ICT & Computer Science – Curriculum Progression from KS3 to KS5

	KS2	KS3	KS4	KS5
Algorithms	Block Programming (Scratch, Beebots) Sequencing Algorithms (e.g. Escape Maze using Beebots) Trial and Error approach to test and adapt an algorithm	Introduction to Syntax based programming: • Using HTML to focus on syntax without including algorithmic concepts yet). Using a Trial and Error Approach. Very visual so students clearly see the impact of their changes. Also relevant to the Information Technology Trend (Creating a product based on a client brief Purpose and target audience, combining assets) • Using Python Turtle (as it is similar to the BeeBot programming task from KS2) but this time using Python (text-based programming) • Python Turtle also is a good visual approach to introduce sequencing and iteration • Then text-based programming based on input/process/output model. Use of sequencing, selection and iteration. Use of variables, comparison and arithmetic operators. Tasks may involve: Predicting the output of a small algorithm, reproducing an algorithm and testing it to identify and fix syntax errors independently. Students start modifying the code/completing/adapting incomplete code more independently based on similar tasks. Maths Concepts: Arithmetic calculations, x,y coordinates, using angles	Fully focus on text based programming and algorithmic thinking using sequencing, selection, iteration. Introducing the concepts of problem decomposition. Students analyse a problem (identify input and outputs, decompose elements of the problem) (e.g. Year 10 Programming project) Use of PRIMM (Predict, Reproduce, Investigate, Modify and Make) Students ask to refine algorithms (to make their code more robust (validation routines), more efficient (e.g. iteration) or more structured (sub routines) Students can identify and select the programming concepts needed to solve a problem (variables, constant, sequencing, selection, iteration, casting, string manipulation, file handling, subroutines…) Maths Concepts: Arithmetic calculations (MOD, DIV, percentage calculations…), x,y coordinates, using angles. Solving maths problems using an algorithm (Areas and volume calculations, Triangular Geometry functions, mean, mod, average calculations…)	Introduction of higher-level programming concepts and 4 programming paradigms: Imperative (LMC) Declarative (PROLOG, SQL) Procedural (Python) OOP (Python, JavaScript) Using more advanced primitive and non-primitive data structures (Hash Tables, Stack, Queues, 2D/2D Arrays, Binary Trees, BST, Graphs) and key algorithms based on these data structures Working on a larger project based on the System Life Cycle, Rapid Application Development (Prototypes), applying Problem Decomposition, Abstraction and Algorithmic Thinking using sequencing, Selection, Iteration, Recursion and OOP concepts. Reflect on the effectiveness of an algorithm using the Big O Notation (Time and Space complexity) Introduce client/server technologies and web-based client-side programming languages (HTML, CSS and JavaScript) and server side (brief introduction to php and SQL) Solving maths problems using an algorithms (Fibonacci Sequences, Frequency analysis, Short path algorithm (decision maths…). Using Maths and Real Physics concepts in an algorithm (3D projection matrix, parabolic trajectory…)

Computer Hardware & Networks	Students use tablets, smartphones, laptops and desktop computers Students identify and use a range of input/output and storage devices. Students connect to a Network either wirelessly or using Ethernet cables	Identify the main computer hardware elements (including inside the computer: motherboard, CPU, RAM, hard drive, SSD Drive) and input/output/Storage Devices). They investigate the main purpose of each component They can describe basic characteristics/specification for some of these components (e.g a 256GB Hard Drive, a 3.5GHz CPU…) (e.g. Buying computer components spreadsheet task) They can identify and describe the main purpose of network components (Router, switch firewall, WAP, NiC card) and start looking at Star Network topologies for a LAN They can name wired and wireless connection methods (Ethernet Cable, Optic fibre, 4G/5G, WiFi, Blutooth)	Identify and describe the main characteristics of the main hardware components that make up a computer system. (Input/Process/Storage/Output) Investigate CPU architecture: Concepts of transistors, logic gates (link to binary data), components of the CPU and concept of FDE cycles. Characteristics of the CPU (clock speed, number of cores, amount of cache) Investigate key characteristics of primary and secondary memory and compare different secondary device technologies and devices to be able to recommend and justify the most suitable storage devices for a given context. They can identify and describe the main purpose of network components and design a small network topology using the Star and Mesh topologies for a given scenario Investigate TCP/IP networks including the TCP/IP Stack and Protocols for each layer of the TCP/IP Stack. Students are introduced to key networking concepts including Packet Switching, use of IP and MAC addresses, use of Domain Name Servers, encryption etc.) and they can identify the main network security threats and methods used to protect a network from these threats. Students investigate different format to store and transfer data including CSV files and flat files databases. They can use SQL to select data from a single table.	Study CPU architecture and the evolution of computers since the 1950's comparing the characteristics of the 4 generations of computers. Study logic gates circuits used inside the ALU, the control unit and the memory unit of the CPU, including full adder circuits and D-Type Flip-Flop circuits. Compare the main characteristics of different CPU architectures (Von Neuman, Harvard and contemporary CPU architecture, RISC and CISC architecture) Use LMC to program the CPU and evaluate the impacts of the FDE cycle on the registers when running an LMC program. They can identify and describe the main purpose of network components and design a small network topology using the Star and Mesh topologies for a given scenario, justifying their choice of hardware and topologies and identifying benefits and drawbacks and possible improvements for a given network design Students investigate key networking concepts including Packet Switching, use of IP and MAC addresses, use of Domain Name Servers, protocols and layers of the TCP/IP Stack etc.) They also investigate the main network security threats and methods used to protect a network from these threats. They investigate a range of symmetric and asymmetric encryption techniques. Students investigate different format to store and transfer data including CSV files, XML, JSON and relational databased. They learn key relational database concepts and can draw an Entity Relationship Diagram for a given scenario. They can use SQL to write queries to select, insert, update or delete data from a relational database.

Digital Data	Students use digital data (text, pictures, sound and video clips) and digital devices (smart phones, tablets, digital camera, etc).	Students can express that digital data is data that a computer system can process and that it is made of binary code (0s and 1s). They understand that more and more technologies rely on digital data (Computers, Digital cameras, smart TVs, smart Speakers, smart Phones, DAB Radios) They learn how to convert numbers from 0 to 255 into binary using 1 Byte They use the ASCII code to convert text into binary. They learn about the RGB code used to convert bitmap pictures into binary. Students learn about storage units: KB, MB, GB, TB used to express the storage capacity of a storage device or the size of a file.	By studying the role of transistors and logic gates inside the CPU, students understand the reason why computers can only process digital data. Students convert numbers from denary to binary and from binary to hexadecimal and vice versa. They can perform basic operations with binary data such as binary additions and binary shifts. They understand the need for different character sets (ASCII code and Unicode) to store text and the relationship between the number of bits per character and the number of characters available in a set. Students understand how bitmap pictures are stored a binary and the impact of colour depth and resolution on the file size and quality. Students understand how sound files are stored as a collection of samples and the impact of sample rate and bit depth on the file size and quality. Students understand basic concepts of lossy and lossless compression and can estimate the size of a text file, picture file and sound file based on various criteria. Students can also perform storage requirements calculations using the storage units introduced at KS3 (KB,MB,GB,TB) Students understand the concept of transfer speed (bandwidth) and the impact of file size and connection speed when connecting to the Internet.	Students investigate a range of logic gates diagrams used to process binary data (Binary addition, binary shifters, D-Type Flip Flop logic gates, 1-BIT ALU, binary Decoder and Multiplexers) Students use Sign Magnitude and 2'Cs notation to convert negative numbers in binary and they use the Normalised Floating Notation to convert decimal numbers into binary. Students investigate a range of hashing, encoding, compression and encryption algorithms. Students investigate Error Detection methods such as Check Digit, Parity Bit and checksum used when transferring data over a network (e.g. TCP protocol) They understand the need for different character sets (ASCII code and Unicode) to store text and the relationship between the number of bits per character and the number of characters available in a set. Students understand how bitmap pictures are stored a binary and the impact of colour depth and resolution on the file size and quality. Students understand how sound files are stored as a collection of samples and the impact of sample rate and bit depth on the file size and quality. Students understand the concepts of lossy and lossless compression and investigate different lossy and lossless compression techniques including run-time encoding, dictionary coding and Huffman Coding. Students can also perform storage requirements calculations using the storage units introduced at KS3/4 (KB,MB,GB,TB) Students understand the concept of transfer speed (bandwidth) and the impact of file size and connection speed when connecting to the Internet.

IT & iMedia	Pupils use standard application software (e.g. MS Word, MS PowerPoint, MS Excel) to create basic documents and manipulate text, number and pictures Pupils also use alternative apps and web based application to complete basic tasks Pupils can combine different assets (e.g. picture files) into their work Pupils can save their work on the school system	Students start with a unit focusing on becoming confident user of the main application software used in school (e.g. MS Office, Office 365, Sharepoint, OneDrive) When using application software to create assets, students do so taking into consideration the target audience and purpose of their document. They use a range of formatting techniques effectively based on the purpose and target audience. (e.g. "School Trip project": Formatting techniques used to write a formal letter to parents in MS Word as opposed to formatting techniques used within a SlideShow to be used in an assembly to advertise a school trip) Students also analyse a given client brief to identify key user requirements (design and content) to create a complex product (website and interactive multimedia product) using a range of primary and secondary assets Students use mainly standard application software and start using more specialised software such as Photoshop to apply graphic design and photo-editing techniques when creating or editing graphics. Students save their work using a suitable folder structure with guidance from the teacher.	Students analyse and interpret a client brief to define a range of design consideration when planning and designing their assets. From the client brief, they identify the target audience and purpose of their products. They collect a range of asset and use a range of techniques to re-purpose their asset when relevant (changing resolution, re-colouring, removing background, cropping, trimming a clip, etc…) They understand the impact of copyright laws when selecting secondary products. (Using copyrighted assets, using royalty-free assets, using public domain assets) Students also use specialised software (graphic editing, photo-editing, video editing, audio editing) to create primary assets or edit secondary assets. They understand the characteristics of different file formats for a range of assets (graphics, audio, video, animation) and can select the suitable file type when saving/exporting/converting their assets and/or products. They use a range of pre-production techniques to plan ahead the production of their products. This includes moodboards, mindmaps, stie maps, sketches, wireframe diagrams, visualisation diagrams, storyboards, scripts and plan ahead the production stage (e.g. work plan) Students use a suitable folder structure to organise all their files and use consistent file naming convention and version control when saving their files. Students test and evaluate the effectiveness of their products, referring back to the client brief/user requirements/target audience and purpose of their products.	Students analyse and interpret a client brief for two internally assessed coursework projects. Students will work closely with a client to complete the full project management cycle. This includes: 1) Identifying problems and determining what is feasible 2) Developing a series of attainable goals 3) producing a range of planning documents in line with client expectations. 4) Create a clear plan of action, allowing them to mitigate any risks or problems that may occur. 5) Time management skills to ensure the project and the milestones are completed at specific points. 6) The execution of project which has decomposed into manageable tasks. 7) Testing to ensure the project is suitable for purpose and functional 8) Liaising with the client and evaluating their own performance They analyse existing real-world businesses to gain insight into what a successful campaign looks like. They identify goals for businesses and evaluate their performance based on the content produced. After conducting research and pinpointing the criteria for a successful social media campaign, students are enlisted by a business to develop a strategy of their own. Students can identify and use a range of software tools to support them during the creation of engaging and persuasive content. This includes locally installed programs and cloud-based services. Students learn about the relevant legislation and how the business they are working for will be affected by it.

Digital Literacy (incl. e-Safety)	Pupils learn how to search the web and select/retrieve information (text and pictures) Pupils discuss safe practice when using the Internet. (e-Safety) Pupils can save their work using appropriate files names Pupils can use a range of application software (incl MS Office suite) and web-based applications.	Pupils become more confident and independent in their ability to search the web and select/retrieve information (text and pictures). They can refine web search queries using the relevant keywords and search techniques. They start considering the reliability of the information found understanding the concepts of information bias, facts vs opinions, purpose of information. They can identify and recommend techniques on how to stay safe when using the Internet including how to choose a strong password, what information is personal, how to access privacy settings, how to block and report abuse/cyberbullying/trolling/grooming/sexting. They learn about network threats such as viruses, trojan horses, identity thefts, phishing emails. Students learn how to save files using a folder structure and relevant file names and how to reorganise their folders (renaming, deleting, moving files) as well as how to transfer files using the Cloup	Pupils become more confident and independent in their ability to search the web and select/retrieve information They can refine web search queries using the relevant keywords and advanced search techniques. Students can use both search engines and royalty free content sharing websites. Students understand the impact of copyright legislation when selecting information or assets for their projects and maintain a source table to indicate the source and copyrights implications of the assets they use in their projects. Students consider the reliability of the information found understanding the concepts of information bias, facts vs opinions and purpose of information. They also take into consideration factors affecting the quality of an asset (file type, resolution) based on their needs for their project. They can repurpose sourced assets if needed. Students use a suitable folder structure independently to organise all their files and use consistent file naming convention and version control when saving their files. Students can keep backups of their work using the cloud (oneDrive) and can transfer their work or share their work (Using email, using OneDrive) They can identify and recommend techniques on how to stay safe when using the Internet including how to choose a strong password, what information is personal, how to access privacy settings, how to block and report abuse/cyberbullying/trolling/grooming/sexting. They learn about network threats such as viruses, trojan horses, identity thefts, phishing emails, brute force attacks, dDos Attacks, social engineering can recommend solutions on how to minimise the risks caused by these network threats.	Same as for KS4 within a business context. More focus on legal implications for businesses (Data Protection Act, Computer Misuse Act, Copyright Design & Patent Act) when using or designing ICT systems and/or assets. Students can define an IT and Network policy to identify safe working practice relevant to a business context, taking into consideration network security concepts, e-safety, health & safety when using IT equipment/working in an office based environment, and legal considerations.