

BCS LEVEL 6 PROFESSIONAL GRADUATE DIPLOMA IN IT ADVANCED DATABASE MANAGEMENT SYSTEMS

SYLLABUS

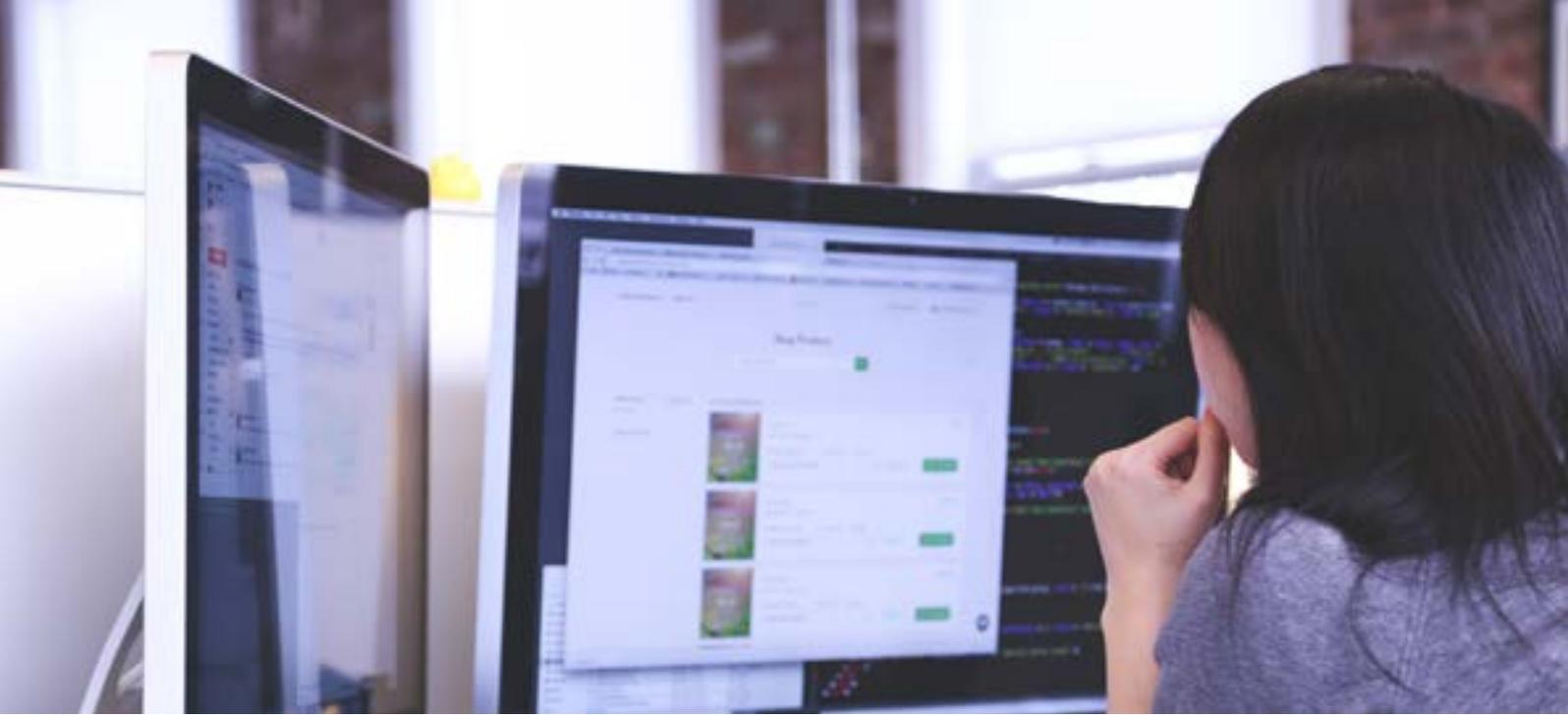


September 2021 v3.0

This is a United Kingdom government regulated qualification which is administered and approved by one or more of the following: Ofqual, Qualifications Wales, CCEA Regulation or SQA.

CONTENTS

- 3.** Introduction
- 4.** Qualification Suitability and Overview
- 4.** SFIA Levels
- 5.** Learning Outcomes
- 6.** Syllabus
- 10.** Examination Format
- 10.** Question Weighting
- 11.** Recommended Reading
- 12.** Using BCS Books
- 13.** Document Change History



Introduction

The final stage within the BCS three-stage Higher Education Qualification programme, the Level 6 Professional Graduate Diploma (PGD) enables candidates who have already achieved the Level 5 Diploma in IT to gain depth of knowledge and expertise in their field.

Our modules have been created in-line with the SFIAPlus framework and latest developments in the industry, giving you a competitive edge in the IT job market and showing your dedication to the industry. You will have the opportunity to learn about topics such as advanced database management, network information systems, web engineering and programming paradigms, as well as to build upon knowledge and skills developed during the Level 5 Diploma.

To successfully achieve the qualification, candidates need to complete:

- One core module (Professional Project in IT)
- Four optional modules

Depending on entrance conditions, completing the Level 6 PGD in IT may support entry onto a Master's degree course at selected global universities.

Advanced Database Management Systems optional module

The Advanced Database Management Systems module is an optional module that forms part of the Level 6 PGD in IT – the final stage within the BCS three-stage Higher Education Qualification programme.

Candidates will be given a detailed insight into relational systems and how to implement them. The module will also develop candidates' knowledge of current themes and advances in relational database systems, object-oriented programming, and XML database systems. Furthermore, candidates will evaluate emerging architectures for database management systems and further develop their understanding of the impact that emerging database standards may have on facilities provided by future database management systems.

Qualification Suitability and Overview

Candidates must have achieved the Diploma in IT or have an appropriate exemption in order to be entered for the Professional Graduate Diploma (PGD). Candidates can study for this PGD 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 6 PGD is suitable for professionals wishing to gain an advanced formal IT qualification, and this module may be particularly relevant for candidates interested in career opportunities such as data science, informatics and data engineering.

Total Qualification Time (Certificate)	Guided Learning Hours (Module)	Assessment Time (Exam)
1414 hours	250 hours	Three 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 6.

DBAD4

Uses database management system software and tools, and knowledge of logical database schemata, to investigate problems and collect performance statistics and create reports. Carries out routine configuration, installation, and reconfiguration of database and related products. Develops and configures tools to enable automation of database administration tasks. Identify problems and issues and recommend corrective actions.

DTAN4

Investigates corporate data requirements, and applies data analysis, design, modelling, and quality assurance techniques, to establish, modify or maintain data structures and their associated components (entity descriptions, relationship descriptions, attribute definitions). Provides advice and guidance to database designers and others using the data structures and associated components.

DBDS4

Develops and maintains specialist knowledge of database and data warehouse concepts, design principles, architectures, software and facilities. Assesses proposed changes to object/data structures, in order to evaluate alternative options. Implements physical database designs to support transactional data requirements for performance and availability. Implements data warehouse designs that support demands for business intelligence and data analytics.

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:

- Critically assess new developments in database technology.
 - Interpret and explain the impact of emerging database standards.
 - Evaluate the contribution of database theory to practical implementations of database management systems.
-

Syllabus

1. Relational theory and concepts

Learners will be able to:

1.1 Explain theoretical concepts.

Indicative content

- a. Foundations of relational systems.

Guidance

Candidates will be required to have knowledge of relational algebra.

1.2 Describe the relational model.

Indicative content

- a. Conformity and integrity
- b. Use of constraints
- c. Mapping design approaches to relational systems

Guidance

Candidates will need knowledge of relational algebra and should understand the value of integrity constraints. They should be well-practised in design approaches and implications of design techniques on table design.

2. Processing database data

Learners will be able to:

2.1 Describe advanced SQL programming.

Indicative content

- a. Using SQL in querying and manipulating data and data objects

Guidance

Candidates should be aware of basic constructs such as joins and subqueries and be able to evaluate a range of alternative solutions to query requirements. They should have a knowledge of the unpredictable and unreliable nature of SQL. This topic is mainly relevant to database development.

2.2 Explain query optimisation.

Indicative content

- a. Query transformations
- b. Optimisation approaches
- c. Use of constraints
- d. Creation and use of a variety of index types

Guidance

Candidates should understand the way in which optimisers work. This includes the ability to transform query specifications, use appropriate indexes and constraints to perform efficient retrieval of data. Candidates will also need to consider parsing as part of the process.

2.3 Explain concurrency control and transaction management.

Indicative content

- a. The ACID principle
- b. Two-phase locking and deadlocks
- c. Recovery and transaction design

Guidance

Candidates should have a detailed knowledge of the ANSI ACID principle for transactions - particularly the isolation levels, as these are markedly different in the leading databases.

2.4 Describe database performance tuning.

Indicative content

- a. Maximising storage and memory usage
- b. Memory components and caching techniques

Guidance

This area is mainly relevant to administration and the Database Administrator. Balancing system resource usage is an important part of tuning the database. Candidates should have a firm understanding of important aspects, such as using appropriate storage technology, and techniques, such as data compression.

2.5 Explain distributed relational systems.

Indicative content

- a. Data replication:
 - i. Synchronous
 - ii. Asynchronous
- c. The Two-Phase Commit protocol and its weaknesses
- d. Implications for cloud storage

Guidance

Candidates should be able to distinguish between truly distributed databases (as in C. J. Date's twelve rules), and those which only partially implement them - often in involving replication techniques. Candidates should have a solid understanding of network issues and protocols such as Two-Phase commit.

3. Post-relational systems

Learners will be able to:

3.1 Demonstrate use of object-oriented systems.

Indicative content

- a. Object oriented database management systems
- b. Deductive database management systems
- c. Spatial database management systems
- d. Temporal database management systems
- e. Constraint database management systems

Guidance

Candidates should understand the reasons behind development of and the perceived need for object support within the database. Candidates should be familiar with Object-relational systems and reasons for using them.

3.2 Describe new database management systems.

Indicative content

- a. New database applications and architectures, e.g.:
 - i. Data warehousing
 - ii. Multimedia
 - iii. Mobility
 - iv. NoSQL
 - v. Native XML databases (NXD)
 - vi. Document-oriented databases
 - vii. Statistical databases

Guidance

Candidates should recognise the limitations of relational systems and the way in which new technologies such as NoSQL, document-oriented, key-value pair databases and the like attempt to alleviate some of the issues.

4. Using standards

Learners will be able to:

4.1 Explain SQL standards in relation to development.

Indicative content

- a. Use of SQL and standards in the industry
- b. Limitations of standardisation

Guidance

Candidates should be familiar with the development of the SQL language and keep up-to-date with the new constructs that are now available, such as common table expressions (also known as factored subqueries). Candidates should also be able to discuss technical and economic considerations when adopting standards.

4.2 Describe the standards for interoperability and integration.

Indicative content

- a. For example:
 - i. Web services
 - ii. JSON

Guidance

Candidates should be able to understand the main industry standards in the area of database interaction should. They will also need to discuss the way in which SQL is accommodated.

5. Database security

Learners will be able to:

5.1 Analyse database security methods and techniques.

Indicative content

- a. Data encryption
- b. Redaction and masking techniques
- c. Authentication and authorisation
- d. Database auditing

Guidance

This is an increasingly important area for data professionals, covering an increasing array of technologies. Candidates should have a firm understanding of password control and identification techniques, as well as authorisation controls such as roles and privileges. They will also need to appreciate the role and responsibilities of a Database Security Administrator.

Examination Format

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

Type	Three written questions from a choice of five, each with equal marks
Duration	Three 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 three questions from a choice of five. All questions are equally weighted and worth 25 marks.

Recommended Reading

Primary texts

Title: An Introduction to Database Systems (eighth edition)
Author: C. J. Date
Publisher: Addison-Wesley Longman
Date: 2003
ISBN: 978-0321197849

Title: Database System Concepts (sixth edition)
Author: A. Silberschatz, H. Korth and S. Sudarshan
Publisher: McGraw-Hill
Date: 2010
ISBN: 978-0073523323

Title: Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data
Author: W. Lemahieu, S. vanden Broucke and B. Baesens
Publisher: Cambridge University Press
Date: 2018
ISBN: 978-1107186125

Title: Database Systems: Practical approach to design, implementation, and management (sixth edition)
Author: T. M. Connolly and C. Begg
Publisher: Pearson Education
Date: 2015
ISBN: 978-1292061184

Additional texts and resources

Title: SQL 1999: Understanding Relational Language Components
Author: J. Melton and A. Simon
Publisher: Morgan-Kaufmann
Date: 2003
ISBN: 978-1558604568

Title: The Ultimate Guide from Beginner to Expert - Learn and Master SQL in No Time
Author: P. Adams
Publisher: Addison Wesley
Date: 2016
ISBN: 978-1540700520

Title: Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems
Author: M. Kleppmann
Publisher: O'Reilly
Date: 2017
ISBN: 978-1449373320

Using BCS Books

Accredited Training Organisations may include excerpts from BCS books in the course materials. If you wish to use excerpts from the books you will need a license from BCS. To request a license, please contact the Head of Publishing at BCS outlining the material you wish to copy and its intended use.

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 July 2021	Document Creation

CONTACT

For further information please contact:

BCS

The Chartered Institute for IT
3 Newbridge Square
Swindon
SN1 1BY

T +44 (0)1793 417 445

www.bcs.org

© 2021 Reserved. BCS, The Chartered Institute for IT

All rights reserved. No part of this material protected by this copyright may be reproduced or utilised in any form, or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system without prior authorisation and credit to BCS, The Chartered Institute for IT.

Although BCS, The Chartered Institute for IT has used reasonable endeavours in compiling the document it does not guarantee nor shall it be responsible for reliance upon the contents of the document and shall not be liable for any false, inaccurate or incomplete information. Any reliance placed upon the contents by the reader is at the reader's sole risk and BCS, The Chartered Institute for IT shall not be liable for any consequences of such reliance.

