A-level Computer Science

It is a fantastic course that allows students to broaden their knowledge of how computers function. If you are interested in learning about how to make computers do what YOU want and would like to know what actually happens inside a computer, then this is the course for you!

You will also learn about what makes computers work, key problem solving skills and advanced programming techniques.

Year 12

Topic 1 The characteristics of contemporary processors, input, output and storage devices

The structure and function of the processor, types of processors and input, output and storage.

TOPIC 2: Systems Software

The function and purpose of operating systems, memory management, interrupts, scheduling, types of OS, bios, device drivers and virtual machines.

Topic 7 Problem solving and programming

Programming constructs: sequence, iteration, branching.
Global and local variables.
Modularity, functions and procedures, parameter passing by value and by reference.
Use of an IDE to develop/debug a program.

Topic 2: Types of Programming Languages

Assembly languages and modes of addressing memory

TOPIC 2 Application Generation

Applications, utilities, open-source vs closed source

TOPIC 8: Algorithms

Bubble sort, insertion sort, merge sort and quick sort
binary search and linear search.

Topic 6 Elements of computational thinking

Thinking abstractly
Thinking ahead
Thinking procedurally
Thinking logically
Thinking concurrently

Topic 2: Software Development

Waterfall, agile, extreme, spiral and rapid development methodologies.

TOPIC 4 Data Types

Representing positive, negative and floating point numbers, hexadecimal, binary addition and subtraction.
Floating point normalisation
Floating point arithmetic, positive and negative numbers, addition and subtraction.
Character sets (ASCII and UNICODE)

TOPIC 4 Data Structures

Arrays (of up to 3 dimensions), records, lists, tuples

We will learn about stacks and queues
How to create, traverse, add data to and remove data.

Topic 7 OOP

Object-oriented languages with an understanding of classes, objects, methods, attributes, inheritance, encapsulation and polymorphism.

Procedural vs OOP

TOPIC 4 Boolean Algebra

Define problems using Boolean logic.
Manipulate Boolean expressions, including the use of Karnaugh maps to simplify Boolean expressions.
Using logic gate diagrams and truth tables.

Topic 3 Exchanging Data

Compression, Encryption and Hashing

HTML, CSS and JavaScript.
Search engine indexing.
PageRank algorithm.
Server and client side processing.

Year 13

Programming Project

Analysis of the problem
Design of the solution
Developing the solution
Evaluation

TOPIC 2 Application Generation

We will learn about translators, stages of compilation, linkers and loaders.

TOPIC 4 Data Structures

Linked-list, graph (directed and undirected), tree, binary search tree, hash table.
How to create, traverse, add data to and remove data from these data structures.

TOPIC 8: Algorithms

Dijkstra's shortest path algorithm and A* algorithm.

TOPIC 4 Boolean Algebra

Use the following rules to derive or simplify statements in Boolean algebra: De Morgan's Laws, distribution, association, commutation, double negation.

The logic associated with D type flip flops, half and full adders.

Topic 3 Exchanging Data Databases

Relational database, flat file, primary key, foreign key, secondary key, entity relationship modelling, normalisation and indexing. Normalisation to 3NF.
SQL
Referential integrity.
Transaction processing, ACID (Atomicity, Consistency, Isolation, Durability), record locking and redundancy.

Topic 6 Elements of computational thinking

Apply knowledge of computation methods: backtracking, data mining, heuristics, performance modelling, pipelining and visualisation to solve problems.

Topic 3 Exchanging Data - Networks

Characteristics of networks and the importance of protocols and standards.
The internet structure:
The TCP/IP Stack.
DNS
Protocol layering.
LANs and WANs.
Packet and circuit switching.

Network security and threats, use of firewalls, proxies and encryption.
Network hardware.
Client-server and peer to peer.

Topic 7 Problem solving and programming

Recursion, how it can be used and compares to an iterative approach.

Tracing algorithms
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TOPIC 8: Algorithms

Measures and methods to determine the efficiency of different algorithms, Big O notation (constant, linear, polynomial, exponential and logarithmic complexity).
Comparison of the complexity of algorithms.

TOPIC 5: ISSUES AND IMPACT

Computing related legislation
Moral and ethical Issues

Computers in the workforce.
• Automated decision making.
• Artificial intelligence.
• Environmental effects.
• Censorship and the Internet.
• Monitor behaviour.
• Analyse personal information.
• Piracy and offensive communications.
• Layout, colour paradigms and character sets.