BCS LEVEL 5 DIPLOMA IN IT

COMPUTER NETWORKS

SYLLABUS

September 2021 v3.0

bcs
The Chartered Institute for IT

CONTENTS

Introduction

The second stage within the BCS three-stage Higher Education Qualification programme, the Level 5 Diploma enables candidates who have already achieved the Level 4 Certificate in IT to progress to higher levels of knowledge and competency.

This internationally-recognised qualification introduces you to the business-related aspects of the IT industry, developing your technological expertise while also considering the potential challenges of the day-to-day running of an organisation, such as legal obligations and intellectual property.

Our modules have been created in-line with the latest developments in the industry, giving you a competitive edge in the IT job market. You will have the opportunity to learn about object-oriented programming, user experience, systems analysis and design, as well as to build upon knowledge and skills developed during the Level 4 Certificate.

To successfully achieve the qualification, candidates need to complete:

- One core module
- Three optional modules
- One Professional Project in IT

Candidates who wish to progress onto the next stage will need to complete the Project at end of the Level 6 Professional Graduate Diploma in IT.

Computer Networks Optional Module

The Computer Networks module is an optional module that forms part of the Level 5 Diploma in IT – the second stage within the BCS three-stage Higher Education Qualification programme.

Candidates will develop specialist knowledge and skills relating to network architecture, the physical properties of communication standards, analysing errors and their impact, LANs and topologies, WAN technology, the principles of inter-networking, and the main parameters of network performance.

Qualification Suitability and Overview

Candidates must have achieved the Certificate in IT or have an appropriate exemption to be entered for the Diploma in IT. Candidates can study for this diploma 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 5 Diploma is suitable for professionals wishing to gain a formal IT qualification, and this module may be particularly relevant for candidates interested in career opportunities such as solutions architecture, network engineering, or database programming.

Total Qualification Time (Certificate)	Guided Learning Hours (Module)	Assessment Time (Exam)
1086 hours	225 hours	Two hours

SFIA Levels

This award 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 5.

ITOP3

Carries out agreed operational procedures, including infrastructure configuration, installation and maintenance. Uses infrastructure management tools to collect and report on load and performance statistics and to automate the provisioning, testing and deployment of new and changed infrastructure. Contributes to the implementation of maintenance and installation work. Uses standard procedures and tools to carry out defined system backups, restoring data where necessary. Identifies operational problems and contributes to their 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.

NTAS3

Identifies and resolves network problems following agreed procedures. Uses network management software and tools to collect agreed performance statistics. Carries out agreed network 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:

- demonstrate an understanding of the physical properties and performance characteristics of communication media; specifically, copper cable, fibre optics and wireless networks
- demonstrate an understanding of the importance of communication standards, including an appreciation of protocol layer models and enhancements to those standards
- demonstrate an appreciation of the theory and practice of common local area networks including virtual and wireless LANs
- demonstrate an appreciation of the theory and practice of wide area networks and their interconnection
- demonstrate an appreciation of the significance of network and inter-network protocols; specifically, IPv4, IPv6, TCP and UDP
- describe the importance of reliability and quality of service, including examples of error recovery strategies, traffic differentiation and prioritisation

Syllabus

1. Introduction

Learners will be able to:

1.1 Explain the theoretical and practical models of network architecture.

Indicative content

a. Historical perspective
b. Theoretical and practical models of network architecture, particularly the ISO OSI seven-layer model and the TCP/IP protocol stack
c. Example networks and services, including LAN and WAN technologies, and their relevance to the OSI model.

Guidance

Candidates are expected to understand the purpose of each of the layers in both models and the mapping between both models. The difference between this syllabus and BCS Certificate Computer and Network Technology is that, at this level, candidates should be able to explain how the models' layers interact with each other, e.g. to explain the journey of a message through the different layers. Example networks and technologies would include packet and circuit switching, for example - ethernet, ISDN, ATM, Wi-Fi, xDSL, WiMAX. Candidates should explain how LAN and WAN technologies relate to different models and their respective layers

2. Digital Communication

Learners will be able to:

2.1 Describe the physical properties of communication standards.

Indicative content

a. Physical properties of transmission media standards, for example, fibre optics, radio communication
b. Maximum data rates (theoretical and practical) for different transmission media standards, including some simple analysis of signals
c. Data encoding of digital signals
d. The distinction between, and analysis of, physical media and wireless media properties
e. The difference between narrowband and broadband technologies with reference to ISDN and xDSL

Guidance

At the physical layer of the OSI/TCP IP models, we can have different layers of transmission media standards. Candidates should be able to identify the different types of media and their characteristics, e.g. maximum data rates they can support.
In this regard, candidates should be able to describe the data encoding methods of digital signals. The focus here is on concept of data encoding itself. Candidates should differentiate between physical and wireless media properties, and understand fibre-optics and other examples. They will also need to differentiate between narrowband and broadband, and how these are used in technologies such as ISDN and xDSL.

3. Errors

Learners will be able to:

3.1 Analyse errors and their impact.

Indicative content

a. The main causes of errors and their effects on transmission
b. Single-bit and burst errors
c. Various error detection and correction strategies including parity, block sum, Hamming Codes, Cyclic Redundancy Checks, and Forward versus Backward error control

Guidance

Candidates should understand main causes of errors and their impact on transmission. They should be able to differentiate between single-bit and burst errors. Candidates should also be able to identify the most appropriate error detection and correction strategy for handling the error.

4. Local Area Networks

Learners will be able to:

4.1 Describe LANs and explain topologies

Indicative content

a. Types of LAN covering standards, topology and performance
b. Example architectures such as Ethernet and fast Ethernet, and Wi-Fi
c. Operating LAN switches and configuring virtual LANs

Guidance

Here the focus is on LAN standard IEEE802.3 (Ethernet). Candidates should be able to describe different layers and how these relate to the OSI model, so that we can see logical evaluation of the topics, including LAN topologies, e.g. bus, ring, star, mesh, cellular and hybrid. Candidates should also be aware of IEEE802.11 (wifi) and its architecture. Candidates will be asked about the purpose of LAN switches, how they operate and how they can support creation of virtual LANs.

5. Wide Area Networks

Learners will be able to:

5.1 Analyse WAN technology.

Indicative content

a. Circuit versus packet switching and associated routing and flow control
b. Detailed examples of existing architectures such as ISDN, Multi-protocol Label Switching (MPLS)
c. Virtual Private Networks (VPN) and their relevance to WANs

Guidance

Candidates should go into more detail in terms of analysing circuit switching and packet switching, including routing and flow control. They are expected to be able to identify examples of architectures working with these technologies, e.g. ISDN would be circuit switched, whereas the internet is packet switched. Candidates will be asked to describe the concept of VPNs and how they work in a WAN environment.

6. Inter-Networks

Learners will be able to:

6.1 Describe the principles of inter-networking.

Indicative content

a. Architectures, addressing and protocols
b. Reference to IPv4, IPv6, TCP and UDP

Guidance

This is where we go into more detail on Layers 3 and 4 of OSI model. Candidates are expected to know details of IPv4 and IPv6, including addressing schemes, operation and other relevant protocols. They should also know main differences between transport protocols (UDP, TCP) and be able to provide examples of when an application uses one instead of the other. They should know purpose of transport layer (layer 4), as well as networking layer (layer 3).

7. Quality of Service

Learners will be able to:

7.1 Explain the definition of service and the main parameters that define network performance.

Indicative content

a. A definition of quality of service and the main parameters that define network performance
b. Router functionality including frame prioritisation, classification and queue management techniques
c. The provision of quality of service management in production networks

Guidance

We expect candidates to be able to define the concept of quality of service by also identifying main parameters that define network performance, e.g. throughput, jitter, delay. The router plays a very important role in achieving quality of service, so candidates are expected to be able to describe the functionality implemented by the router, including frame prioritisation, classification and queue management techniques. Candidates should describe protocols that network administrators use to implement quality of service in a production network, such as RSVP and DiffServ.

Examination Format

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

Type	Four written questions from a choice of six, each with equal marks
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

Candidates will choose four questions from a choice of six. All questions are equally weighted and worth 25 marks

Recommended Reading

Primary texts

Title:	Data and Computer Communications (10th edition)
Author:	W. Stallings
Publisher:	Pearson Education
Date:	2013
ISBN:	978-1292014388

Title:	Computer Networks (5th edition)
Author:	A. Tanenbaum
Publisher:	Pearson Education
Date:	2013
ISBN:	978-1292024226

Additional texts

Title:	Wireless Communication and Networks (second edition)
Author:	W. Stallings
Publisher:	Pearson Education
Date:	2015
ISBN:	978-1292027388

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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 1.0 **June 2021**	Document Creation

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