Department: Computer Science

Our Curriculum Aims:

- To instil a love of learning for computing and give pupils reasons to continue to explore it.
- To encourage pupils to be good digital citizens and, respectful and responsible users of IT.
- To provide a skill base for digital work for all subject areas at the school.
- To encourage enterprising pupils who are resilient and independent in thought, action and learning.
- To allow pupils to appreciate the social, ethical, legal, and environmental aspects surrounding computing.
- To encourage pupils to consider the global impact of Computer Science.
- To provide an understanding of the principle of computational thinking and its place in computing and, indeed, in everyday life.
- To provide pupils with the tools to effectively employ computing, through computational thinking and algorithms.
- To provide a solid knowledge of programming and appropriate programming techniques.
- To provide a platform for GCSE, A level and beyond.

The Department ***Subject Achievement Map*** *identifies the skills and knowledge acquisition needed to progress in the subject from year 7-11.*

For each topic studied in Years 7 and 8, ***Topic Descriptor Sheets*** *detail the knowledge and skills needed to progress in that topic. Topic Descriptors are shared with students at the start of every topic.*

Year 7

AIM - Becoming digitally literate and understand the fundamentals of Computer Science basics.

	Name of topic	Key Content of the Topic	Assessment points
HT 1	Unit 1 – AGSB Network	Computer Safety. Network access. Use of Office 365 tools (SharePoint and TEAMS) Use of Satchel One / SMHW	In lesson assessment of using tools
	Unit 2 – Office OneNote, Word & PowerPoint	Basic tools in OneNote, Word and PowerPoint. How to present	2 Word tasks assessed Peer assessed Presentation In class Quizzes
HT 2	Unit 2 – Office Excel	The use of Excel to create a model. Functions and formatting used.	Excel modelling assessed task In class Quizzes
	Unit 3 – Safety & E Safety	How to stay safe when using a computer at school and at home. Health conditions related to using the computer. E safety and social media use.	Workspace at home assessment In class Quizzes
HT 3	Unit 4 – Computer Hardware	Identify the different components inside and outside a computer. Understand the purpose of these devices	In class Quizzes
	Unit 5 -Binary	To understand that computer use binary to communicate.	Calculation Assessment In class Quizzes
	Unit 6 – Fetch Decode Execute Cycle	See how information is stored on a computer and how a processor performs calculations on binary.	FDE Cycle Assignment In class Quizzes
	Unit 7 – Computational Thinking	Understand that computer is used to solve problems in a systematic way. Knowing how to solve logic puzzles is useful in Computer Science	In class Quizzes
HT 4	Unit 8 - Algorithms	To follow steps in an order and to see how we can write programs clearly using Flowcharts. Understand the basic building blocks in Computer Science of sequence, selection and iteration	OneNote workbook.
	Unit 9 – MicroBit programming	Programming physical devices and investigate a range of inputs and output on the device. Sequence, selection and iteration in action.	Numerus small MicroBit challenges assessed
HT 5	Unit 10 – Game Design	Consider the main elements to program within a computer game. How will they be programmed?	Peer Assessment of Game Model
	Unit 11 – Python Programming	Move from a block editor to text editor using Python. Continue to look at the basic building blocks, sequence, selection and iteration is used in Python	Numerus small Python challenges assessed
HT 6	Unit 11 – Python Programming		Numerus small Python challenges assessed

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Year 8

AIM – Deepen knowledge of Computer Science in real world examples using programming

	Name of topic	Key Content of the Topic	Assessment points
HT 1	1 Control systems	Programming using Flowcharts and Pseudocode – real life modelling of programming tasks using Flowol	1 task on understanding of flowchart 1 task on understanding of the Flowol Program 3 tasks on individual designed tasks based on Flowol
HT 2	1 Control systems Continued 2 Computer hardware	2 weeks of Control systems to finish the topic Understanding the internal working and purpose of the hardware to build on the basics taught in year 7. This takes the boys up to a GCSE level of understanding	See above for Control systems Hardware is a sequence of 8 individual tasks to check the understanding of the topics covered
HT 3	3Computer Modelling	Using Excel to model an event, allowing students to individually plan and cost an event, resulting in a model similar to that of a real-life situation. Makes use of statistics, probability and the advanced analytics functions of Excel	4 assessment points: 1 Planning and presentation 2 Layout 3 Working model 4 Understanding and implementation of variables
HT 4	3Computer Modelling		
HT 5	4 Python programming	The python challenges are a series on python programs designed to get progressively harder. They start off building the understanding learned in year 7 and the hardest challenge is of A level standard. The aim is to learn and research how to complete as many challenges within the time allocated independently. The impact of Computing and ICT tasks involve the moral and ethical use of ID tags for students in a school environment and the use of digital loyalty cards to track customers details	There are several key grade points through the challenges which are required steps to get their relevant FEDS score. Foundation level is based upon programming skills learned in year 7 leading to Secure which shows sufficient understanding to progress in year 9. There are 2 assessments for the Impacts on Computing
HT 6	4 Python programming Continued 5 Impacts of Computing and ICT		

Year 9

AIM – To prepare for working life with Computers and for GCSE

	Name of topic	**Key Content of the Topic**	**Assessment points**
HT 1	Computer Legislation	Covering the areas of GDPR, Computer Misuse Act and Freedom of information act.	In Class Quizzes Written responses and in class discussion participation.
	Binary and Hex	Understanding the fundamentals of how a computer uses and stores, numbers, letters, and images. Covers, Denary to Binary, Binary to Denary, Denary to Hexadecimal, Hexadecimal to Binary, Binary to Hexadecimal, Hexadecimal to Denary, Binary Addition, Characters to Binary, Images to Binary.	In Class Quizzes
HT 2	Cryptography	Looking at Why is cryptography & encryption is a crucial part of the modern world. Several cryptography puzzles.	In class puzzles. Build own
	Python Programming Fundamentals	Recapping the fundamentals of Python programming of sequence, selection and iteration.	In Class Quizzes Small python challenges handed in.
HT 3	Digital Citizenship	A topic to look at their future use of Computers covering topics What is a Good Citizen? How does your digital self-differ from your physical self? How do you treat Yourself, Other and Information online? Valuable Data & Password Management. Fraud & Fake news. Protecting Devices. Social Media	In class discussions
HT 4	Searching & Sorting Algorithms	2 Common algorithms considered, Searching and Sorting. Different types of each algorithms discussed and performed on given data.	OneNote and In Class Quizzes
HT 5	Advanced Python Techniques	Using Python to program techniques such as Lists, Sub programs and File handling.	In Class Quizzes Small python challenges handed in.
HT 6	Python Game Design	The advanced Python Techniques are then implemented within a Role-Playing game. Students given the basic program which they must develop.	RPG Report
	AI	Discuss the use of AI within society and the workplace? How can we use AI responsibly in future?	In Class Discussion
Extra	Cryptocurrencies	The use of money across the world is considered with the questions raised “Do we really need physical money?” “Should there be 1 currency across the world”	Written responses and in class discussion participation.

What can parents do to support their sons?

Check Satchel One to ensure students are completing work that has been set. Work is normally handed in through Microsoft 365 Teams or through their Class Notebook (One Note).

GCSE Computer Science

Specification: OCR (Syllabus code J267)

Why Choose GCSE Computer Science

This is a course that has real relevance in our modern world. While you will no doubt already have some knowledge of computers and related areas, the course will give you an in-depth understanding of how computer technology works and a look at what goes on "behind the scenes".

With the increasing popularity of small portable computers, such as smart phones, tablets and the Internet of Things, the ability to program is a skill which is increasingly in demand. A recent study highlighted the **lack of British programming talent**, and the App (short for application, or program) industry is clamouring for young, exciting programmers (developers). This course enables you to learn to program and appreciate more about how hardware works. Through this you will develop critical thinking, analysis and problem-solving skills. The course is designed to be a fun and interesting way to develop these skills, which can be transferred to other subjects and even applied in day-to-day life.

In this way, the course will make an excellent preparation for learners who want to study or work in areas that rely on these skills, especially where they are applied to technical problems, for example in engineering, financial and resource management, science and medicine.

Computer Science continues to have a growing importance. This means there will be a bigger demand for professionals who are qualified in this area. If you want to go on to higher study and employment in the field of Computer Science, you will find that this course provides a superb stepping-stone.

You will:

- Understand the function of the CPU and how it operates.
- Understand binary notation and mathematics, produce logic diagrams and truth tables.
- Explore different forms of hardware and software and understand their function and purpose.
- Evaluate and reflect critically on the way you and others use IT.
- Explore and learn about wired and wireless networks.
- Develop coded (programmed) solutions to satisfy various problems.
- Discuss and review the impact of computers.
- Consider the social, legal, ethical and moral issues and security needs associated with Computing.

Assessment is by two exams (100%, each being worth 50%) and a single programming project (non-assessed). The first exam is regarding computer systems, whereas the second looks at computational thinking, algorithms and programming. Computer Science GCSE results are among the highest in the School.

The project is a programming problem to analyse, plan, design, develop, test and evaluate. The project is a substantial coding challenge that varies from year to year.

Who is the course suitable for?

Anyone with an interest in computers, programming or the application of computers in the modern world.

Key Stage Four Curriculum Overview

Year 10

Name of topic	Key Content of the Topic	Cohort assessment points **(will also be class specific tests and homeworks)**
Computational thinking	Principles of computational thinking: • Abstraction • Decomposition • Algorithmic thinking	End of topic test
State and logic	• Simple logic diagrams using operators AND, OR and NOT • Truth tables • Combining Boolean operators • Applying logical operators in truth tables to solve problems	End of topic test
Inputs, outputs and processes	• Identify the inputs, outputs and process for a problem • Structure diagrams • Identify common errors • Trace tables	End of topic test
Data types	• Integer • Real • Boolean • Character and string • Casting	End of topic test
The processor	• The purpose of the CPU • Common CPU components and their function • Von Neumann architecture • CPU Performance and how common characteristics of CPUs affect their performance • Embedded systems	End of topic test
Sequence, selection and iteration	• Sequence • Selection • Iteration	End of topic test
Storage	• Primary memory • Secondary storage	End of topic test
Data	• Units • Numbers • Binary	End of topic test Worksheets

	• Hexadecimal • Characters • Images • Sound	
Searches and sorts	• Linear search • Binary search • Bubble sort • Insertion sort • Merge sort	End of topic test
Compression	• Lossy • Lossless	End of topic test
Programming techniques	• String manipulation • File handling • Records • SQL • Arrays • Functions • Random numbers	Coding task assessments
NOTE: Coding is taught throughout the year		

Year 11

Name of topic	Key Content of the Topic	Assessment points
Defensive design	• Design considerations • Input validation • Maintainability	End of topic test
Testing	• Purpose • Types of error • Selecting and using suitable test data • Refining algorithms	End of topic test
Systems software	• Operating systems • Utilities	End of topic test
Networks	• Networks and topologies • Wired and wireless networks • Protocols • Layers	End of topic test
Security	• Threats • Identifying and preventing vulnerabilities	End of topic test
NEA 1		

IDEs	• Common tools and facilities	End of topic test
Translators	• Characteristics and purpose of different levels of programming languages • Purpose of translators • Characteristics of compilers and interpreters	End of topic test
Ethics	• Impacts of digital technology on the wider society	End of topic test
Laws	• Legislation affecting computers	End of topic test
NEA 2		
Revision		

Recommended Revision Guides for GCSE

Revision Guidance:

- Use the course theory self-audit document to recap theory and look for gaps.
- Prepare own summary notes for revision (mind maps or whatever works for you!)

Resources to help:

1. Your Microsoft Team and Class Notebook (OneNote)
2. Microsoft 365 – GCSE Computer Science site – plenty of revision material, including the Student Workbook and ZZ notes.
3. Bitesize GCSE Computer Science website – written by TM, CR and SM.
4. Craig and Dave videos

Support available for GCSE Students

- The Python Programming Club supports pupils who are struggling with programming.
- Programming mentors support pupils.
- The Computer Science Clinic runs twice a week at lunchtime.

A Level Computer Science

Specification: OCR H446 Computer Science

Key Content of the Topic Teacher 1	**Assessment points** **(also class specific tests and homework)**	**Key Content of the Topic Teacher 2**	**Assessment points** **(also class specific tests and homework)**
Principles of computational thinking: • Thinking abstractly • Thinking ahead • Thinking procedurally • Thinking logically • Thinking concurrently	Online quizzes End of topics tests	Programming techniques: • Sequence • Selection • Iteration • Recursion • Global and local variables • Modularity, functions, and procedures • Parameter passing by value and by reference • Use of an IDE to develop/debug a program	Online quizzes End of topic tests Coding exercises
Computational methods: • Problem recognition • Problem decomposition	Online quizzes End of topics tests	Data types part 1: • Primitives • Positive integers in binary • Negative binary numbers - sign and magnitude, Two's Complement • Binary addition • Binary subtraction	Online quizzes End of topic tests Worksheets
The structure and function of the processor: • The ALU • The CU • Special registers • Buses • How the processor relates to assembly language • The FDE cycle and its effects on registers • Factors affecting CPU performance – clock speed, cores, cache • Pipelining • Von Neumann Architecture • Harvard Architecture • Contemporary architectures	Online quizzes End of topic tests	Boolean algebra: • Boolean logic • Boolean expression manipulation • Karnaugh maps • Derive and simplify Boolean statements • De Morgan's laws • Distribution, association, commutation, double negation • Logic gates and diagrams • Truth tables • D type flip flops • Half and full adders	Online quizzes End of topic tests Worksheets Coding challenges

Types of processor: - CISC and RISC - GPUs and their uses - Multicore and parallel systems	Online quizzes End of topic tests	Data types part 2: - Floating point arithmetic - Positive and negative FP numbers - FP addition and subtraction - Bitwise manipulation and masks - Shifts – AND, OR, XOR - Characters sets	Online quizzes End of topic tests Worksheets
Types of programming language: - Programming paradigms - Procedural languages - Assembly and Little Man Computer - Modes of addressing - Object-oriented languages – classes, objects, methods, attributes, inheritance, encapsulation and polymorphism	Online quizzes End of topic tests Worksheets Coding challenges	Web technologies: - HTML - CSS - Javascript - Search engine indexing - PageRank algorithm - Server-side and client-side processing	Online quizzes End of topic tests Coding challenges
Input, output and storage: - Input, output and storage devices - RAM and ROM - Virtual storage	Online quizzes End of topic tests	Data structures: - Arrays - Records - Lists - Tuples - Linked lists - Graphs - Stacks - Queues - Trees - Binary search tree - Hashing and hash tables - Tree traversals, additions and deletions	Online quizzes End of topic tests Coding challenges
Systems software: - Operating systems - Memory management – paging, segmentation, and virtual memory - Interrupts and the interrupt service routine - Scheduling – the scheduler, burst and quantum, round robin, first come first served, shortest job first, shortest time remaining, multi-level	Online quizzes End of topic tests	Computing related legislation: - The Data Protection Act 1998 - The Computer Misuse Act 1990 - The Copyright, Designs and Patents Act 1988 - The Regulation of Investigatory Powers Act 2000	Online quizzes End of topic tests

feedback queues, priority, process starvation • Types of OS • The BIOS • Device drivers • Virtual machines			
Databases: • Flat file • Relational • Keys • Entity relationship modelling • Normalisation to 3rd normal form • Structured Query Language • Referential integrity • Transaction processing – ACID • Record locking and redundancy	Online quizzes End of topic tests Worksheets Database building challenges	Moral and ethical issues: • Moral, social, ethical and cultural opportunities and risks • Artificial intelligence • Automated decision making • Environmental effects • Censorship and the internet • Piracy and offensive communications • Layout, colour paradigms and character sets	Online quizzes End of topic tests
Algorithms: • Measuring the efficiency of algorithms – Big O notation • Sorts - bubble, insertion, merge • Searches – linear, binary	Online quizzes End of topic tests Worksheets Coding challenges	Computational methods: • Use of divide and conquer • Backtracking • Data mining • Heuristics • Performance modelling • Visualisation	Online quizzes End of topic tests
Applications generation: • The nature of applications • Utilities • Open source and closed source • Translators – interpreters, compilers and assemblers • Stages of compilation – lexical analysis, syntax analysis, code generation, optimization • Linkers and loaders • Libraries	Online quizzes End of topic tests	Algorithms: • Dijkstra’s shortest path • A* algorithm	Online quizzes End of topic tests Worksheets

Coding

Throughout the course coding exercises are given, refined, and assessed.

Coursework

Coursework runs from the last half term in Y12 through to the end of the 3rd half term in Y13. Coursework lessons are interspersed with theory lessons.

Recommended Revision Guides for A Level

Revision Guidance:

- Use the course theory self-audit document to recap theory and look for gaps.
- Prepare own summary notes for revision (mind maps or whatever works for you!)

Resources to help:

1. Your Microsoft Team and Class Notebook (OneNote)
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