Computer Science

Preparing students for tomorrow, bit by bit

The Computing department will help to create, share, and apply knowledge in all branches of Computer Science and ICT. We will educate students to be successful, ethical, and effective problem solvers with a passion to innovate and create, rather than just passive consumers and users of technology. We will develop an understanding and appreciation of all aspects of digital products, from how they work to how they look. We will foster curiosity and encourage exploration to create students who can contribute positively to the well-being of our society and who are prepared to tackle the complex 21st Century challenges facing the world.

Summary focus areas:

- Innovate, create, develop
- Solving 21st Century problems
- Active developers not passive consumers

Autumn		Spring		Summer	
C# Programming Data Representation	Fundamentals of Algorithms Computer Systems Cyber Security	Ethical, Legal and Environmental Impacts C# Programming Relational Databases	Relational Databases Fundamentals of Networks C# Programming	C# Programming Project	C# Programming Project

Homework for Computing is designed to support and extend the students' studies from their lessons. Work may be a mixture of practical, computer-based tasks and paper-based written work or design tasks. Activities set as homework may be:

- Preparatory work or research ahead of a new topic or concept being discussed in lessons.
- Extension work that allows the student to explore a topic in more depth or in other contexts.
- Application work that allows students to practise skills or demonstrate abilities.

Students are expected to spend around an hour on a homework activity each week and work is marked promptly to help students to identify and understand their weaknesses to make incremental improvements over the course of the year.

Unit	Duration (lessons)	Learning Objectives/Outcomes

C# programming Part 1	8	• Understand the different types of data and data structures:
		   o integers
		   o booleans
		   o doubles
		   o characters
		   o strings
		• Be able to program with arrays
		• Be able to use arithmetic operations in code
		• Be able to use relational operations in code
		• Be able to use Boolean operations and use selection and iteration to control program flow and understand the usesof different type of loop

Data representation	8	• Understand how binary numbers are used
		• Understand how binary can be used to represent text, images and sound by exploring binary representation systems and concepts such as:
		   o ASCII
		   o Unicode
		   o Bitmap images
		   o Colour depth and resolution
		   o Sound sampling, rates and resolutions
		• Convert between Binary, Hexadecimal and Decimalnumbers
		• Understand and distinguish between units of data (bit, byte, kilobyte etc)
		• Understand that data can be compressed using lossy andlossless methods.

Fundamentals of Algorithms	4	• Understand what an algorithm is and how/why computersuse them • Be able to explain and model the Binary Search algorithm • Be able to explain the advantage of a binary search over alinear search.

Computer systems and architectures	5	• Explain the Von Neumann architecture • Understand the term 'embedded system' • Explain the role and operation of main memory and the major components of a central processing unit (CPU) Understand and explain the factors that affect the performance of a CPU: • clock speed • number of processor cores • cache size • cache type • Understand and explain the Fetch-Decode-Execute cycle • Understand the differences between main memory, secondary storage, RAM and ROM • Understand different types of secondary storage and their advantages/disadvantages • Explain the operation of solid state, optical and magnetic storage • Explain the term 'cloud storage' and discuss its advantages and disadvantages
Cyber security	5	• Be able to define the term cyber security and be able to describe its main purposes • Understand and be able to explain cyber security threats: • social engineering techniques • malicious code • weak and default passwords • misconfigured access rights • removable media • unpatched and/or outdated software • Explain what penetration testing is and what it is used for • Define and describe the term social engineering Describe malware (and how one can protect against): • computer virus • trojan • spyware • adware Understand and explain common security measures:

		• biometric measures
		• password systems
		• CAPTCHA (or similar)
		• two-factor authentication
		• automatic software updates
Ethical, Legal and Environmental Impacts	5	• Understand, define and discuss ethical concerns in computing such as public safety and data security. • Understand, define and discuss legal concerns such as hacking, data leaks, copyright, blackmail etc • Understand, define and discuss environmental concerns such as energy consumption (including cryptocurrencies) and pollution and precious metals • Discuss the emerging impact of wearable technology and cybernetic implants. • Discuss the emerging impact of autonomous vehicles.
C# Programming Part 2	5	• Be able to use loops and logic independently • Be able to read from and write to files • Be able to generate and use random numbers • Be able to use string operations to use substrings and combine strings using concatenation. • Be able to solve simple problems using code
Relational Databases	6	• Define key database terminology • Tables, Rows and Fields • Primary Keys and Foreign Keys Understand and use Structured Query Language (SQL) • SELECT...FROM...WHERE • ORDER BY...ASC/DESC • INSERT INTO... VALUES... • UPDATE...SET...WHERE • DELETE... FROM... WHERE
Fundamentals of Networks	5	• Understand what a computer network is • Be able to discuss the advantages and disadvantages of using a computer network • Describe and explain LAN/PAN/WAN networks • Be able to describe and compare the bus, ring and star networking topologies • Be able to explain the different hardware needed as part of a network system and the role each piece of hardware plays

		• Understand common networking protocols and their role in communication between different devices • Explain 4 different layers of the TCP/IP protocol stack
C# Programming Part 3	7	• Be able to use loops and logic independently • Be able to read from and write to files • Be able to solve problems independently using code • Be able to apply normal/abnormal/extreme data to testing
C# Programming Project	20	• Work on a 'substantial programming project' as required by the exam board.