BCS LEVEL 4 CERTIFICATE IN IT

COMPUTER AND NETWORK TECHNOLOGY

SYLLABUS

THIS QUALIFICATION WILL BE RETIRING IN 2026

September 2023 v4.2

CONTENTS

Introduction

Encompassing three core modules, the Level 4 Certificate in IT explores the fundamentals of computer and network technology, processor architecture, operating and information systems, software development, and networks.

Candidates will gain a solid foundation upon which they will be able to build a career pathway into information technology. Career opportunities include entry-level positions in the rapidly growing fields of computer science and software development.

Upon successful completion of this qualification, candidates will be equipped with the knowledge and understanding to enable them to progress on to a broad range of further development areas such as Big Data management, software engineering and web application development. Candidates will be prepared to progress onto the BCS Level 5 Diploma in IT, with the ability to customise their learning pathways based on their areas of special interest.

Computer and Network Technology Core Module

This Computer and Network Technology module is one of three core modules that forms part of the Level 4 Certificate in IT – the first stage within the BCS three-stage Higher Education Qualification programme. Candidates will develop fundamental knowledge and understanding of the basics of computer and network technology, processor architecture and networks, and will be introduced to operating systems and system software.

Qualification Suitability and Overview

There are no specific entrance requirements for the Certificate in IT. Candidates can study for this certificate by attending a training course provided by a BCS accredited Training Provider or through self-study, although it is strongly recommended that all candidates register with an approved centre. Studying with an approved centre will deliver significant benefits.

Candidates are required to become a member of BCS, The Chartered Institute for IT, to sit and be awarded the qualifications. Candidates may apply for a four-year student membership that will support them throughout their studies.

The Level 4 Certificate is suitable for candidates new to the profession who are keen to develop industry-relevant skills and knowledge, as well as professionals wishing to gain a formal IT qualification. Candidates taking this module may be interested in career opportunities such as network and computer systems administration, network architecture, or network engineering.

Total Qualification Time (Certificate)	Guided Learning Hours (Module)	Assessment Time (Exam)
~~7~~34 hours	**200 hours**	**2 hours**

SFIA Levels

This certificate provides candidates with the level of knowledge highlighted within the table, enabling candidates to develop the skills to operate successfully at the levels of responsibility indicated.

Level	Levels of Knowledge	Levels of Skill and Responsibility (SFIA)
K7		Set strategy, inspire and mobilise
K6	Evaluate	Initiate and influence
K5	Synthesise	Ensure and advise
K4	Analyse	Enable
K3	**Apply**	**Apply**
K2	**Understand**	**Assist**
K1	**Remember**	**Follow**

SFIA Plus

This syllabus has been linked to the SFIA knowledge skills and behaviours required at Level 4.

ITOP2

Carries out agreed operational procedures of a routine nature. Contributes to maintenance, installation and problem resolution..

NTDS3

Produces outline system designs and specifications, and overall architectures, topologies, configuration databases and design documentation of networks and networking technology within the organisation. Specifies user/system interfaces, including validation and error correction procedures, processing rules, access, security and audit controls. Assesses associated risks, and specifies recovery routines and contingency procedures. Translates logical designs into physical designs..

NTAS2

Assists in investigation and resolution of network problems. Assists with specified maintenance procedures.

SCAD2

Receives and responds to routine requests for security support. Maintains records and advises relevant persons of actions taken. Assists in the investigation and resolution of issues relating to access controls and security systems.

SYSP3

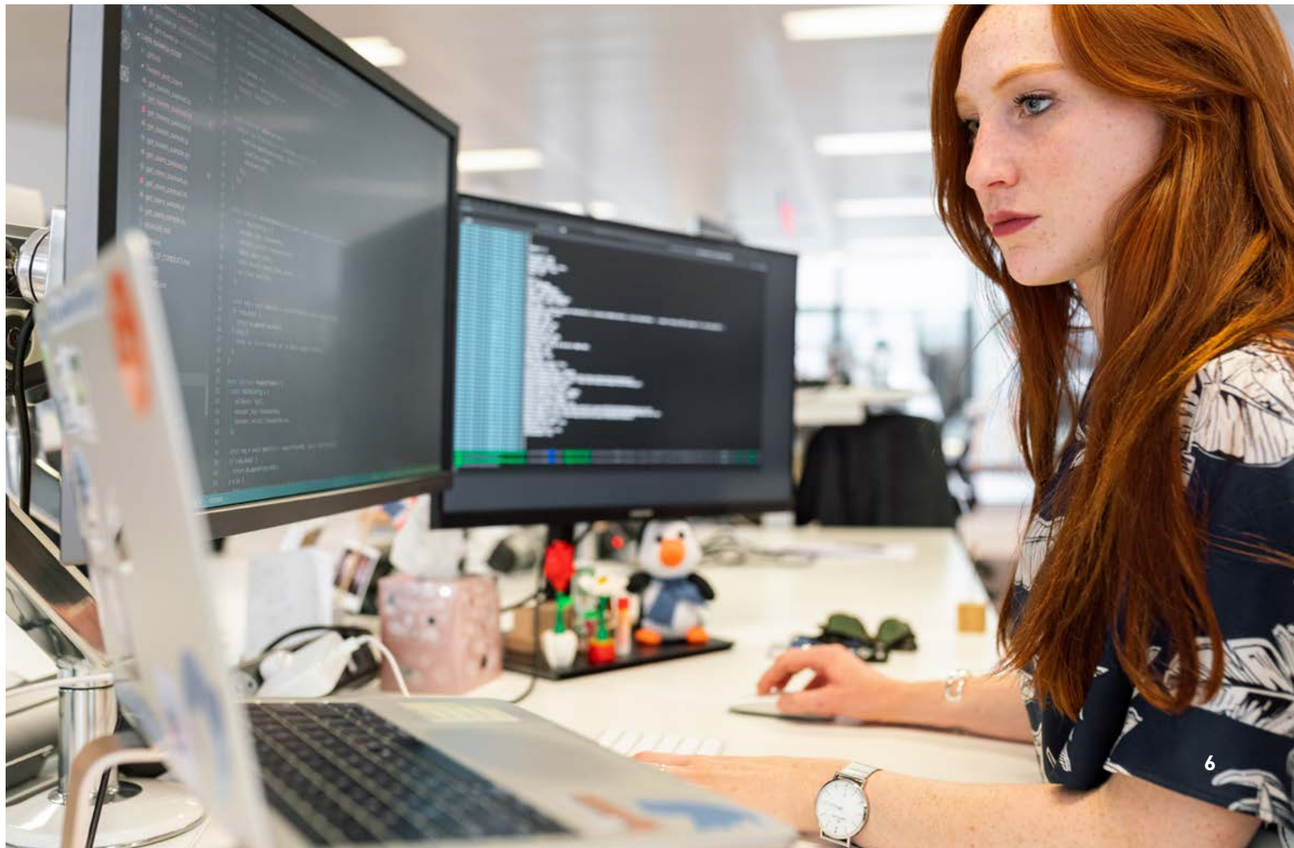
Uses system management software and tools to collect agreed performance statistics. Carries out agreed system software maintenance tasks.

Further detail around the SFIA Levels can be found at www.bcs.org/levels.

Learning Outcomes

Upon completion of this module, candidates will be able to:

- Use Boolean algebra and other digital design techniques to construct simple digital circuits such as adders used to build computers.
- Understand different computer architectures.
- Use low-level instructions and addressing modes to construct a simple program.
- Read the technical specification of a PC and network systems, interpret the performance indicators, and explain their significance to non-computer personnel.
- Appreciate the importance of the memory hierarchy of a computer system and its peripherals.
- Describe the operating principles of commonly used peripheral devices, their characteristics and performance.
- Understand the role of system software.
- Use the Internet to find information on the performance of computer systems and trends in computer systems.
- Understand the way in which digital information is transmitted across networks, the characteristics of data paths and the need for modulation.



Syllabus

1. Fundamentals

Learners will be able to:

1.1 Demonstrate and apply representation of decimal integers within computer systems.

Indicative content	Guidance
a. Representation of decimal integers (e.g. binary, hexadecimal) b. Conversion of integers from one base to another c. Representation of negative numbers, fractional numbers, and floating point numbers in binary form d. Decimal to floating point conversion and vice versa e. Floating-point addition f. Limitations of floating point arithmetic	Candidates should be able to demonstrate how computer systems represent the decimal numerical system and how computer systems use these representations to perform numerical calculations. Candidates will be expected to demonstrate practical application, converting from one base to another, as well as how negative and fractional numbers are represented.

1.2 Explain and design a system that uses a variety of logic gates.

Indicative content	Guidance
a. AND, OR, NAND, NOR, EOR b. Inverter Boolean algebra c. Simplification of logic equations d. Truth tables e. Using Boolean algebra to construct digital circuits	Candidates should be able to demonstrate or design a system that uses a variety of logic gates, showing an understanding of the difference between them and different applications. Candidates will be expected to show an understanding of Boolean algebra with practical application.

1.3 Demonstrate and apply sequential logic elements.

Indicative content	Guidance
a. D flip-flops b. RS flip-flops c. JK flip-flops d. Simple logic circuits: Full adder, multiplexer, shift register, counter	Candidates should be able to design a logic circuit using sequential logic elements and simple logic circuits, demonstrating and understanding the difference between them in different applications.

2. Processor Architecture

Learners will be able to:

2.1 Explain different types of computer systems.

Indicative content	Guidance
a. Mainframe b. Desktop c. Laptop d. Embedded e. Tablet	Candidates should be able to show an understanding of the historical evolution from mainframe to tablet. They should also understand differences between these systems, e.g. power, computational characteristics, resources, and should be able to compare them.

2.2 Describe the concept of a stored program.

Indicative content	Guidance
a. Fetch/execute cycle b. Structure of the CPU at the level of registers, buses, and functional units.	Candidates should be able to explain how a program is stored within a computer, as well as the life cycle of a program from the point it is invoked to the point it is executed. This includes the journey through registers, buses, all different functionalities. They should be able to describe the purpose of each of these elements, e.g. CPU, register, and what part each of them plays in the process.

2.3 Explain different instruction formats.

Indicative content

a. One-, two-, three-address
b. Register-to-register machines and load/store machines
c. Computer instructions, e.g. data movement, arithmetical and logical, flow control
d. The stack and its use in implementing subroutines and exceptions
e. Local storage and recursion

Guidance

Computers cannot store an instruction as humans see it – it is translated into a format computers can understand. Candidates should be able to explain these formats, understand differences between them and when they should be used. They should also be able to explain different data structures available to handle instructions, as well as how the instructions are being manipulated.

2.4 Describe trends in processor technology.

Indicative content

a. Pipelining
b. Multicore processors
c. Limits of Moore's law
Information storage
d. Memory hierarchy from cache to secondary storage
e. Operation of solid state, magnetic and optical storage devices
f. Performance of these storage devices and their characteristics

Guidance

Candidates should be able to describe the evolution of processor technology, considering Moore's law. Candidates should also know the way memory is organised within a computer and the different types of storage devices. They should be able to describe the differences between them, advantages and disadvantages, in terms of performance and other characteristics.

2.5 Explain the characteristics and performance of peripherals.

Indicative content

a. Display devices
b. Printers
c. Keyboards
d. Input/output techniques: peripheral polling, DMA, interrupt driven I/O.

Guidance

Candidates should be able to describe input and output techniques. Candidates will be expected to describe the use of a device, rather than describing the device itself.

3. Introduction to operating systems and system software

Learners will be able to:

3.1 Introduction to operating systems and system software.

Indicative content

a. The human interface
b. The operating principles and characteristics of printers, display devices, input devices, and biometric devices

Guidance

When you connect a device, the operating system has to perform some tasks in order to be able to use the device - this is interaction between human and computer. Candidates will be expected to explain the support the operating system provides, to enable user interaction.

3.2 Explain the concept of multitasking.

Indicative content

a. Interrupts
b. Concurrency
c. Scheduling
d. Memory management
e. Virtual memory

Guidance

A computer doesn't just execute one task at a time; it has to deal with multiple programs or tasks at once. How does an operating system allow the execution of these programs at the same time, for example, by defining the concepts of interrupts or concurrency? Candidates should be able to talk about multitasking in terms of these concepts.

3.3 Demonstrate understanding of system performance.

Indicative content

a. Definition
b. Measurement
c. Benchmark.

Guidance

We have a choice of computer systems within the market. Sometimes as individuals or companies, we have to choose which is the best fit for carrying out certain tasks. This means evaluating system performance and identifying which system is most suitable. Candidates should be able to understand what system performance means, what it covers, how it can be measured and what we mean by the concept of 'benchmark'. This is not a practical task - candidates will not be asked to evaluate a system themselves, but should understand the concepts behind evaluation.

4. Networks

Learners will be able to:

4.1 Describe communication principles.

Indicative content	Guidance
a. Principles of communication b. LAN c. WAN d. Wi-Fi and wireless technologies	Candidates should be able to describe the basic principles of communication, such as how computers communicate with each other, the differences are between LAN and WAN, and network topologies.

4.2 Explain different protocols used for data transmission.

Indicative content	Guidance
a. ISO 7-layer OSI model b. TCP/IP c. Relationship between them d. Typical protocols	Computer experts use the ISO seven-layer model to describe how computers communicate on a network – but this only works as a reference model. The way computers actually communicate is decided by TCP/IP model. Candidates are expected to understand the purpose of each of the ISO model's seven layers, the functionality of the four layers of the TCP/IP model, the relationship between them, and examples of protocols which would work in each of the layers.

4.3 Describe different network communication equipment.

Indicative content	Guidance
a. Modems b. Routers c. Bridges d. Switches	Candidates will be expected to describe the purpose of each of these components, the type of protocol data units they handle (e.g., packet, frame), the differences between them, and in which layer of the ISO model we can find them.

Learners will be able to:

4.4 Explain security risks on computer networks and their impact.

Indicative content	Guidance
a. Malware: viruses, worms, Trojan horses, spyware and their effect on system reliability and performance b. Network attacks: scanning, sniffing, denial of service, man in the middle, social engineering	Candidates should be able to describe different types of malware, as well as network-specific attacks, such as those listed above. Candidates should be able to describe security risks, give examples of them, the differences between them, and the impact of an attack. Candidates will not need to talk about prevention or mitigation.

4.5 Explain advances in communication technology.

Indicative content	Guidance
a. The cloud b. Internet of things (IoT) c. Software-defined networks d. Network automation	Candidates are expected to understand these concepts and the ways they have changed how people do things - what is the impact of these advances on businesses and individuals?

Examination Format

This module is assessed through completion of an invigilated written exam.

Type	Two questions from Section A and five questions from Section B
Duration	Two hours
Supervised	Yes
Open Book	No (no materials can be taken into the examination room)
Passmark	10/25 (40%)
Delivery	Paper format only

Adjustments and/or additional time can be requested in line with the BCS reasonable adjustments policy for candidates with a disability or other special considerations.

Question Weighting

Section A and Section B each carry equal marks. Candidates are advised to spend about one hour on Section A (30 minutes per question) and one hour on Section B (12 minutes per question).

Recommended Reading

Primary texts

Title: The Principles of Computer Hardware (fourth edition)
Author: A. Clements
Publiser: Oxford University Press
Publisher Date: 2006
ISBN: 978-0199273133

Title: Computer Networks (fifth edition)
Author: A. Clements
Publiser: Pearson
Publisher Date: 2013
ISBN: 978-1292024226

Title: Modern Operating Systems (fourth edition)
Author: A. S. Tanenbaum
Publiser: Prentice Hall
Publisher Date: 2014
ISBN: 978-0133591620

Title: Computer Systems Architecture - A Networking Approach (second edition)
Author: R. Williams
Publiser: Prentice Hall
Publisher Date: 2006
ISBN: 978-0321340795

Additional texts

Title:	The Architecture of Computer Hardware (second edition)
Author:	I. Englander
Publiser:	Wiley
Publisher Date:	2009
ISBN:	978-0471715429

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Document Change History

Any changes made to the syllabus shall be clearly documented with a change history log. This shall include the latest version number, date of the amendment and changes made. The purpose is to identify quickly what changes have been made.

Version Number	Changes Made
Version 4.0 June 2021	Document Creation
Version 4.1 August 2022	Learning Objective 2.3 updated.

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