any faults and limitations. The learner should attempt to modify the system tocorrect for any limitations and then produce a final set of performance figures for thecompleted system. The learner should then evaluate the final system against thedesign specification and suggest further developments.The learner should fully document the development of each task in a report. It is theevidence contained within this report and the system produced upon which the NEAshould be marked and assessed. The report should contain evidence for each task ofthe following sections:. System planning – including analysis of the problem and a design specification. System development – including the development of the system in terms of subsystems,annotated circuit diagrams and description of testing each sub-systemand the recording of results. System realisation – including annotated block and circuit diagrams; evidence oflayout planning; description of testing of complete systems and the recording ofresults and user guide. Evaluation – including a detailed evaluation of the system against the designspecification and suggestions for improvement.The report should be presented in a logical order that is clearly presented and easyto understand. It should contain an acknowledgement of all sources of informationand help. Photographs of the complete physical system must be included in thereport.  | Past paper questions as starters Weekly homework – NEA pagesPeer and self-assessment of NEA progressEnd of project assessment (NEA) |
| **Spring 2** | **Main project (NEA 2) continued** |  | **As above** |
| **Easter 1** | **NEA 1 & 2 hand in** |  |  |
|  | **Revision** |  |  |
| **Easter 2** | **Revision** |  |  |
|  | **Exams** |  |  |